

Exelon Generation Company, LLC
Byron Station
4450 North German Church Road
Byron, IL 61010-9794

www.exeloncorp.com

January 17, 2002

LTR: BYRON 2002-0005
File: 2.01.0700

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

Byron Station, Units 1 and 2
Facility Operating License Nos. NPF-37 and NPF-66
NRC Docket Nos. STN 50-454 and STN 50-455

Subject: Revision 1 to Byron Station, Unit 1 Cycle 11A, Core Operating Limits Report and
Revision 1 to Byron Station, Unit 2 Cycle 10A, Core Operating Limits Report

Reference: Letter from R. L. Lopriore (Exelon Generating Company, LLC) to the NRC, "Byron
Station, Unit 1 Cycle 11A, Core Operating Limits Report and Byron Station, Unit 2
Cycle 10A, Core Operating Limits Report," dated May 22, 2001

In accordance with Technical Specification 5.6.5, "Core Operating Limits Report (COLR)," we are submitting the revised COLRs for Byron Station, Unit 1 Cycle 11A, and Byron Station, Unit 2 Cycle 10A. The Unit 1 and Unit 2 COLRs were revised to add an End of Life, All Rods Out, Hot Full Power Moderator Temperature Coefficient limit at 60 parts per million Reactor Coolant boron concentration and to consolidate the shutdown margin limits for the various modes. In addition for Unit 2, the Hot Full Power, Axial Flux Difference upper limit was revised from +5% to +10% with the Power Distribution Monitoring System inoperable.

Should you have any questions concerning these reports, please contact William Grundmann, Regulatory Assurance Manager, at (815) 234-5441, extension 2800.

Respectfully,



Richard P. Lopriore
Site Vice President
Byron Nuclear Generating Station

Attachments: 1) Byron Station, Unit 1 Cycle 11A, COLR, Revision 1
2) Byron Station, Unit 2 Cycle 10A, COLR, Revision 1

RPL/JL/dpk

cc: Regional Administrator – NRC Region III
NRC Senior Resident Inspector – Byron Station
NRC Project Manager – NRR – Byron Station
Office of Nuclear Facility Safety – Illinois Department of Nuclear Safety

Accol

ATTACHMENT 1

**Byron Station Unit 1 Cycle 11A Core Operating Limits Report
Revision 1**

NUCLEAR FUEL MANAGEMENT DEPARTMENT
TRANSMITTAL OF DESIGN INFORMATION

☒ SAFETY RELATED
☐ NON-SAFETY RELATED
☐ REGULATORY RELATED

Originating Organization
☒ Nuclear Fuel Management
☐ Other (specify) _____

NFM ID # NFM0100048
Rev. No. 1
Page 1 of 15

Station Byron Unit 1 Cycle 11A Generic _____

To: Kenneth N. Kovar – Byron

Subject Byron Unit 1 Cycle 11A Core Operating Limits Report in ITS Format and W(z) Function

Brian L. Manges

Preparer

Brian L. Manges
Preparer's Signature

12/07/2001
Date

Tyrone L. Stevens

Reviewer

Tyrone L. Stevens
Reviewer's Signature

12/10/01
Date

D. Redden

NFM Supervisor

D. Redden
Approver's Signature

12/10/01
Date

Status of Information:

☒ Verified
☐ Unverified
☐ Engineering Judgement

Method and Schedule of Verification for Unverified TODIs: _____

Description of Information:

Attached is the Byron Unit 1 Cycle 11A Core Operating Limits Report (COLR) in the ITS format and W(z) function. This COLR is for uprate at 3586.6 MWt. **Revision 1 of this TODI supercedes Revision 0.**

Purpose of Information:

In Revision 1, the SDM limits for MODE 5 were revised to 1.3% $\Delta k/k$ for LCO 3.1.1. Revision 1 also incorporates the EOL HFP ARO MTC surveillance limit at 60 ppm. Byron Station is requested to perform a Plant Review of this document. Upon completion of the Plant Review, Byron Station is to transmit the COLR portion to the Nuclear Regulatory Commission pursuant to Technical Specification 5.6.5. Please provide NFM (Brian Manges) with a copy of Byron Station's completed Plant Review and COLR submittal to the NRC.

Source of Information:

1. Westinghouse Letter 01CB-G-057 (CAC-01-104), dated April 6, 2001
2. TODI NFM0000188, Sequence 0 "Pressurizer Pressure DNB Limit", A. W. Wong to D. Wozniak and T. Luke, December 15, 2000
3. Westinghouse Letter 01CB-G-047 (ASD-01-90), dated March 23, 2001
4. Westinghouse Letter CAC-01-123, dated April 11, 2001
5. TODI NFM0100054, Sequence 0, "RCS Average Temperature DNB Limit", A. Wong to D. Wozniak and C. Dunn, dated 4/19/2001

Supplemental Distribution: P. E. Reister / J. E. Langan (BY)

CORE OPERATING LIMITS REPORT (COLR) for BYRON UNIT 1 CYCLE 11A

1.0 CORE OPERATING LIMITS REPORT

This Core Operating Limits Report (COLR) for Byron Station Unit 1 Cycle 11A 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	3.2.5	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) 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 BYRON UNIT 1 CYCLE 11A

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.

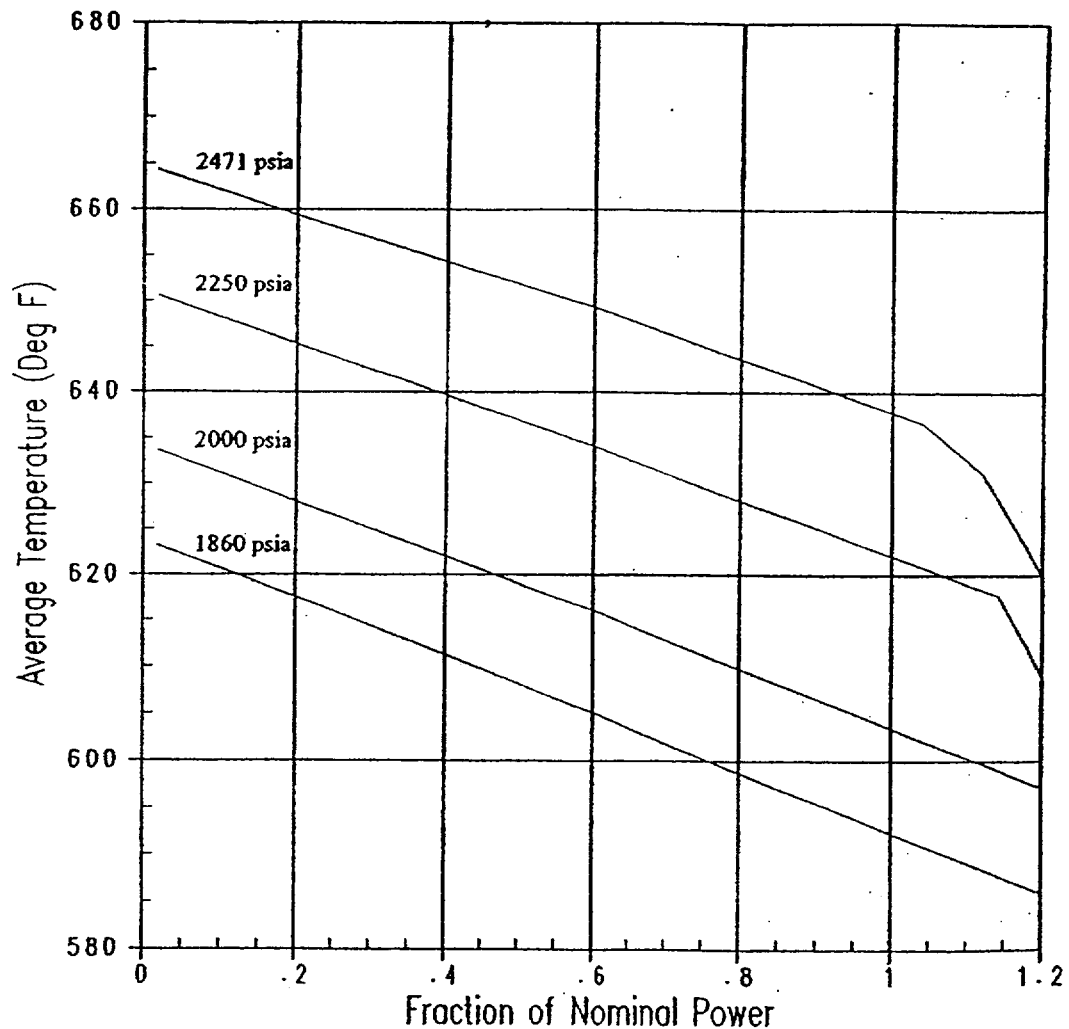


Figure 2.1.1: Reactor Core Limits

CORE OPERATING LIMITS REPORT (COLR) for BYRON UNIT 1 CYCLE 11A

2.2 Shutdown Margin (SDM)

The SDM limit for MODES 1, 2, 3, 4, and 5 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, 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 $+3.73 \times 10^{-5} \Delta k/k/^{\circ}F$.
- 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 less negative than or equal to $-3.7 \times 10^{-4} \Delta k/k/^{\circ}F$.
- 2.3.4 The EOL/ARO/HFP-MTC Surveillance limit at 60 ppm shall be less negative than or equal to $-4.3 \times 10^{-4} \Delta k/k/^{\circ}F$

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 Limit (LCO 3.1.5)

