

SEP 15 2006

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TS 5.6.5.d

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

Prairie Island Nuclear Generating Plant Unit 1  
Docket 50-282  
License No. DPR-42

Core Operating Limits Report (COLR) for Prairie Island Unit 1 Cycle 24, Revision 1

By letter dated May 28, 2006, Nuclear Management Company, LLC (NMC) submitted the Unit 1, Cycle 24, COLR, Revision 0. Westinghouse notified NMC on June 14, 2006, that the Unit 1, Cycle 24, COLR, Revision 0, contained an error involving the heat flux hot channel ( $F_q$ ) transient penalty factor used in Table 3. On June 15, 2006, Westinghouse transmitted the corrected values as Revision 1 to the Unit 1, Cycle 24 COLR. Pursuant to the requirements of Technical Specification 5.6.5.d, NMC submits Unit 1, Cycle 24, COLR, Revision 1.

Westinghouse has ascertained that this error was limited to Table 3 of the Unit 1, Cycle 24, COLR, Revision 0, and other information in the COLR was not impacted by the error. The error was not present in any prior cycle and is not present in the information for the current Unit 2 Cycle 23. The corrected information requires the application of a value slightly larger than the reported transient  $F_q$  penalty factor for burnups greater than approximately 13 GigaWatt days (GWd)/ Metric Tons Uranium (MTU). The reported transient  $F_q$  penalty factor data for burnup values up to approximately 13 GWD/MTU was correct in the original Revision 0 COLR. The corrected Revision 1 COLR only changed transient  $F_q$  penalty factor values for burnups greater than approximately 13 GWD/MTU. Since the current Unit 1 burnup as of September 1, 2006 is 3290 MegaWatt days (MWd)/MTU, there was no impact on plant operations during the time the error existed in the COLR.

Summary of Commitments

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

  
Thomas J. Palmisano  
Site Vice President, Prairie Island Nuclear Generating Plant  
Nuclear Management Company, LLC

Enclosure (1)

cc: Administrator, Region III, USNRC  
Project Manager, Prairie Island, USNRC  
Resident Inspector, Prairie Island, USNRC

**ENCLOSURE 1**

**PRAIRIE ISLAND NUCLEAR GENERATING PLANT  
CORE OPERATING LIMITS REPORT  
UNIT 1 – CYCLE 24  
REVISION 1**

PRAIRIE ISLAND NUCLEAR GENERATING PLANT

Core Operating Limits Report

Record of Revision

Unit	Cycle	Revision No.	Approval Date	Remarks
2	13	0	3/22/90	Original Unit 2 Core Operating Limits Report, distributed with Technical Specification Revision 92.
1	14	0	3/22/90	Original Unit 1 Core Operating Limits Report, distributed with Technical Specification Revision 92.
		1	7/27/90	Incorporated expanded V(z) curves.
		2	9/27/90	Clarified rod insertion limit curve applicability.
		3	2/11/91	Incorporated revised $F_Q$ of 2.45 as a result of NRC approval of Westinghouse Topical Report WCAP-10924-P-A, Volume 1, Addendum 4, October 1990.
2	14	0	-	Not used.
		1	9/27/90	Updated to Unit 2 Cycle 14, incorporated expanded V(z) curves and clarified rod insertion limit curve applicability.
		2	2/11/91	Incorporated revised $F_Q$ of 2.45 as a result of NRC approval of Westinghouse Topical Report WCAP-10924-P-A, Volume 1, Addendum 4, October 1990.
1	15	0	6/25/91	Updated to Unit 1 Cycle 15.
2	15	0	3/9/92	Updated to Unit 2 Cycle 15 and clarified labeling of Figure 4. Clarified the actions to be taken if the nuclear enthalpy rise hot channel factor exceeds the Technical Specification limit.
1	16	0	12/28/92	Updated to Unit 1 Cycle 16, removed V(z) curves and replaced them with list of bounding V(z) values for three ranges of exposures.
2	16	0	12/8/93	Updated to Unit 2 Cycle 16. Removed the multiple V(z) curves and replaced them with a single figure with bounding V(z) curves for four ranges of exposures. Incorporated additional discussion related to V(z) and K(z).

PRAIRIE ISLAND NUCLEAR GENERATING PLANT

Core Operating Limits Report

Record of Revision

Unit	Cycle	Revision No.	Approval Date	Remarks
2	16	1	11/3/94	The table containing the bounding V(z) values and Figure 2 updated to incorporate revised bounding V(z) values for the exposure range of 14-21.5 GWD/MTU. Figures 3 through 6 re-formatted.
1	17	0	6/17/94	Updated to Unit 1 Cycle 17. Removed the list of bounding V(z) values and replaced it with multiple V(z) curves. Incorporated additional discussion related to V(z) and K(z).
2	17	0	6/2/95	Updated to Unit 2 Cycle 17. Incorporated Table 1 and expanded Figure 2 with updated bounding V(z) values.
1	18	0	2/7/96	Updated to Unit 1 Cycle 18. Incorporated revised $E_{\Delta H}$ limit of 1.77. Incorporated Table 1 and updated Figure 2 with revised bounding V(z) values.
2	18	0	2/27/97	Updated to Unit 2 Cycle 18. Revised $E_{\Delta H}$ limit to 1.77. Updated Table 1 and Figures 2a through 2e with revised bounding V(z) values. Incorporated new Figures 2f and 2g with additional bounding V(z) values.
1	19	0	9/25/97	Updated to Unit 1 Cycle 19. Updated Table 1 and Figures 2a through 2f with revised bounding V(z) values.
2	19	0	12/17/98	Updated to Unit 2 Cycle 19. Updated Table 1 and Figures 2a through 2d with revised bounding V(z) values. Deleted Figures 2e, 2f and 2g.
1	20	0	5/13/99	Updated to Unit 1 Cycle 20. Updated Table 1 and Figures 2a through 2f with revised bounding V(z) values.
		1	8/4/00	Technical Specification Amendment 151: Relocate shutdown margin (SDM) requirements from Tech Specs and incorporate additional SDM requirements for Modes 3-6 from revised analysis of Uncontrolled Dilution event.