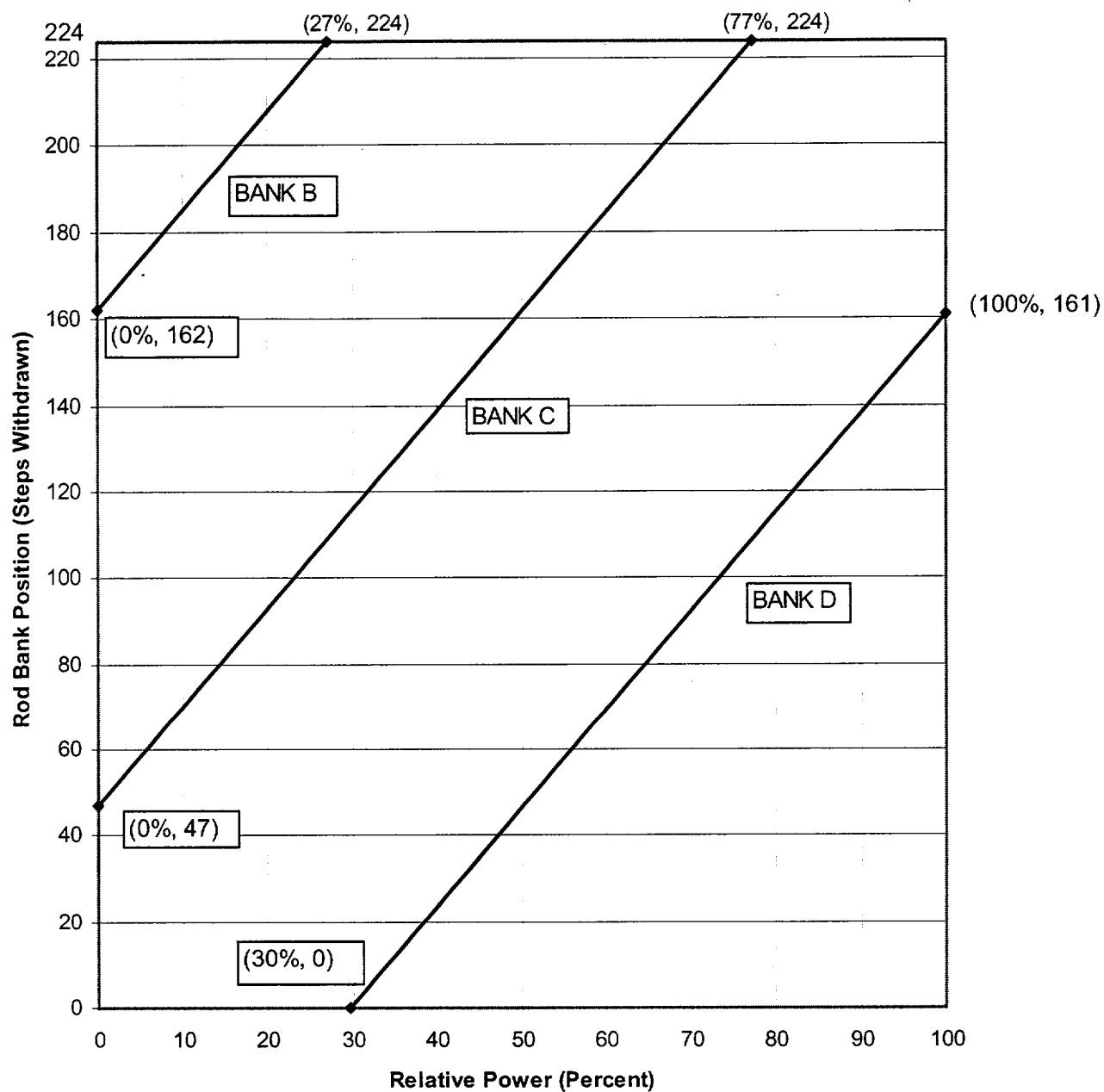
- 2.4.1 All shutdown banks shall be fully withdrawn to at least 224 steps.

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 BYRON UNIT 1 CYCLE 11A

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



CORE OPERATING LIMITS REPORT (COLR) for BYRON UNIT 1 CYCLE 11A

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

2.6.1

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

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

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.

2.6.2 $W(Z)$ Values:

a) When PDMS is OPERABLE, $W(Z) = 1.00000$ for all axial points.

b) When PDMS is Inoperable, $W(Z)$ is provided in Figures 2.6.2.a through 2.6.2.c

The normal operation $W(Z)$ values have been determined at burnups of 8801, 14000, and 18000 MWD/MTU.

For this cycle, the $F_Q^C(z)$ penalty factors are equal to 2% per 31 Effective Full Power Days (EFPD). 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.

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

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 FQ measurement uncertainty = 1.05 when PDMS is Inoperable

U_e = Engineering uncertainty factor = 1.03

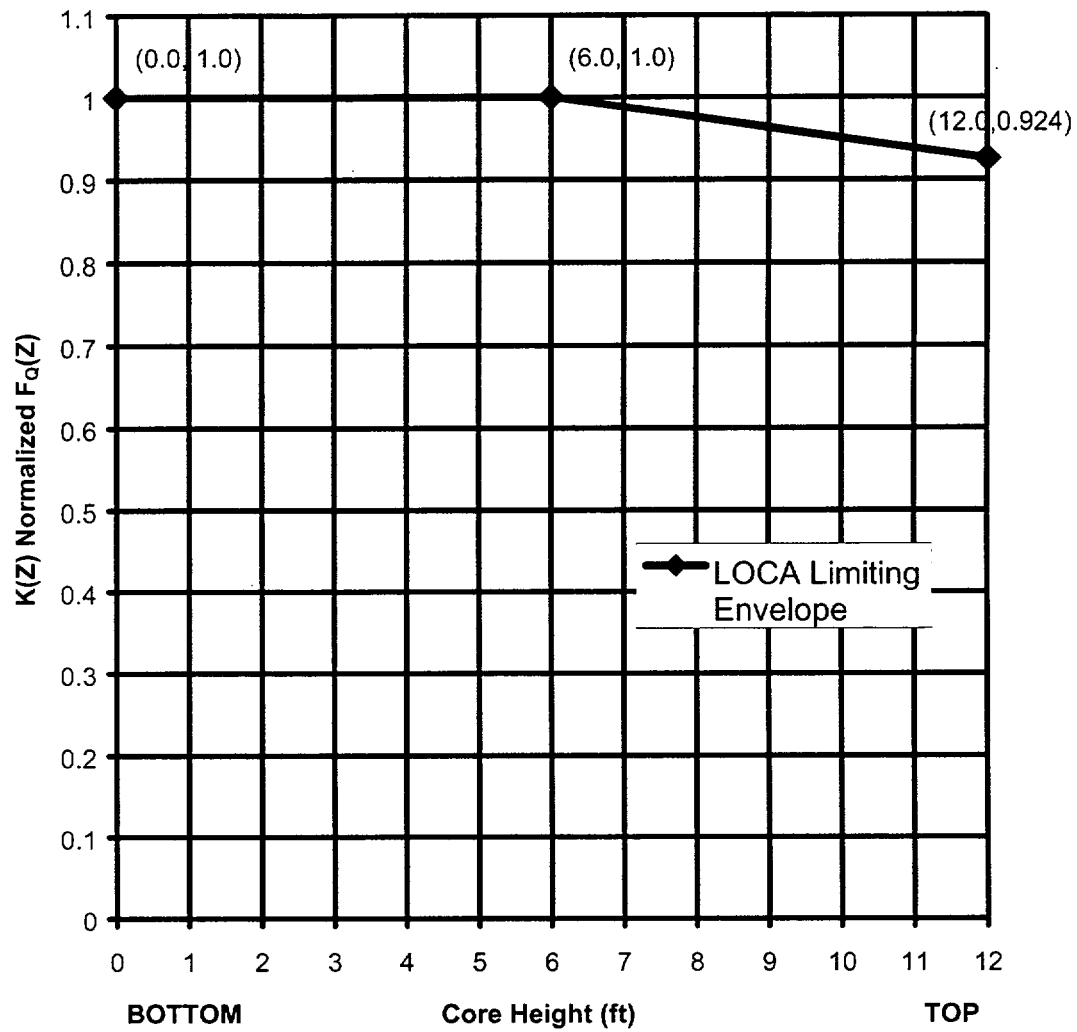
2.6.4 PDMS Alarms:

$F_Q(Z)$ Warning Setpoint $\geq 2\%$ of $F_Q(Z)$ Margin

$F_Q(Z)$ Alarm Setpoint $\geq 0\%$ of $F_Q(Z)$ Margin

CORE OPERATING LIMITS REPORT (COLR) for BYRON UNIT 1 CYCLE 11A

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



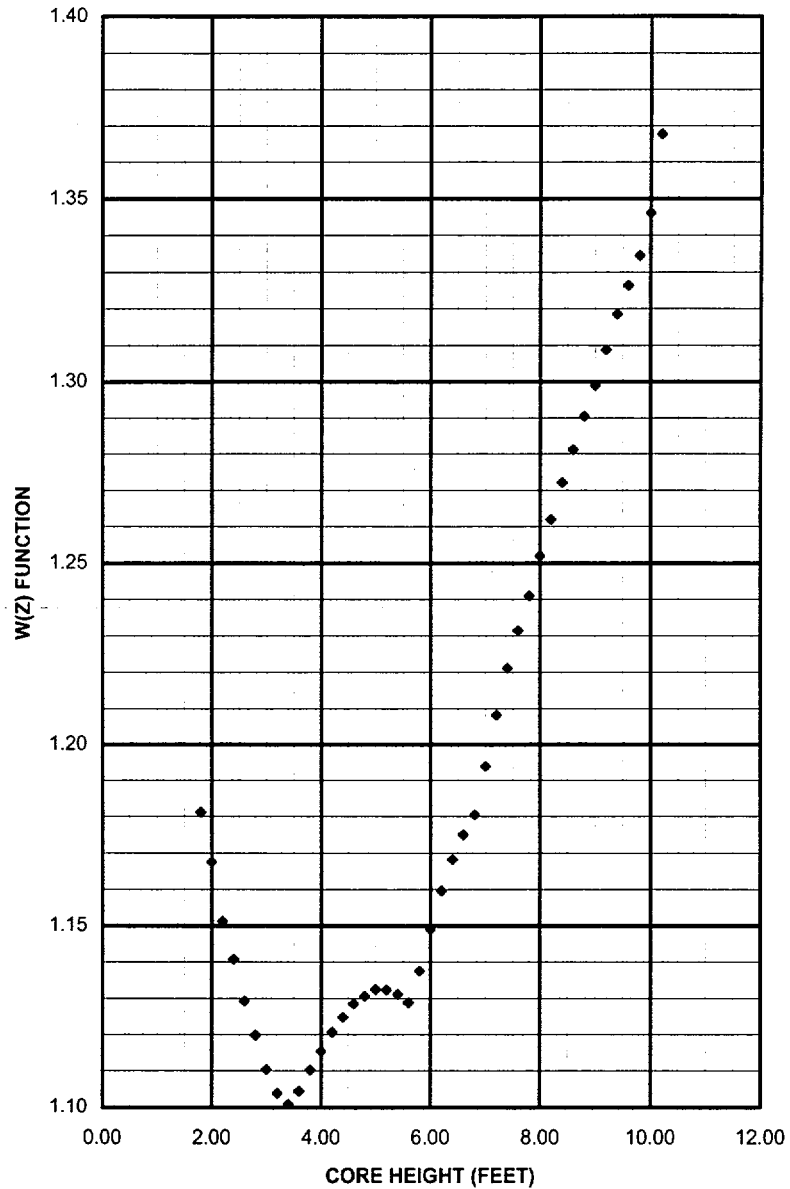
CORE OPERATING LIMITS REPORT (COLR) for BYRON UNIT 1 CYCLE 11A

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	1.1812
2.00	1.1675
2.20	1.1513
2.40	1.1408
2.60	1.1293
2.80	1.1198
3.00	1.1104
3.20	1.1040
3.40	1.1010
3.60	1.1046
3.80	1.1102
4.00	1.1155
4.20	1.1206
4.40	1.1247
4.60	1.1285
4.80	1.1306
5.00	1.1324
5.20	1.1323
5.40	1.1311
5.60	1.1288
5.80	1.1375
6.00	1.1490
6.20	1.1596
6.40	1.1682
6.60	1.1748
6.80	1.1804
7.00	1.1940
7.20	1.2082
7.40	1.2212
7.60	1.2315
7.80	1.2410
8.00	1.2519
8.20	1.2619
8.40	1.2721
8.60	1.2811
8.80	1.2904
9.00	1.2989
9.20	1.3087
9.40	1.3185
9.60	1.3264
9.80	1.3344
10.00	1.3461
10.20	1.3678
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

Byron Unit 1 Cycle 11A

Figure 2.6.2.a

Summary of W(Z) Function at 8801 MWD/MTU
(Top and Bottom 15% Excluded per WCAP-10216)



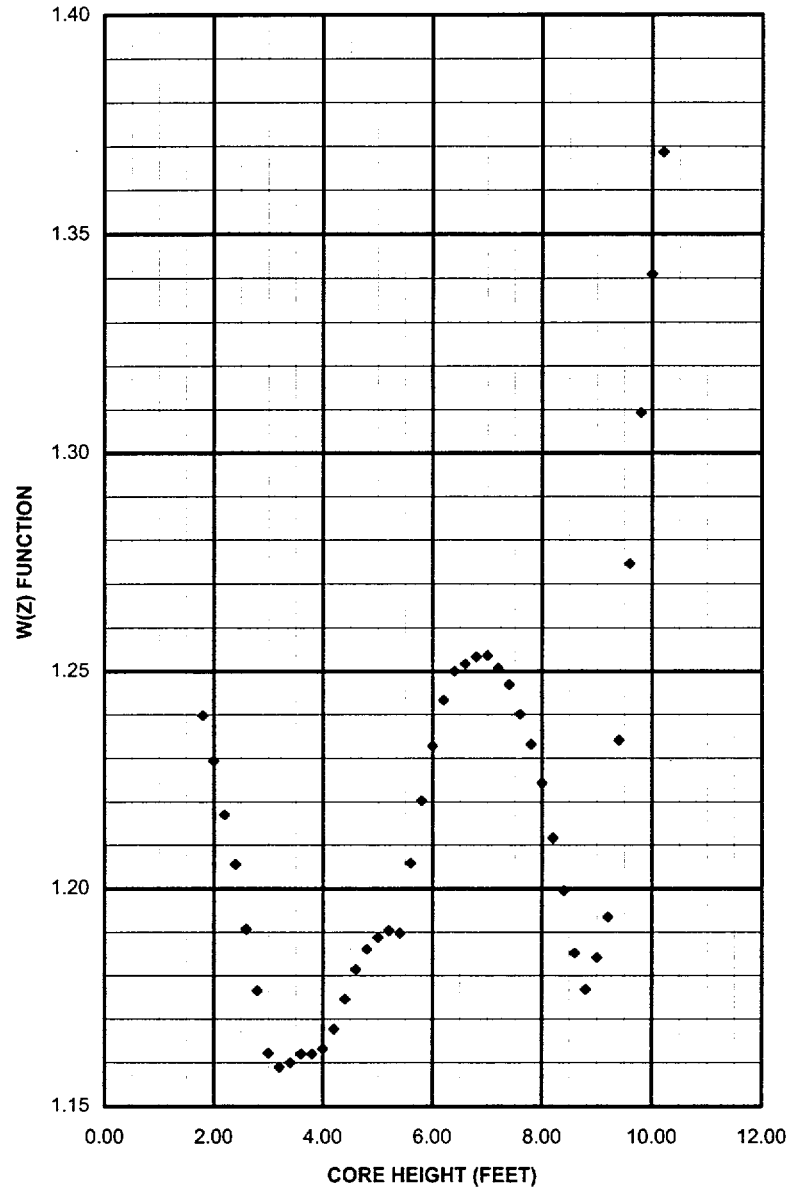
CORE OPERATING LIMITS REPORT (COLR) for BYRON UNIT 1 CYCLE 11A

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	1.2398
2.00	1.2294
2.20	1.2169
2.40	1.2055
2.60	1.1907
2.80	1.1766
3.00	1.1622
3.20	1.1590
3.40	1.1600
3.60	1.1620
3.80	1.1620
4.00	1.1632
4.20	1.1678
4.40	1.1747
4.60	1.1814
4.80	1.1862
5.00	1.1889
5.20	1.1904
5.40	1.1898
5.60	1.2058
5.80	1.2203
6.00	1.2328
6.20	1.2434
6.40	1.2500
6.60	1.2517
6.80	1.2534
7.00	1.2537
7.20	1.2508
7.40	1.2469
7.60	1.2401
7.80	1.2332
8.00	1.2243
8.20	1.2115
8.40	1.1996
8.60	1.1853
8.80	1.1769
9.00	1.1842
9.20	1.1935
9.40	1.2341
9.60	1.2747
9.80	1.3093
10.00	1.3409
10.20	1.3686
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

Byron Unit 1 Cycle 11A

Figure 2.6.2.b

Summary of W(Z) Function at 14000 MWD/MTU
(Top and Bottom 15% Excluded per WCAP-10216)



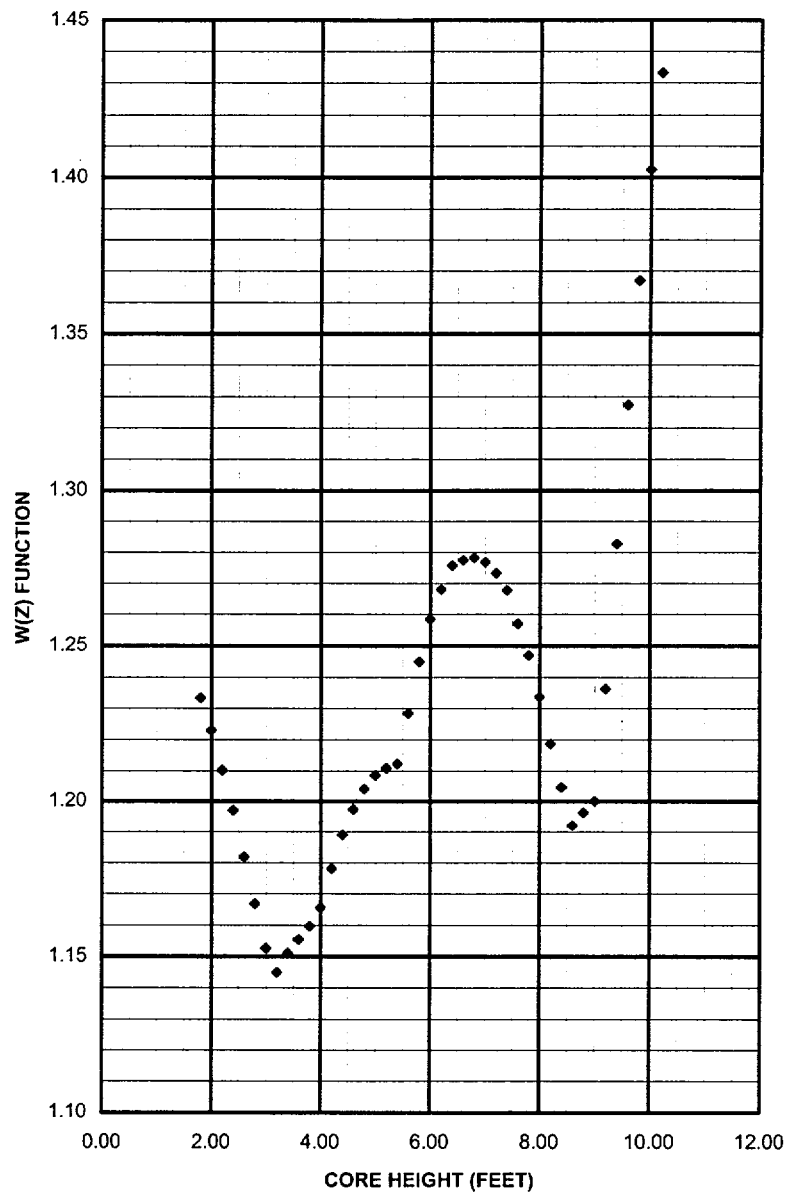
CORE OPERATING LIMITS REPORT (COLR) for BYRON UNIT 1 CYCLE 11A