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Core Operating Limits Report

Record of Revision

Unit	Cycle	Revision No.	Approval Date	Remarks
2	20	0	5/31/00	Updated to Unit 2 Cycle 20. Updated Table 1 and Figures 2a through 2d with revised bounding V(z) values. Added new Table 2 and Figures 2e, 2f and 2g with additional bounding V(z) values. Added references to Tables 1 and 2 and to Figures 2e, 2f and 2g to discussion of heat flux hot channel factor limits. Added discussion clarifying applicability of axial flux difference limits when using Tables 1 and 2 and Figures 2a through 2g. Added discussion of two tier V(z) curve presented in Table 2 and Figure 2g.
		1	8/4/00	Technical Specification Amendment 142: Relocate shutdown margin (SDM) requirements from Tech Specs and incorporate additional SDM requirements for Modes 3-6 from revised analysis of Uncontrolled Dilution event.
1	20	2	9/1/00	Revised to change axial flux difference target band.
1	21	0	1/31/01	Updated to support refueling activities associated with Unit 1 Cycle 21. Revision 0 of the Unit 1 Cycle 21 COLR had to be issued prior to confirming the applicability of the LOCA analysis. Therefore, Revision 0 of the Unit 1 Cycle 21 COLR does not contain all of the operating limits necessary to support operation of Unit 1 Cycle 21.
1	21	1	2/19/01	Updated to Unit 1 Cycle 21. Updated Tables 1 and 2 and Figures 2a through 2f with revised bounding V(z) values.
1	21	2	10/02/02	Revised to support License Amendment 158 changes, including revision of all references to TS, revision of F <sub>Q</sub> symbols, addition of Table 4, ITC limits, DNB limits and refueling boron concentrations.
2	21	0	2/06/02	Updated to Unit 2 Cycle 21.
2	21	1	10/02/02	Revised to support License Amendment 149

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Core Operating Limits Report

Record of Revision

Unit	Cycle	Revision No.	Approval Date	Remarks
				changes, including revision of all references to TS, revision of $F_Q$ symbols, addition of Table 4, ITC limits, DNB limits and refueling boron concentrations. Also revised to include an additional $V(z)$ curve to give greater $F_Q$ margin between 13.0 and 16.0 GWd/MTU.
1	22	0	11/25/02	Updated to Unit 1 Cycle 22. Updated Tables 1 and 2 and Figures 2a through 2f with revised bounding $V(z)$ values. Incorporated new Figure 2g with additional bounding $V(z)$ values. Updated Table 3 with revised minimum shutdown margin limits. Deleted and revised text to eliminate duplication with the Technical Specifications and the Bases.
2	22	0	9/19/03	Updated to Unit 2 Cycle 22. Updated Tables 1 and 2. A reduced number of exposure ranges were calculated in Table 1, therefore new Figures 2a through 2e with revised bounding $V(z)$ values replaced Figures 2a through 2f. New Figure 2f replaced Figure 2g for the 2 tier band bounding $V(z)$ values. Updated Table 3 with revised minimum shutdown margin limits. Deleted and revised text to eliminate duplication with the Technical Specifications and the Bases.
1	22	1	7/6/04	Revision to incorporate Westinghouse Safety Analysis Transition per LA 162/153. Revision 1 contains transitional values for the OP/OT $\Delta T$ Trip setpoints that will be used while the physical changes are implemented.
2	22	1	7/6/04	Revision to incorporate Westinghouse Safety Analysis transition per LA 162/153. Revision 1 contains transitional values for the OP/OT $\Delta T$ Trip setpoints that will be used while the physical changes are implemented.
2	22	2	7/12/04	Revised $F_Q$ limit from 2.4 to 2.5. Removed OP and OT delta-T setpoints based on NMC methodology and replaced with Westinghouse developed setpoints.
1	22	2	7/16/04	Revised $F_Q$ limit form 2.4 to 2.5. Removed OP and OT delta-T setpoints based on NMC

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Unit	Cycle	Revision No.	Approval Date	Remarks
				methodology and replaced with Westinghouse developed setpoints.
1	23	0	10/20/04	Updated to Unit 1 Cycle 23.
2	23	0	-	Not used due to core redesign.
2	23	1	5/19/05	Updated to Unit 2 Cycle 23 and to support redesign of Unit 2 Cycle 23 core.
1	23	1	7/11/05	Revised ITC upper limit from $< 0$ pcm/ $^{\circ}$ F for power levels $> 70\%$ RTP to less than a line that slopes linearly from 0 pcm/ $^{\circ}$ F at 70% RTP to -2.9 pcm/ $^{\circ}$ F at 100% RTP. Revised the title of Figure 3 to reference T.S. 3.1.4 Condition B and revised the title of Figure 4 to reference T.S. 3.1.4 Condition A. Added references 24 and 25 to include the 50.59 screenings written to issue revision 1.
1	24	0	5/10/06	Updated to Unit 1 Cycle 24.
1	24	1	8/7/06	Updated Table 3 to reflect the correct $F_q^w(z)$ penalty factors.