Height
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	1.2333
2.00	1.2230
2.20	1.2102
2.40	1.1972
2.60	1.1819
2.80	1.1669
3.00	1.1526
3.20	1.1450
3.40	1.1511
3.60	1.1554
3.80	1.1597
4.00	1.1656
4.20	1.1782
4.40	1.1890
4.60	1.1975
4.80	1.2041
5.00	1.2086
5.20	1.2108
5.40	1.2122
5.60	1.2284
5.80	1.2449
6.00	1.2585
6.20	1.2681
6.40	1.2757
6.60	1.2774
6.80	1.2782
7.00	1.2768
7.20	1.2733
7.40	1.2679
7.60	1.2571
7.80	1.2469
8.00	1.2337
8.20	1.2186
8.40	1.2047
8.60	1.1922
8.80	1.1965
9.00	1.2001
9.20	1.2363
9.40	1.2828
9.60	1.3274
9.80	1.3669
10.00	1.4026
10.20	1.4333
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

Byron Unit 1 Cycle 11A

Figure 2.6.2.c

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

CORE OPERATING LIMITS REPORT (COLR) for BYRON UNIT 1 CYCLE 11A

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

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

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

2.7.2 Uncertainty when PDMS is inoperable

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

$$U_{F_{\Delta H}} = U_{F_{\Delta H}m}$$

where:

$$U_{F_{\Delta H}m} = \text{Base } F_{\Delta H}^N \text{ measurement uncertainty} = 1.04$$

2.7.3 PDMS Alarms:

$F_{\Delta H}^N$ Warning Setpoint $\geq 2\%$ of $F_{\Delta H}^N$ Margin

$F_{\Delta H}^N$ Alarm Setpoint $\geq 0\%$ of $F_{\Delta H}^N$ 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 Figure 2.8.1 or the latest valid PDMS Surveillance Report, whichever is more conservative.

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)

$$2.9.1 \quad DNBR_{APSL} \geq 1.659$$

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

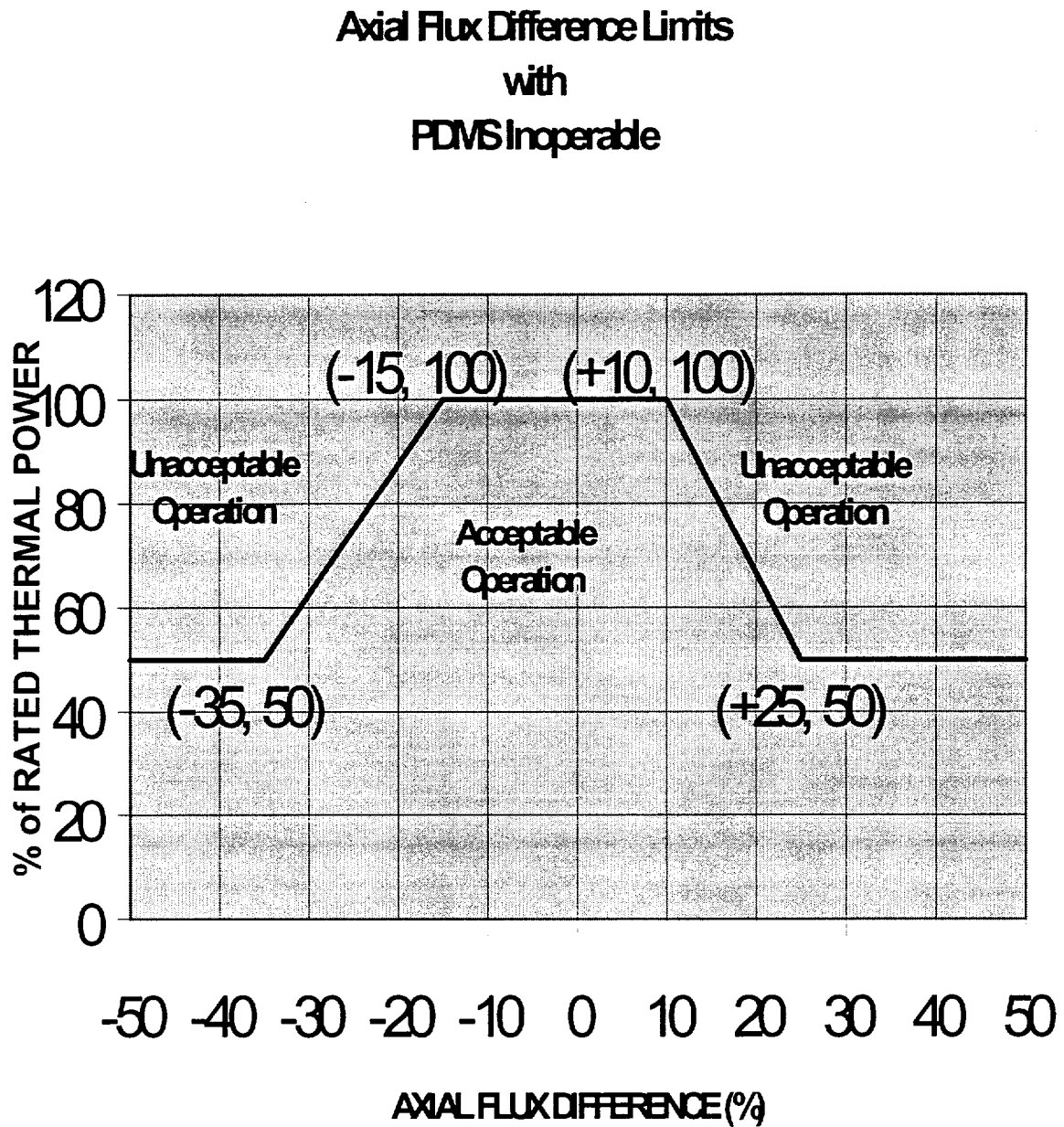
2.9.2 PDMS Alarms:

DNBR Warning Setpoint $\geq 2\%$ of DNBR Margin

DNBR Alarm Setpoint $\geq 0\%$ of DNBR Margin

CORE OPERATING LIMITS REPORT (COLR) for BYRON UNIT 1 CYCLE 11A

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



CORE OPERATING LIMITS REPORT (COLR) for BYRON UNIT 1 CYCLE 11A

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

- 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 0.00181 / psig.
- 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 $f_1(\Delta I)$ "positive" breakpoint shall be +10% ΔI .
- 2.10.13 The $f_1(\Delta I)$ "negative" breakpoint shall be -18% ΔI .
- 2.10.14 The $f_1(\Delta I)$ "positive" slope shall be +3.47% / % ΔI .
- 2.10.15 The $f_1(\Delta I)$ "negative" slope shall be -2.61% / % ΔI .

CORE OPERATING LIMITS REPORT (COLR) for BYRON UNIT 1 CYCLE 11A

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

- 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 $f_2(\Delta I)$ "positive" breakpoint shall be 0 for all ΔI .
- 2.11.13 The $f_2(\Delta I)$ "negative" breakpoint shall be 0 for all ΔI .
- 2.11.14 The $f_2(\Delta I)$ "positive" slope shall be 0 for all ΔI .
- 2.11.15 The $f_2(\Delta I)$ "negative" slope shall be 0 for all ΔI .

CORE OPERATING LIMITS REPORT (COLR) for BYRON UNIT 1 CYCLE 11A

2.12 Reactor Coolant System (RCS) DNB Parameter 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 380,900 gpm.

2.13 Boron Concentration

2.13.1 The refueling boron concentration shall be greater than or equal to 2000 ppm (LCO 3.9.1).

2.13.2 The Reactor Coolant System boron concentration shall be greater than or equal to 2075 ppm at all 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)

ATTACHMENT 2

Byron Station Unit 2 Cycle 10A Core Operating Limits Report Revision 1

NUCLEAR FUEL MANAGEMENT DEPARTMENT
TRANSMITTAL OF DESIGN INFORMATION

☒ SAFETY RELATED
☐ NON-SAFETY RELATED
☐ REGULATORY RELATED

Originating Organization
☒ Nuclear Fuel Management
☐ Other (specify) _____

NFM ID # NFM0100050
Rev. No. 1
Page 1 of 16

Station Byron Unit 2 Cycle 10A Generic _____

To: Kenneth N. Kovar – Byron

Subject Byron Unit 2 Cycle 10A Core Operating Limits Report in ITS Format and W(z) Function

Brian L. Manges
Preparer

Brian L. Manges
Preparer's Signature

12/7/2001
Date

Tyrone L. Stevens
Reviewer

Tyrone L. Stevens
Reviewer's Signature

12/10/01
Date

D. Redden
NFM Supervisor

D. Redden
Approver's Signature

12/10/01
Date

Status of Information:

☒ Verified
☐ Unverified
☐ Engineering Judgement

Method and Schedule of Verification for Unverified TODIs: _____

Description of Information:

Attached is the Byron Unit 2 Cycle 10A Core Operating Limits Report (COLR) in the ITS format and W(z) function. This COLR is for uprate at 3586.6 MWt. **Revision 1 of this TODI supercedes Revision 0.**

Purpose of Information:

In Revision 1, the SDM limits for MODE 5 were revised to 1.3% $\Delta k/k$ for LCO 3.1.1. Revision 1 also incorporates the EOL HFP ARO MTC surveillance limit at 60 ppm. Finally Revision 1 revises the AFD band to +10 at HFP conditions (Figure 2.8.1). Byron Station is requested to perform a Plant Review of this document. Upon completion of the Plant Review, Byron Station is to transmit the COLR portion to the Nuclear Regulatory Commission pursuant to Technical Specification 5.6.5. Please provide NFM (Brian Manges) with a copy of Byron Station's completed Plant Review and COLR submittal to the NRC. This TODI supercedes Reference 7.

Source of Information:

1. Westinghouse Letter 01CB-G-194 (CAC-01-289), dated December 6, 2001
2. TODI NFM0000188, Sequence 0 "Pressurizer Pressure DNB Limit", A. W. Wong to D. Wozniak and T. Luke, December 15, 2000
3. Westinghouse Letter 01CB-G-076 (ASD-01-113, Rev 1), dated April 16, 2001
4. TODI NFM0100054, Sequence 0, "RCS Average Temperature DNB Limit", A. W. Wong to D. Wozniak and C. Dunn, dated April 19, 2001
5. TODI NFM0100040, Revision 0, "Byron Unit 2 Cycle 10A OTAT and OTAP Setpoint Values", dated March 30, 2001
6. Westinghouse Letter 01CB-G-196 (ASD-01-276), dated December 5, 2001

Supplemental Distribution: P. E. Reister / J. E. Langan (BY)

CORE OPERATING LIMITS REPORT (COLR) for BYRON UNIT 2 CYCLE 10A

1.0 CORE OPERATING LIMITS REPORT

This Core Operating Limits Report (COLR) for Byron Station Unit 2 Cycle 10A 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	3.2.5	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) 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 BYRON UNIT 2 CYCLE 10A

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.

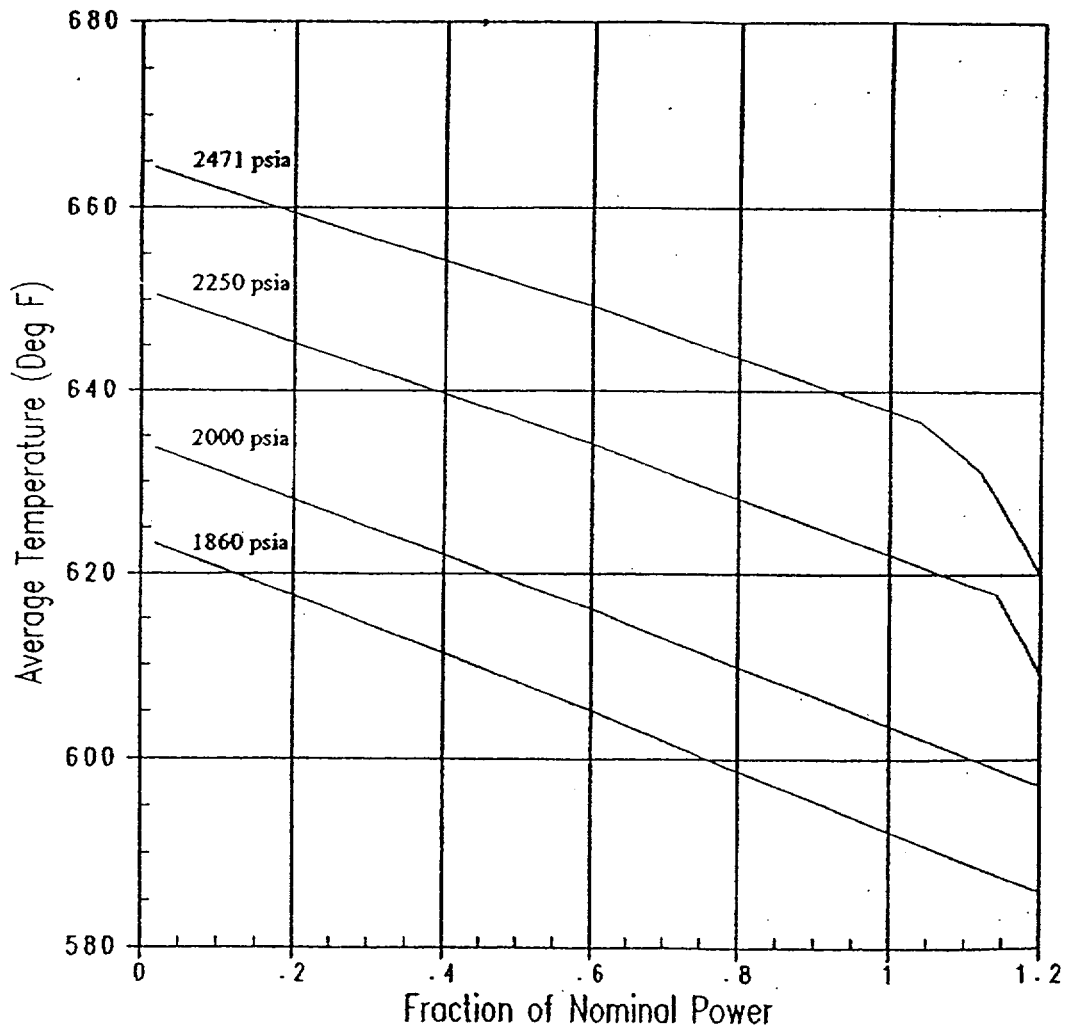


Figure 2.1.1: Reactor Core Limits

CORE OPERATING LIMITS REPORT (COLR) for BYRON UNIT 2 CYCLE 10A

2.2 Shutdown Margin (SDM)

The SDM limit for MODES 1, 2, 3, 4, and 5 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, 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 $+2.0 \times 10^{-5} \Delta k/k/^{\circ}F$.
- 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 less negative than or equal to $-3.7 \times 10^{-4} \Delta k/k/^{\circ}F$.
- 2.3.4 The EOL/ARO/HFP-MTC Surveillance limit at 60 ppm shall be less negative than or equal to $-4.3 \times 10^{-4} \Delta k/k/^{\circ}F$.

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 Limit (LCO 3.1.5)

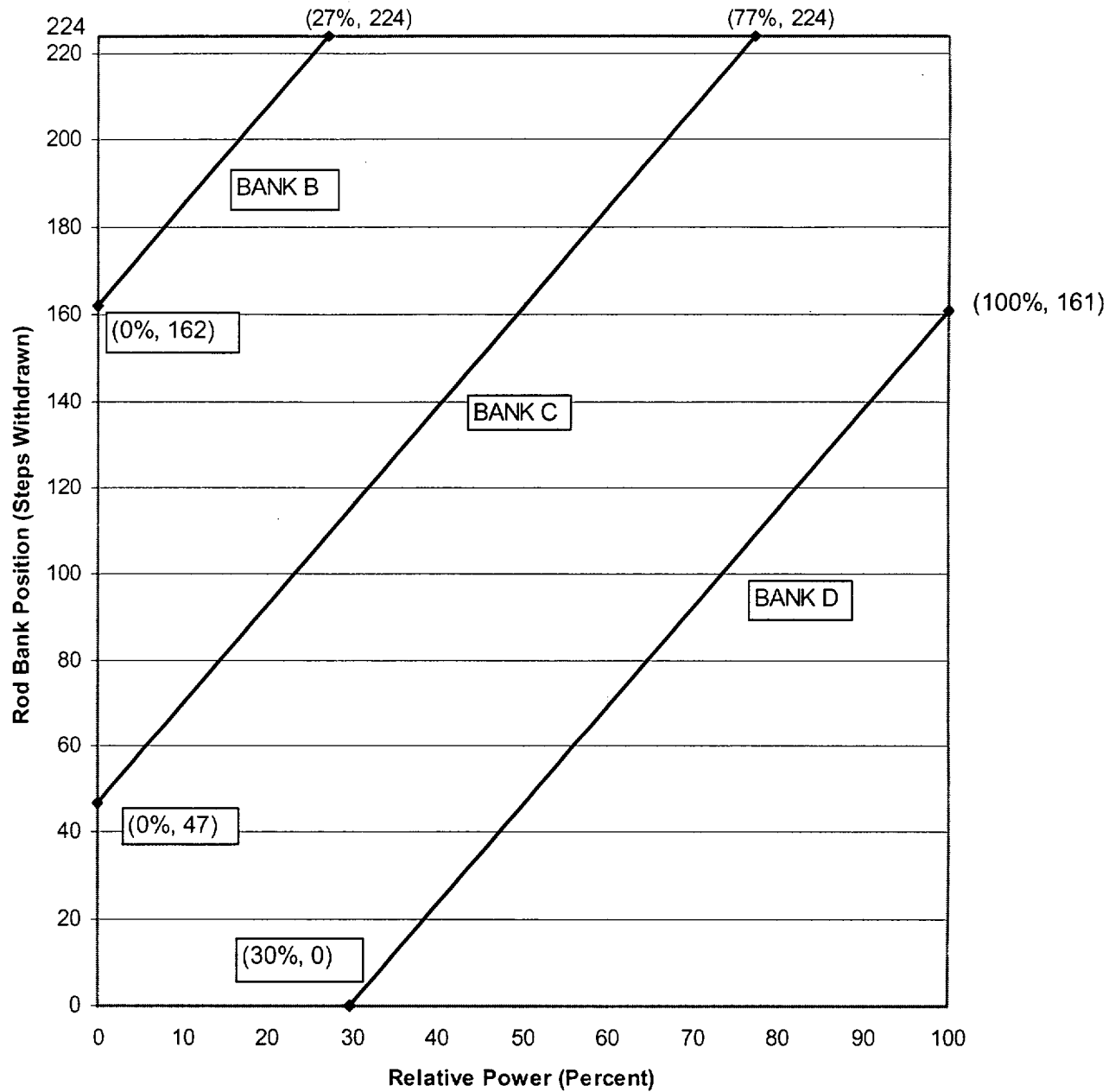
- 2.4.1 All shutdown banks shall be fully withdrawn to at least 224 steps.