**PRAIRIE ISLAND NUCLEAR GENERATING PLANT**

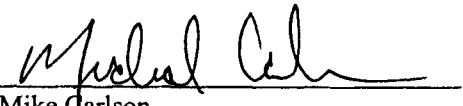
**CORE OPERATING LIMITS REPORT**

**UNIT 1 – CYCLE 24**

**REVISION 1**

Reviewed By:  Date: 7/20/06  
Lynn Johnson  
Supervisor, NSSS

Reviewed By:  Date: 7/19/2006  
Ed Mercier  
Supervisor, PWR Analyses

Approved By:  Date: 8/7/06  
Mike Carlson  
Director, Site Engineering

Note: This report is not part of the Technical Specifications  
This report is referenced in the Technical Specifications

**PRAIRIE ISLAND NUCLEAR GENERATING PLANT**  
**CORE OPERATING LIMITS REPORT**  
**UNIT 1 - CYCLE 24**  
**REVISION 1**

This report provides the values of the limits for Unit 1 Cycle 24 as required by Technical Specification Section 5.6.5. These values have been established using NRC approved methodology and are established such that all applicable limits of the plant safety analysis are met. The Technical Specifications affected by this report are listed below:

1. 2.1.1 Reactor Core SLs
2. 3.1.1 Shutdown Margin (SDM)
3. 3.1.3 Isothermal Temperature Coefficient (ITC)
4. 3.1.5 Shutdown Bank Insertion Limits
5. 3.1.6 Control Bank Insertion Limits
6. 3.1.8 Physics Tests Exceptions - MODE 2
7. 3.2.1 Heat Flux Hot Channel Factor ( $F_Q(z)$ )
8. 3.2.2 Nuclear Enthalpy Rise Hot Channel Factor ( $F_{\Delta H}^N$ )
9. 3.2.3 Axial Flux Difference (AFD)
10. 3.3.1 Reactor Trip System (RTS) Instrumentation  
Overtemperature  $\Delta T$  and Overpower  $\Delta T$  Parameter Values for Table 3.3.1-1
11. 3.4.1 RCS Pressure, Temperature, and Flow - Departure from Nucleate Boiling (DNB) Limits
12. 3.9.1 Boron Concentration

1. 2.1.1 Reactor Core Safety Limits

Reactor Core Safety Limits are shown in Figure 1.

Reference Technical Specification section 2.1.1.

2. 3.1.1 Shutdown Margin Requirements

Minimum Shutdown Margin requirements are shown in Table 1.

Reference Technical Specification section 3.1.1.

3. 3.1.3 Isothermal Temperature Coefficient (ITC)

ITC Upper limit:

- a.  $< 5$  pcm/ $^{\circ}$ F for power levels  $< 70\%$  RTP; and
- b. less than a line which slopes linearly from
  - i)  $0$  pcm/ $^{\circ}$ F at power level =  $70\%$  RTP to
  - ii)  $-1.5$  pcm/ $^{\circ}$ F at power level =  $100\%$  RTP

ITC Lower limit:

- a.  $-32.7$  pcm/ $^{\circ}$ F

Reference Technical Specification section 3.1.3.

4. 3.1.5 Shutdown Bank Insertion Limits

The shutdown rods shall be fully withdrawn.

Reference Technical Specification section 3.1.5.

5. 3.1.6 Control Bank Insertion Limits

The control rod banks shall be limited in physical insertion as shown in Figures 2, 3, and 4.

The control rod banks withdrawal sequence shall be Bank A, Bank B, Bank C, and finally Bank D.

The control rod banks shall be withdrawn maintaining 128 step tip-to-tip distance.

Reference Technical Specification section 3.1.6.

6. 3.1.8 Physics Tests Exceptions - MODE 2

Minimum Shutdown Margin requirements during physics testing are shown in Table 1.

Reference Technical Specification section 3.1.8.

7. 3.2.1 Heat Flux Hot Channel Factor ( $F_Q(Z)$ )

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

$$CFQ = 2.50$$

$K(Z)$  is a constant value = 1.0 at all elevations.

$W(Z)$  values are provided in Table 2.

$F_Q^W(Z)$  Penalty Factors are provided in Table 3.

**Applicability:** MODE 1.

Reference Technical Specification section 3.2.1

8. 3.2.2 Nuclear Enthalpy Rise Hot Channel Factor ( $F_{\Delta H}^N$ )

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

$$F_{\Delta H} \leq 1.77 \times [1 + 0.3(1 - P)]$$

where: P is the fraction of RATED THERMAL POWER at which the core is operating.

**Applicability:** MODE 1.

Reference Technical Specification section 3.2.2

9. 3.2.3 Axial Flux Difference (AFD)

The indicated axial flux difference, in % flux difference units, shall be maintained within the allowed operational space defined by Figure 5.

**Applicability:** MODE 1 with RATED THERMAL POWER  $\geq$  50% RTP.

Reference Technical Specification sections 3.2.3.