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 110 step overlap limit.

CORE OPERATING LIMITS REPORT (COLR) for BYRON UNIT 2 CYCLE 10A

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



CORE OPERATING LIMITS REPORT (COLR) for BYRON UNIT 2 CYCLE 10A

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

2.6.1

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

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

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.

2.6.2 $W(Z)$ Values:

a) When PDMS is OPERABLE, $W(Z) = 1.00000$ for all axial points.

b) When PDMS is Inoperable, $W(Z)$ 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 951, 4000, 10000, and 18000 MWD/MTU.

For this cycle, the $F_Q^C(z)$ penalty factors are equal to 2% per 31 Effective Full Power Days (EFPD). 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.

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

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_e = Engineering uncertainty factor = 1.03

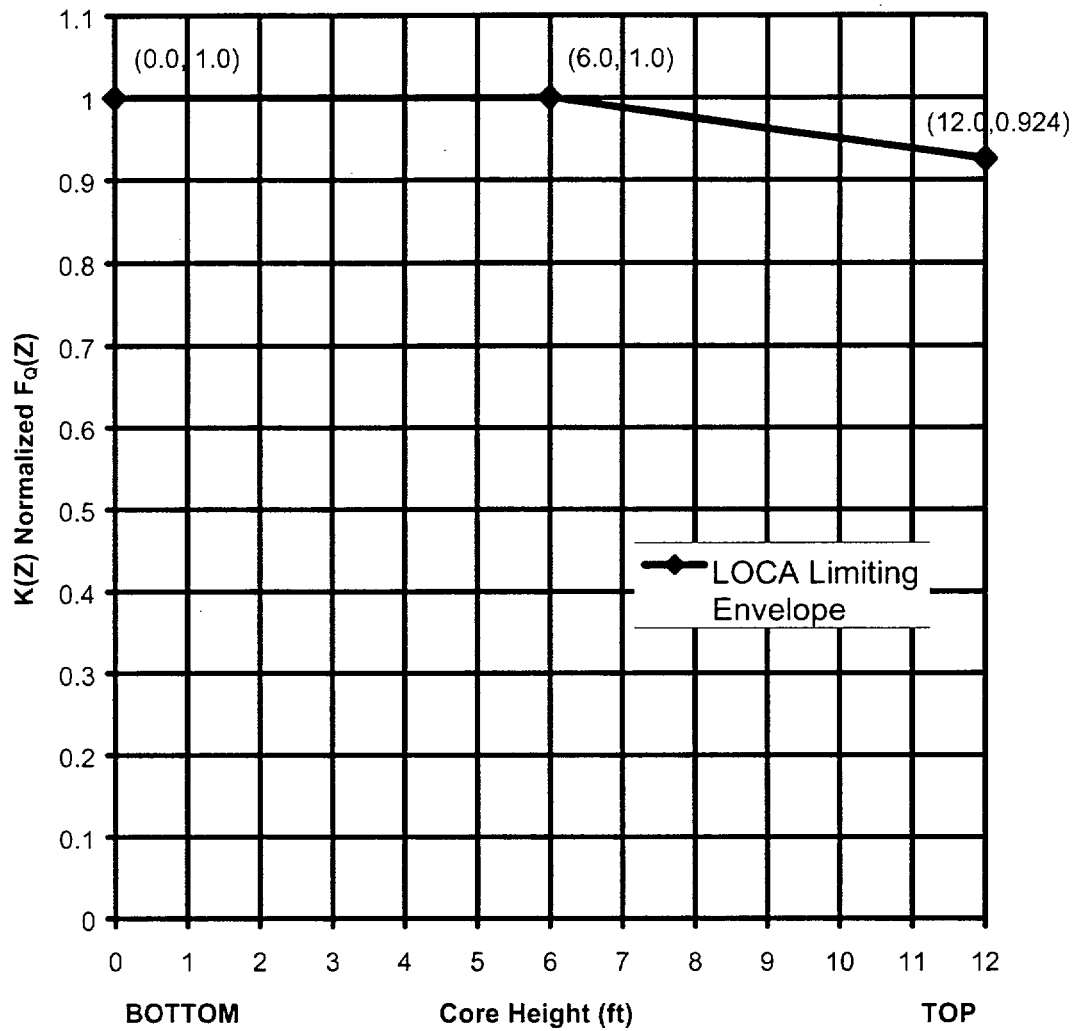
2.6.4 PDMS Alarms:

$F_Q(Z)$ Warning Setpoint $\geq 2\%$ of $F_Q(Z)$ Margin

$F_Q(Z)$ Alarm Setpoint $\geq 0\%$ of $F_Q(Z)$ Margin

CORE OPERATING LIMITS REPORT (COLR) for BYRON UNIT 2 CYCLE 10A

Figure 2.6.1
K(Z) - Normalized $F_0(Z)$ as a Function of Core Height



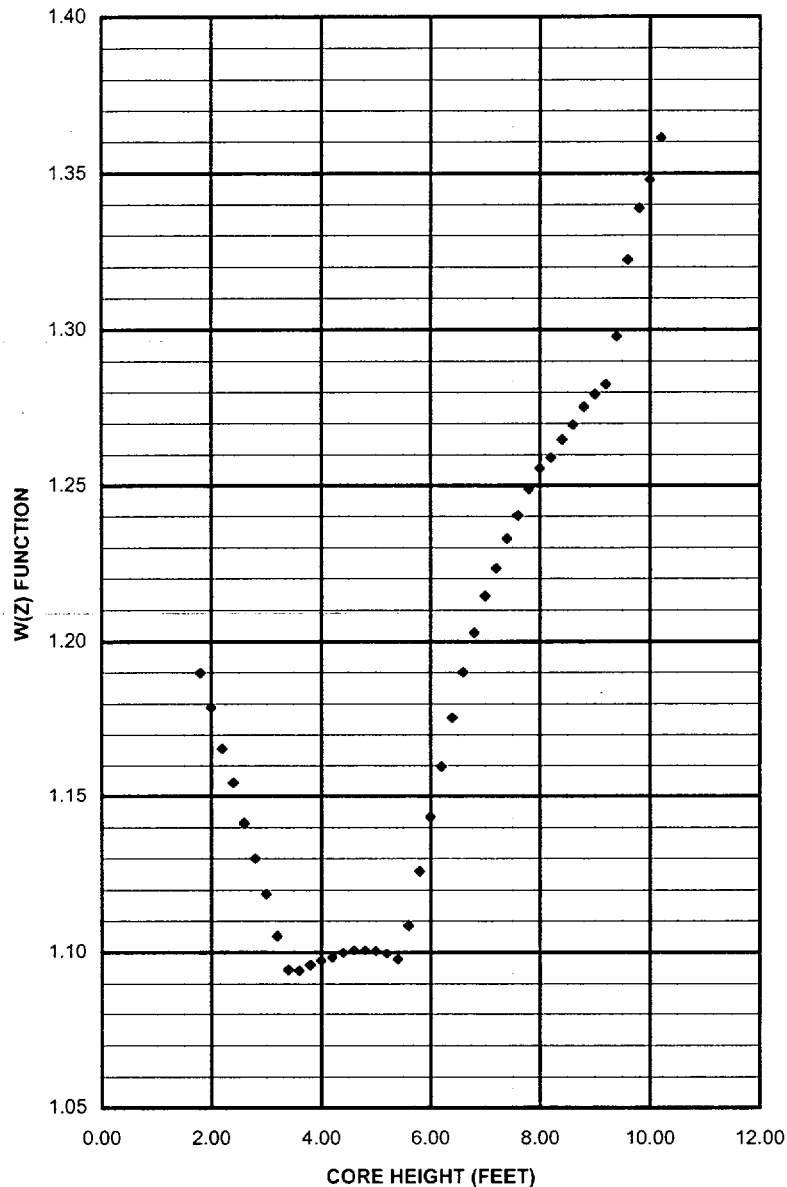
CORE OPERATING LIMITS REPORT (COLR) for BYRON UNIT 2 CYCLE 10A

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	1.1899
2.00	1.1789
2.20	1.1656
2.40	1.1546
2.60	1.1413
2.80	1.1300
3.00	1.1187
3.20	1.1054
3.40	1.0944
3.60	1.0941
3.80	1.0959
4.00	1.0974
4.20	1.0984
4.40	1.0999
4.60	1.1008
4.80	1.1007
5.00	1.1006
5.20	1.0997
5.40	1.0978
5.60	1.1086
5.80	1.1259
6.00	1.1432
6.20	1.1597
6.40	1.1754
6.60	1.1901
6.80	1.2028
7.00	1.2146
7.20	1.2234
7.40	1.2329
7.60	1.2403
7.80	1.2488
8.00	1.2555
8.20	1.2590
8.40	1.2647
8.60	1.2696
8.80	1.2754
9.00	1.2794
9.20	1.2825
9.40	1.2979
9.60	1.3224
9.80	1.3388
10.00	1.3480
10.20	1.3614
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

Byron Unit 2 Cycle 10A

Figure 2.6.2.a

Summary of W(Z) Function at 951 MWD/MTU
(Top and Bottom 15% Excluded per WCAP-10216)



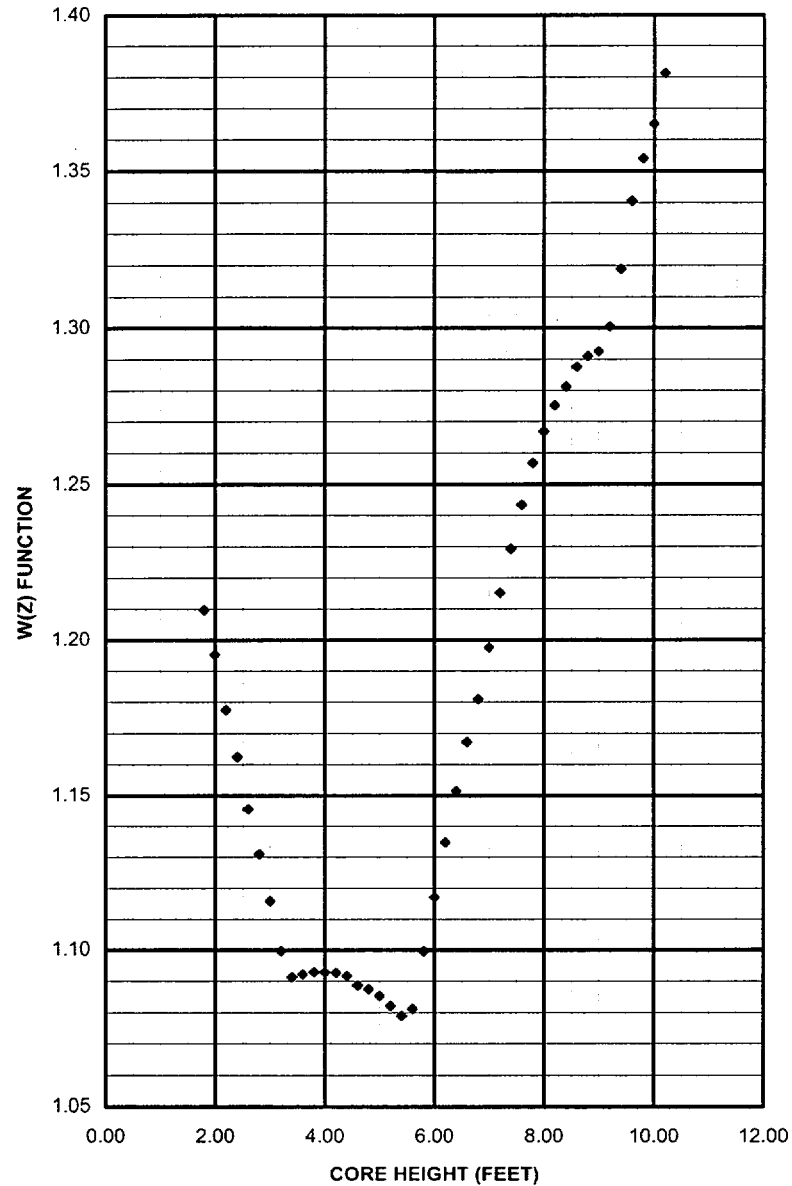
CORE OPERATING LIMITS REPORT (COLR) for BYRON UNIT 2 CYCLE 10A

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	1.2096
2.00	1.1952
2.20	1.1775
2.40	1.1623
2.60	1.1456
2.80	1.1309
3.00	1.1158
3.20	1.0997
3.40	1.0913
3.60	1.0922
3.80	1.0930
4.00	1.0929
4.20	1.0928
4.40	1.0917
4.60	1.0887
4.80	1.0874
5.00	1.0853
5.20	1.0821
5.40	1.0790
5.60	1.0812
5.80	1.0996
6.00	1.1170
6.20	1.1348
6.40	1.1515
6.60	1.1672
6.80	1.1809
7.00	1.1975
7.20	1.2152
7.40	1.2294
7.60	1.2434
7.80	1.2567
8.00	1.2669
8.20	1.2752
8.40	1.2813
8.60	1.2876
8.80	1.2911
9.00	1.2927
9.20	1.3005
9.40	1.3189
9.60	1.3405
9.80	1.3540
10.00	1.3650
10.20	1.3813
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

Byron Unit 2 Cycle 10A

Figure 2.6.2.b

Summary of W(Z) Function at 4000 MWD/MTU
(Top and Bottom 15% Excluded per WCAP-10216)



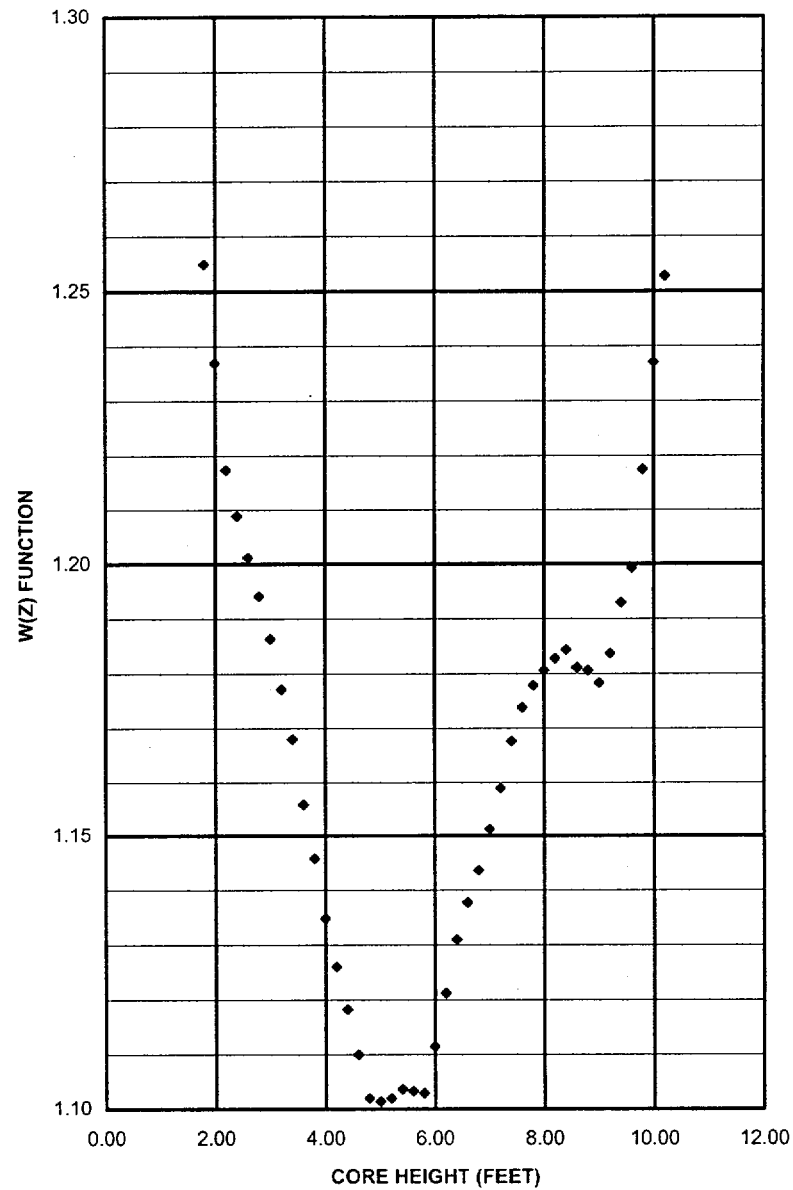
CORE OPERATING LIMITS REPORT (COLR) for BYRON UNIT 2 CYCLE 10A

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	1.2549
2.00	1.2369
2.20	1.2174
2.40	1.2089
2.60	1.2012
2.80	1.1941
3.00	1.1863
3.20	1.1771
3.40	1.1680
3.60	1.1560
3.80	1.1459
4.00	1.1349
4.20	1.1261
4.40	1.1183
4.60	1.1100
4.80	1.1020
5.00	1.1014
5.20	1.1020
5.40	1.1036
5.60	1.1033
5.80	1.1029
6.00	1.1115
6.20	1.1212
6.40	1.1310
6.60	1.1378
6.80	1.1437
7.00	1.1513
7.20	1.1590
7.40	1.1676
7.60	1.1738
7.80	1.1778
8.00	1.1806
8.20	1.1827
8.40	1.1843
8.60	1.1811
8.80	1.1806
9.00	1.1783
9.20	1.1836
9.40	1.1929
9.60	1.1993
9.80	1.2175
10.00	1.2370
10.20	1.2527
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