10. 3.3.1 Reactor Trip System (RTS) Instrumentation

Overtemperature  $\Delta T$  and Overpower  $\Delta T$  Parameter Values for Table 3.3.1-1;

Overtemperature  $\Delta T$  Setpoint

Overtemperature  $\Delta T$  setpoint parameter values:

- $\Delta T_0$  = Indicated  $\Delta T$  at RATED THERMAL POWER, %
- T = Average temperature, °F
- T' = 560.0 °F
- P = Pressurizer Pressure, psig
- P' = 2235 psig
- $K_1$   $\leq$  1.17
- $K_2$  = 0.014 /°F
- $K_3$  = 0.00100 /psi
- $\tau_1$  = 30 seconds
- $\tau_2$  = 4 seconds
- f( $\Delta I$ ) = A function of the indicated difference between top and bottom detectors of the power range nuclear ion chambers. Selected gains are based on measured instrument response during plant startup tests, where  $q_t$  and  $q_b$  are the percent power in the top and bottom halves of the core respectively, and  $q_t + q_b$  is total core power in percent of RATED THERMAL POWER, such that
  - (a) For  $q_t - q_b$  within -13, +8 % f( $\Delta I$ ) = 0
  - (b) For each percent that the magnitude of  $q_t - q_b$  exceeds +8% the  $\Delta T$  trip setpoint shall be automatically reduced by an equivalent of 1.73 % of RATED THERMAL POWER.
  - (c) For each percent that the magnitude of  $q_t - q_b$  exceeds -13 % the  $\Delta T$  trip setpoint shall be automatically reduced by an equivalent of 3.846 % of RATED THERMAL POWER.

Overpower  $\Delta T$  Setpoint

Overpower  $\Delta T$  setpoint parameter values:

- $\Delta T_0$  = Indicated  $\Delta T$  at RATED THERMAL POWER, %
- T = Average temperature, °F
- T' = 560.0 °F
- $K_4$   $\leq$  1.11
- $K_5$  = 0.0275/°F for increasing T; 0 for decreasing T
- $K_6$  = 0.002/°F for T > T' ; 0 for T  $\leq$  T'
- $\tau_3$  = 10 seconds

11. 3.4.1 RCS Pressure, Temperature, and Flow - Departure from Nucleate Boiling (DNB) Limits

Pressurizer pressure limit = 2205 psia  
RCS average temperature limit = 564°F  
RCS total flow rate limit = 178,000 gpm

Reference Technical Specification section 3.4.1.

12. 3.9.1 Refueling Boron Concentration.

The boron concentration of the reactor coolant system and the refueling cavity shall be sufficient to ensure that the more restrictive of the following conditions is met:

- a)  $K_{eff} \leq 0.95$
- b) 2000 ppm
- c) The Shutdown Margin specified in Table 1

Reference Technical Specification section 3.9.1.

## REFERENCES

1. NSPNAD-8101-A, "Qualification of Reactor Physics Methods for Application to Prairie Island," Revision 2, October 2000.
2. NSPNAD-8102-PA, "Prairie Island Nuclear Power Plant Reload Safety Evaluation Methods for Application to PI Units," Revision 7, July 1999.
3. NSPNAD-97002-PA, "Northern States Power Company's "Steam Line Break Methodology," Revision 1, October 2000.
4. WCAP-9272-P-A, "Westinghouse Reload Safety Evaluation Methodology," July, 1985.
- 5.a WCAP-10054-P-A, "Westinghouse Small Break ECCS Evaluation Model using the NOTRUMP Code," August, 1985.
- 5.b WCAP-10054-P-A, "Westinghouse Small Break ECCS Evaluation Model using the NOTRUMP Code," Addendum 2 Revision 1, July 1997.
- 6.a WCAP-10924-P-A, "Westinghouse Large Break LOCA Best Estimate Methodology," Revision 1, Volume 1 Addendum 1,2,3, December 1988.
- 6.b WCAP-10924-P-A, "Westinghouse Large Break LOCA Best Estimate Methodology," Revision 2 , Volume 2 Addendum 1, December 1988.
- 6.c WCAP-10924-P-A, "Westinghouse Large Break LOCA Best Estimate Methodology," Revision 1, Volume 1 Addendum 4, March 1991.
7. XN-NF-77-57-(A), XN-NF-77-57, Supplement 1 (A), "Exxon Nuclear Power Distribution Control for Pressurized Water Reactors Phase II," May 1981.
8. WCAP-13677-P-A, "10 CFR 50.46 Evaluation Model Report: W-COBRA/TRAC 2-Loop Upper Plenum Injection Model Update to Support ZIRLO<sup>TM</sup> Cladding Options," February 1994.
9. NSPNAD-93003-A, "Prairie Island Units 1 and 2 Transient Power Distribution Methodology," Revision 0, April 1993.
10. WCAP-10216-P-A, Revision 1A, "Relaxation of Constant Axial Offset Control/ FQ Surveillance Technical Specification," February 1994.
11. WCAP-8745-P-A, "Design Bases for the Thermal Overpower  $\Delta T$  and Thermal Overtemperature  $\Delta T$  Trip Functions," September 1986.
12. WCAP-11397-P-A, "Revised Thermal Design Procedure," April 1989.

13. WCAP-14483-A, "Generic Methodology for Expanded Core Operating Limits Report," January 1999.
14. WCAP-7588 Rev. 1-A, "An Evaluation of the Rod Ejection Accident in Westinghouse Pressurized Water Reactors Using Spatial Kinetics Methods," January 1975.
15. WCAP-7908-A, "FACTRAN – A FORTRAN IV Code for Thermal Transients in a UO<sub>2</sub> Fuel Rod," December 1989.
16. WCAP-7907-P-A, "LOFTRAN Code Description," April 1984.
17. WCAP-7979-P-A, "TWINKLE – A Multidimensional Neutron Kinetics Computer Code," January 1975.
18. WCAP-10965-P-A, "ANC: A Westinghouse Advanced Nodal Computer Code," December 1985.
19. WCAP-11394-P-A, "Methodology for the Analysis of the Dropped Rod Event," January 1990.
20. WCAP-11596-P-A, "Qualification of the PHOENIX-P/ANC Nuclear Design System for Pressurized Water Reactor Cores," June 1988.
21. WCAP-12910 Rev. 1-A, "Pressurizer Safety Valve Set Pressure Shift," May 1993.
22. WCAP-14565-P-A, "VIPRE-01 Modeling and Qualification for Pressurized Water Reactor Non-LOCA Thermal-Hydraulic Safety Analysis," October 1999.
23. WCAP-14882-P-A, "RETRAN-02 Modeling and Qualification for Westinghouse Pressurized Water Reactor Non-LOCA Safety Analyses," April 1999.
24. 50.59 Evaluation 1054, "Unit 1 Cycle 24 Core Reload."



**Table 1**

**Minimum Required Shutdown Margin**

Plant Conditions	Number of Charging Pumps Running**		
	0-1 Pump	2 Pumps	3 Pumps
Mode 1*	-	-	-
Mode 2*	2.0%	2.0%	2.0%
Mode 3, $T_{ave} \geq 520^{\circ}\text{F}$	2.0%	2.0%	2.0%
Mode 3, $350^{\circ}\text{F} \leq T_{ave} < 520^{\circ}\text{F}$	2.0%	2.0%	2.5%
Mode 4	2.0%	4.5%	6.5%
Mode 5***, $T_{ave} \leq 200^{\circ}\text{F}$	2.5%	5.5%	8.0%
Mode 6, ARI***, $T_{ave} \geq 68^{\circ}\text{F}$	5.129%	5.5%	8.0%
Mode 6, ARO***, $T_{ave} \geq 68^{\circ}\text{F}$	5.129%	6.5%	10.0%
Physics Testing in Mode 2	0.5%	0.5%	0.5%

Operational Mode Definitions, as per TS Table 1.1-1.

- \* For Mode 1 and Mode 2 with  $K_{eff} \geq 1.0$ , the minimum shutdown margin requirements are provided by the Rod Insertion Limits.
- \*\* Charging pump(s) in service only pertains to steady state operations. It does not include transitory operations. For example, operations such as starting a second charging pump in order to secure the operating pump would fall under the one pump in service column.
- \*\*\* These values are also applicable for the Unit 1 Cycle 23 end of cycle.

**Table 2 - W(z) Values(Top 10% and Bottom 8% excluded)**

	Height [ft]	BU [MWd/MTU]			
		150	6000	12000	20000
		AO = 3.26	AO = -1.66	AO = -3.51	AO = -1.03
[BOTTOM] 1	0.00	1.0000	1.0000	1.0000	1.0000
2	0.20	1.0000	1.0000	1.0000	1.0000
3	0.40	1.0000	1.0000	1.0000	1.0000
4	0.60	1.0000	1.0000	1.0000	1.0000
5	0.80	1.0000	1.0000	1.0000	1.0000
6	1.00	1.3879	1.2397	1.1747	1.1918
7	1.20	1.3736	1.2294	1.1659	1.1821
8	1.40	1.3572	1.2177	1.1562	1.1719
9	1.60	1.3391	1.2052	1.1460	1.1619
10	1.80	1.3197	1.1920	1.1356	1.1520
11	2.00	1.2992	1.1783	1.1251	1.1423
12	2.20	1.2779	1.1643	1.1147	1.1327
13	2.40	1.2561	1.1504	1.1045	1.1233
14	2.60	1.2341	1.1367	1.0946	1.1142
15	2.80	1.2124	1.1212	1.0848	1.1040
16	3.00	1.1897	1.1164	1.0768	1.1043
17	3.20	1.1705	1.1169	1.0741	1.1156
18	3.40	1.1620	1.1164	1.0781	1.1281
19	3.60	1.1622	1.1155	1.0842	1.1414
20	3.80	1.1621	1.1140	1.0900	1.1538
21	4.00	1.1607	1.1117	1.0950	1.1650
22	4.20	1.1588	1.1099	1.0995	1.1748
23	4.40	1.1560	1.1097	1.1032	1.1831
24	4.60	1.1524	1.1087	1.1062	1.1898
25	4.80	1.1480	1.1069	1.1086	1.1949
26	5.00	1.1428	1.1069	1.1103	1.1983
27	5.20	1.1372	1.1105	1.1116	1.2004
28	5.40	1.1308	1.1167	1.1137	1.2009
29	5.60	1.1227	1.1231	1.1185	1.1998
30	5.80	1.1237	1.1287	1.1259	1.2020
31	6.00	1.1312	1.1371	1.1348	1.2090
32	6.20	1.1387	1.1489	1.1448	1.2180
33	6.40	1.1466	1.1591	1.1558	1.2281
34	6.60	1.1536	1.1686	1.1674	1.2381
35	6.80	1.1595	1.1772	1.1782	1.2468
36	7.00	1.1643	1.1846	1.1878	1.2535
37	7.20	1.1679	1.1907	1.1963	1.2582
38	7.40	1.1701	1.1958	1.2041	1.2607
39	7.60	1.1707	1.2003	1.2110	1.2608
40	7.80	1.1698	1.2032	1.2161	1.2582
41	8.00	1.1670	1.2041	1.2193	1.2529
42	8.20	1.1624	1.2030	1.2204	1.2448
43	8.40	1.1559	1.1998	1.2192	1.2338
44	8.60	1.1475	1.1950	1.2163	1.2206
45	8.80	1.1370	1.1853	1.2089	1.2092
46	9.00	1.1340	1.1821	1.2067	1.1957
47	9.20	1.1441	1.1930	1.2161	1.1818
48	9.40	1.1564	1.2031	1.2261	1.1817
49	9.60	1.1675	1.2121	1.2352	1.1840
50	9.80	1.1813	1.2189	1.2413	1.1872
51	10.00	1.1954	1.2264	1.2496	1.1905
52	10.20	1.2076	1.2373	1.2630	1.1928
53	10.40	1.2241	1.2472	1.2736	1.1942
54	10.60	1.2361	1.2605	1.2881	1.1978
55	10.80	1.2462	1.2736	1.3041	1.2028
56	11.00	1.0000	1.0000	1.0000	1.0000
57	11.20	1.0000	1.0000	1.0000	1.0000
58	11.40	1.0000	1.0000	1.0000	1.0000
59	11.60	1.0000	1.0000	1.0000	1.0000
60	11.80	1.0000	1.0000	1.0000	1.0000
[TOP] 61	12.00	1.0000	1.0000	1.0000	1.0000