Byron Unit 2 Cycle 10A

Figure 2.6.2.c

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



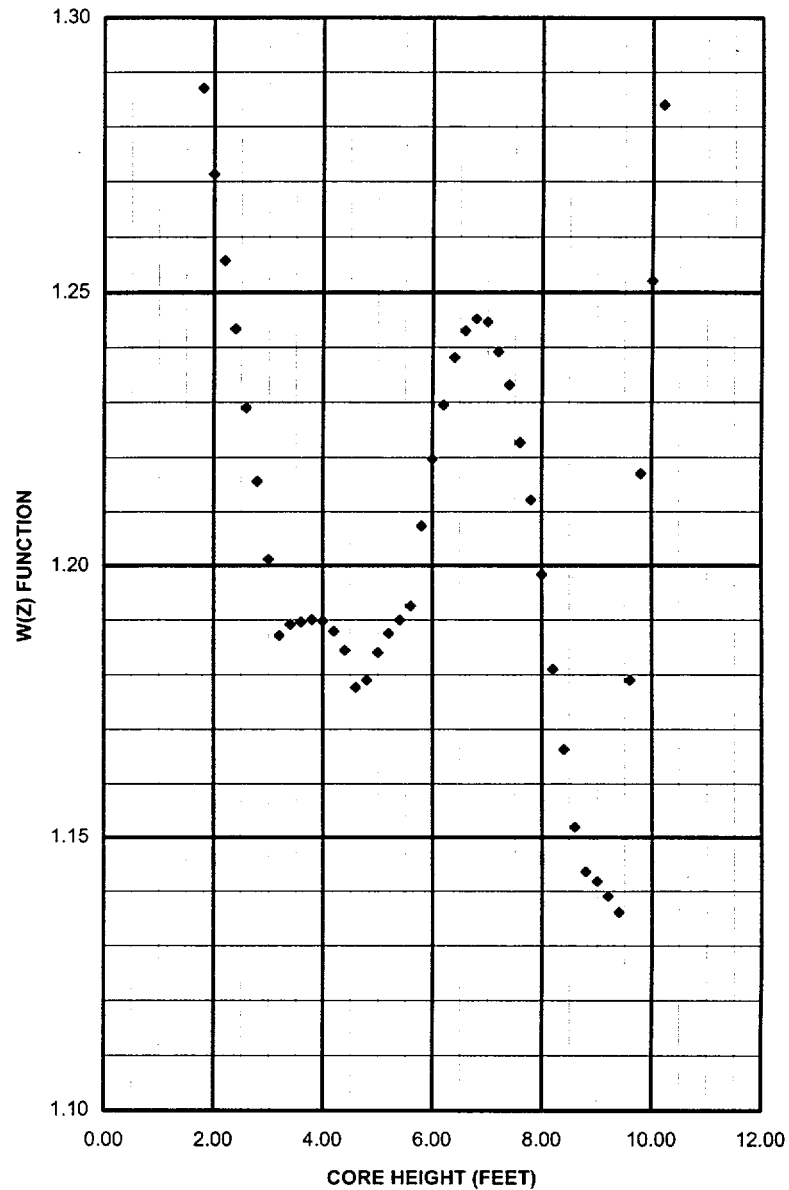
CORE OPERATING LIMITS REPORT (COLR) for BYRON UNIT 2 CYCLE 10A

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	1.2870
2.00	1.2714
2.20	1.2558
2.40	1.2433
2.60	1.2290
2.80	1.2156
3.00	1.2012
3.20	1.1872
3.40	1.1892
3.60	1.1896
3.80	1.1901
4.00	1.1898
4.20	1.1880
4.40	1.1844
4.60	1.1776
4.80	1.1790
5.00	1.1840
5.20	1.1876
5.40	1.1900
5.60	1.1926
5.80	1.2074
6.00	1.2197
6.20	1.2295
6.40	1.2381
6.60	1.2430
6.80	1.2452
7.00	1.2446
7.20	1.2392
7.40	1.2332
7.60	1.2227
7.80	1.2122
8.00	1.1984
8.20	1.1810
8.40	1.1663
8.60	1.1519
8.80	1.1437
9.00	1.1419
9.20	1.1391
9.40	1.1362
9.60	1.1790
9.80	1.2170
10.00	1.2520
10.20	1.2840
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

Byron Unit 2 Cycle 10A

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 BYRON UNIT 2 CYCLE 10A

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

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

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

2.7.2 Uncertainty when PDMS is inoperable

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

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

where:

$$U_{F_{\Delta Hm}} = \text{Base } F_{\Delta H}^N \text{ measurement uncertainty} = 1.04$$

2.7.3 PDMS Alarms:

$F_{\Delta H}^N$ Warning Setpoint $\geq 2\%$ of $F_{\Delta H}^N$ Margin

$F_{\Delta H}^N$ Alarm Setpoint $\geq 0\%$ of $F_{\Delta H}^N$ 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 Figure 2.8.1 or the latest valid PDMS Surveillance Report, whichever is more conservative.

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)

$$2.9.1 \quad DNBR_{APSL} \geq 1.659$$

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

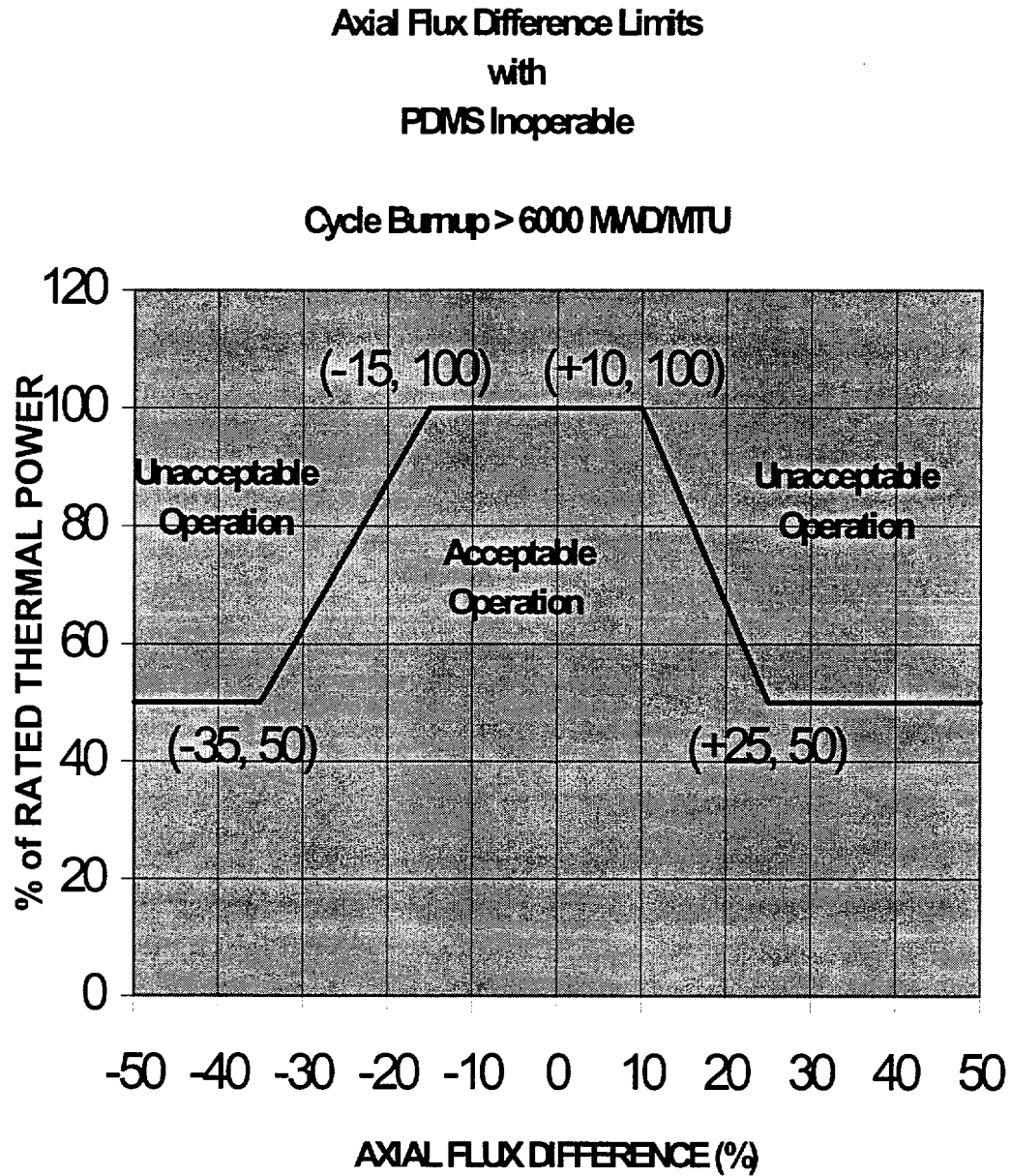
2.9.2 PDMS Alarms:

DNBR Warning Setpoint $\geq 2\%$ of DNBR Margin

DNBR Alarm Setpoint $\geq 0\%$ of DNBR Margin

CORE OPERATING LIMITS REPORT (COLR) for BYRON UNIT 2 CYCLE 10A

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



CORE OPERATING LIMITS REPORT (COLR) for BYRON UNIT 2 CYCLE 10A

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

- 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 0.00181 / psig.
- 2.10.4 The nominal T_{avg} at RTP (indicated) T' shall be less than or equal to 587.0 °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 $f_1 (\Delta I)$ "positive" breakpoint shall be +10% ΔI .
- 2.10.13 The $f_1 (\Delta I)$ "negative" breakpoint shall be -18% ΔI .
- 2.10.14 The $f_1 (\Delta I)$ "positive" slope shall be +3.47% / % ΔI .
- 2.10.15 The $f_1 (\Delta I)$ "negative" slope shall be -2.61% / % ΔI .

CORE OPERATING LIMITS REPORT (COLR) for BYRON UNIT 2 CYCLE 10A

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

- 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 587.0 °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 $f_2(\Delta I)$ "positive" breakpoint shall be 0 for all ΔI .
- 2.11.13 The $f_2(\Delta I)$ "negative" breakpoint shall be 0 for all ΔI .
- 2.11.14 The $f_2(\Delta I)$ "positive" slope shall be 0 for all ΔI .
- 2.11.15 The $f_2(\Delta I)$ "negative" slope shall be 0 for all ΔI .

CORE OPERATING LIMITS REPORT (COLR) for BYRON UNIT 2 CYCLE 10A

2.12 Reactor Coolant System (RCS) DNB Parameter 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 592.1 °F.

2.12.3 The RCS total flow rate shall be greater than or equal to 380,900 gpm.

2.13 Boron Concentration

2.13.1 The refueling boron concentration shall be greater than or equal to 2000 ppm (LCO 3.9.1).

2.13.2 The Reactor Coolant System boron concentration shall be greater than or equal to 1918 ppm at all 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)