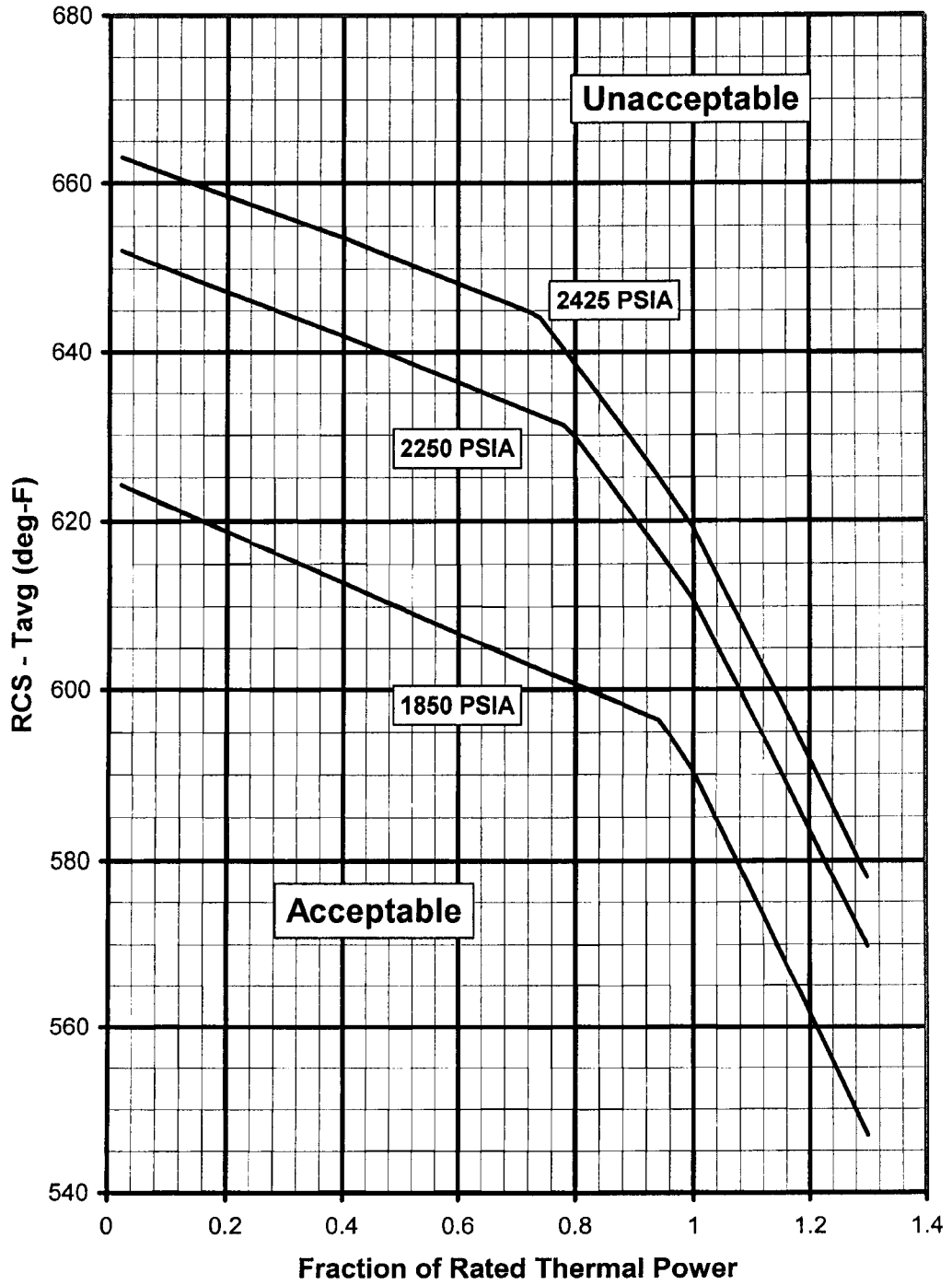
**Table 3**  
 **$F^W_{Q(Z)}$  Penalty Factor**

<b>Cycle Burnup (MWD/MTU)</b>	<b><math>F^W_{Q(Z)}</math> Penalty Factor</b>
0	1.020
13281	1.020
13432	1.023
13583	1.027
13734	1.027
13885	1.027
14036	1.025
14187	1.023
14338	1.021
14488	1.020

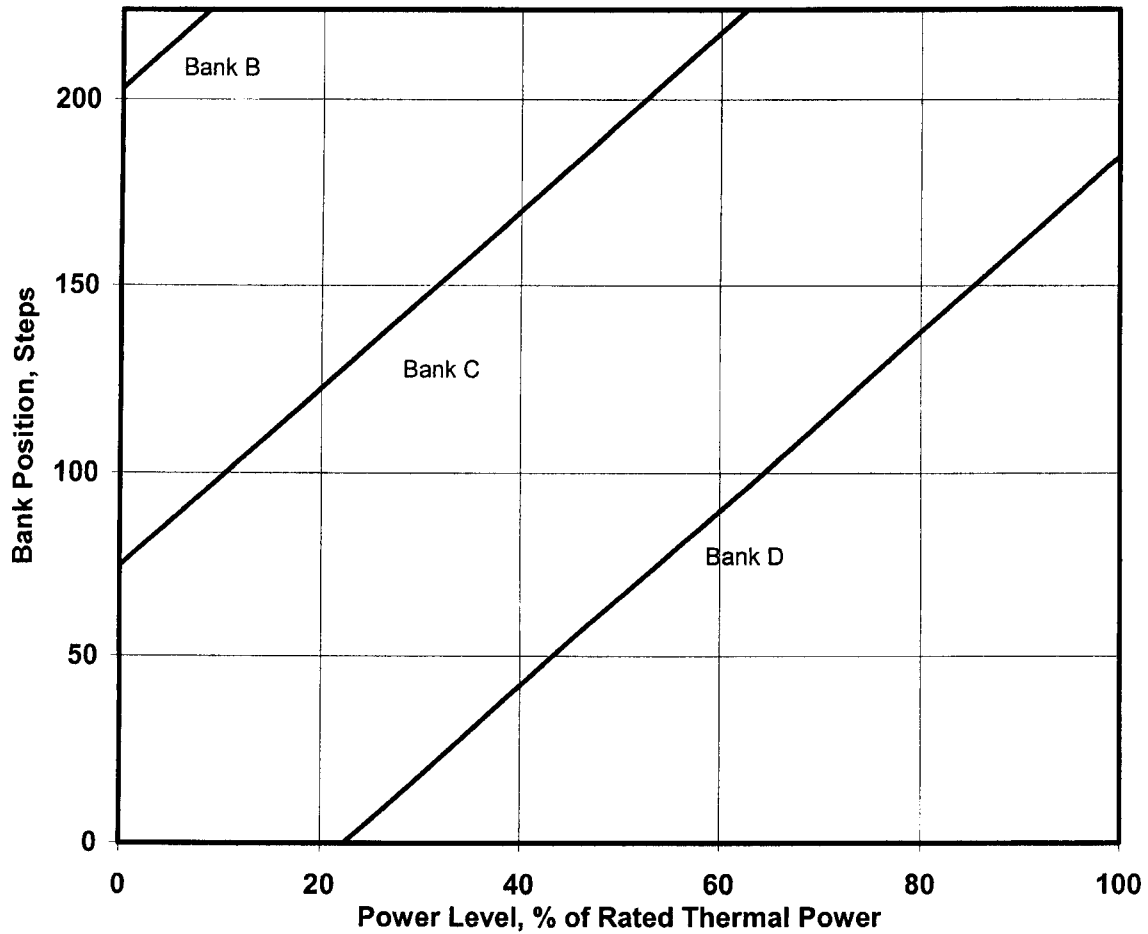
$F^W_{Q(Z)} = 1.020$  for all burnups except those listed above. Linear interpolation is adequate for intermediate cycle burnups.

Figure 1

Reactor Core Safety Limits



**Figure 2**  
**Rod Insertion Limit, 128 Step Tip-to-Tip**

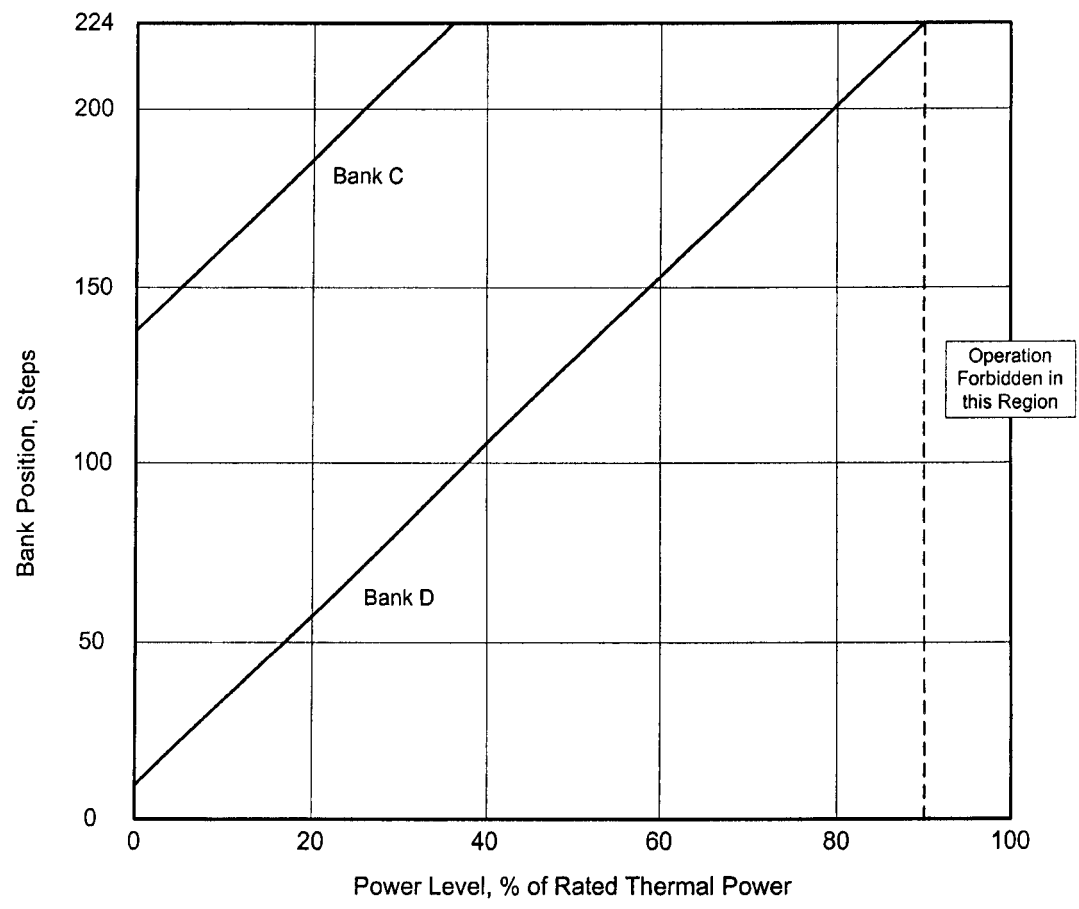


Bank Positions Given By:

- Bank D =  $(150 / 63) * (P - 100) + 185$
- Bank C =  $(150 / 63) * (P - 100) + 185 + 128$
- Bank B =  $(150 / 63) * (P - 100) + 185 + 128 + 128$

NOTE: The top of the active fuel height corresponds to 224 steps. The ARO parking position may be any position above 224 steps.

**Figure 3**  
**Rod Insertion Limit, 128 Step Tip-to-Tip, One Bottomed Rod**  
**(Technical Specification 3.1.4 Condition B)**

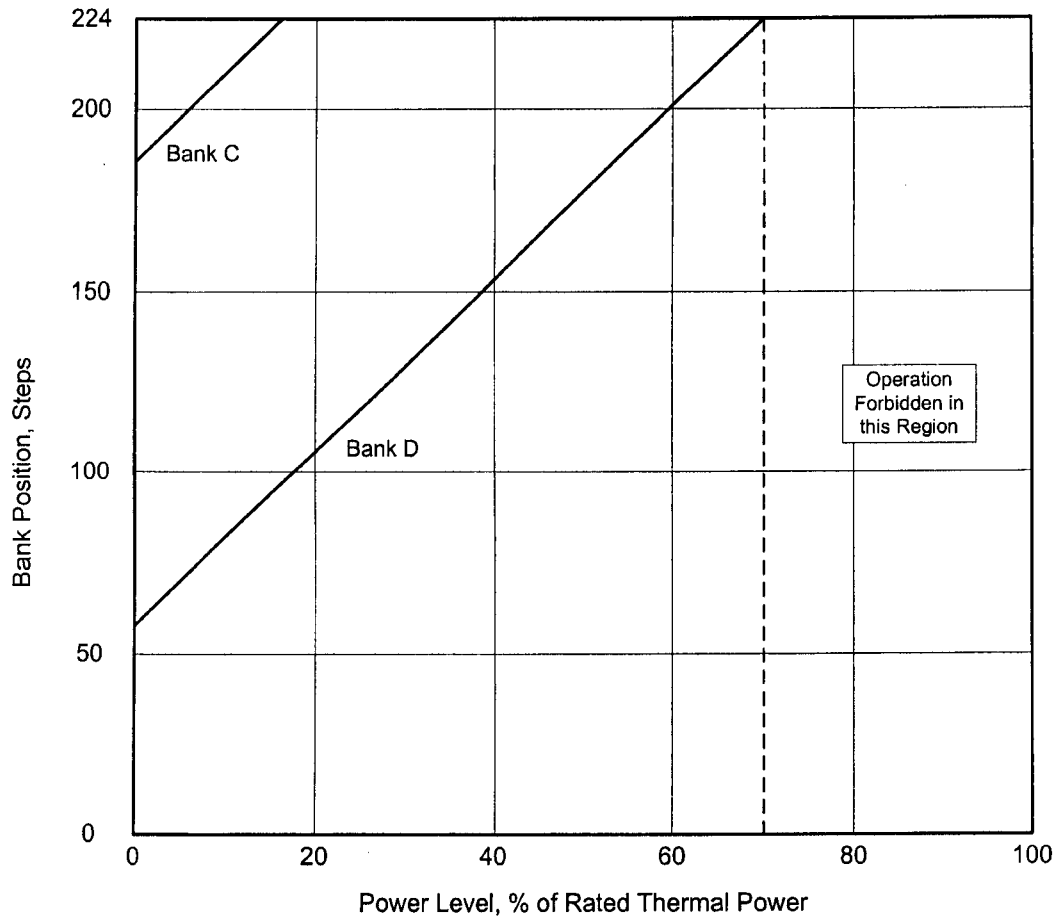


Bank Positions Given By:

- Bank D =  $(150 / 63) * (P - 90) + 224$
- Bank C =  $(150 / 63) * (P - 90) + 224 + 128$

NOTE: The top of the active fuel height corresponds to 224 steps. The ARO parking position may be any position above 224 steps.

**Figure 4**  
**Rod Insertion Limit, 128 Step Tip-to-Tip, One Inoperable Rod**  
**(Technical Specification 3.1.4 Condition A)**



Bank Positions Given By:

- Bank D =  $(150 / 63) * (P - 70) + 224$
- Bank C =  $(150 / 63) * (P - 70) + 224 + 128$

NOTE: The top of the active fuel height corresponds to 224 steps. The ARO parking position may be any position above 224 steps.

**Figure 5**  
**Flux Difference Operating Envelope**

