JAFP-15-0103

ENCLOSURE 2

Core Operating Limits Report
Revision 29

(Non-proprietary Version)

(26 Pages Including Contents)

JAFP-15-0103 Enclosure 2 Contents

Core Operating Limits Report 25 Pages

Entergy

ENTERGY NUCLEAR OPERATIONS, INC.
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
REPORT

CORE OPERATING LIMITS REPORT
REVISION 29

APPROVED BY: S. DEFILLIPPO DATE: 7/27/15
REACTOR ENGINEERING SUPERVISOR

APPROVED BY: Actins DATE: 7/27/15
GENERAL MANAGER – PLANT OPERATIONS
D. Poulin

Information Notice

This is a non-proprietary version of the James A. FitzPatrick COLR Revision 29, which has proprietary information removed. Portions of the document that have been removed are indicated by white space inside open and closed bracket as shown here [[ ]].

REVISION RECORD

Revision	Cycle	Date	Description
29	**22**	July 2015	COLR Rev. 29 is valid for Cycle 22 operation with the impacts of the elevated 38-39 FSC on bundle flow and core bypass flow addressed in the installed 3D-Monicore databank.

Summary of Changes		
Rev. 29	Effective upon final approval	Applicable for use during Cycle 22 Operation. Revision issued to address the SRLR-Rev.1 (Ref. 3.8) analyses that evaluated the impacts of the Cycle 22 elevated 38-39 FSC on bundle flow and core bypass flow when the installed 3D-Monicore databank contains the implementation of 38-39 FSC adjusted inlet orifice loss coefficients and increased bypass flow for 3DM core monitoring.model. Update for a SRLR-Rev.1 (Ref. 3.8) reference and for an addition of the specific OLMCPR limits required for cell 38-39 GNF2 fuel. GESTAR reference updated to the latest revision 21 (Ref. 3.7). GESTAR Rev. 21 includes the NRC approved use of the analysis code TRACG04 for use in Option I-D stability analyses. COLR reference pointing to the latest revision of GESTAR addresses the concern raised in CR-HQN-2015-00639. The Fuel Impact report, reference 3.21 is added. It clearly delineates that the SRLR Rev.1 specific OLMCPR limits are only applicable once the 3DMonicore databank for explicit 38-39 FSC model is installed. This revision record and summary added.
Rev. 28	10/01/2014	Applicable for use during Cycle 22 Operation. Revision issued to update this document for FitzPatrick Reload 21 Cycle 22 cycle dependent data. GESTAR reference updated to the latest revision 20 (Ref. 3.7). Update to cycle specific references. Update for a reference with a latest revision for GNF2 GNF2 Advantage Generic Compliance with NEDE-24011-P-A (GESTAR II) Update for a reference with the final regulatory approval for PRIME implementation in downstream analysis codes. FWTR is permitted in Cycle 22 operation.Content of TABLE 8.4 defining MCPR Operating Limit for Final Feedwater Temperature Reduction is added. This revision record and summary added.

TABLE OF CONTENTS

1.0 PURPOSE

This report provides the cycle-specific operating limits for Cycle 22 of the James A. FitzPatrick Nuclear Power Plant. The following limits are addressed:

- Operating Limit Minimum Critical Power Ratio (MCPR)
- Flow Dependent MCPR Limits
- Average Planar Linear Heat Generation Rate (APLHGR)
- Linear Heat Generation Rate (LHGR)
- Flow-Biased Average Power Range Monitor (APRM) and Rod Block Monitor (RBM) Allowable Values
- Stability Option ID Exclusion Region

2.0 APPLICABILITY

The plant shall be operated within the limits specified in this report. If any of these limits are exceeded, the corrective actions specified in the Technical Specifications shall be taken.

3.0 REFERENCES

3.1 EN-LI-113, Licensing Basis Document Change process

3.2 JAFNPP Technical Specifications

3.3 EC45913, Cycle 22 Core Reload

3.4 EN-DC-503, 3D Monicore New Cycle Update and Databank Maintenance.

3.5 Plant Operation Up To 100% Power With One Steam Line Isolated, JAF-SE-96-035.

3.6 GE Report, J.A. FitzPatrick Nuclear Power Plant APRM/RBM/Technical Specifications/Maximum Extended Operating Domain (ARTS/MEOD), NEDC-33087P, Revision 1, September 2005

3.7 General Electric Standard Application for Reactor Fuel, NEDE-24011-P-A-21, May 2015; and the U.S. Supplement, NEDE-24011-P-A-21-US, May 2015.

3.8 GNF Report, Supplemental Reload Licensing Report for FitzPatrick Reload 21 Cycle 22, 001N8543-SRLR, Revision 1, July 2015. [EC 58732, ECH-NE-14-00034 R1]

3.9 "GNF2 Fuel Design Cycle-Independent Analyses for Entergy FitzPatrick", GE Report, GEH-0000-0074-2662-R1, June 2010. [EC23634, JAF-RPT-08-00013 R1]

3.10 Licensing Topical Report, ODYSY Application for Stability Licensing Calculations Including Option I-D and II Long Term Solutions, NEDE-33213P-A, April 2009

3.11 GE Letter, R. Kingston to P. Lemberg, Scram Time versus Notch Positions for Option B, REK-E: 02-009, May 28, 2002

3.12 GE Report, James A. FitzPatrick Nuclear Power Plant Final Feedwater Temperature Reduction NEDC-33077, September 2002.

3.13 JD-02-122, Final Feedwater Temperature Reduction Implementation.

3.14 KGO-ENO-JB1-13-085, NEDC-33270P, R5, GNF2 Advantage Generic Compliance with NEDE-24011-P-A (GESTAR II), May 2013

3.15 GNF Report, Fuel Bundle Information Report for FitzPatrick Reload 21 Cycle 22, 001N8544-FBIR, Revision 0, Class II, August 2014. [EC 52654, ECH-NE-14-00035 R0]

3.16 JF-03-00402, ARTS/MEOD Phase 1 Implementation

3.17 JAF-RPT-MISC-04489, Rev.7, Power-Flow Map Report

3.18 GE Hitachi, "Effect of Cycle Extension on the Reload Stability Analyses for Options I-D, II and III", 0000-0125-2402-R0, November 2010

3.19 KGO-ENO-JB1-13-062, Applicability of GE Methods to Expanded Operating Domains, NEDC-33173P-A R4, November 2012.

3.20 KGO-ENO-EP1-14-113, SL MCPR Summary Results for FitzPatrick Cycle 22, Sept.15, 14.

3.21 GNF, 002N6416, R1, "Raised Fuel Support Casting Fuel Impact Analysis for FitzPatrick Cycle 22", July 2015 [Accepted in EC5873 per EN-DC-149]

4.0 DEFINITIONS

4.1 Average Planar Linear Heat Generation Rate (APLHGR):

The APLHGR shall be applicable to a specific planar height and is equal to the sum of the heat generation rate per unit length of fuel rod for all the fuel rods in the specified assembly at the specified height divided by the number of fuel rods in the fuel assembly at the height.

4.2 Linear Heat Generation Rate (LHGR):

The LHGR shall be the heat generation rate per unit length of fuel rod. It is the integral of the heat flux over the heat transfer area associated with the unit length.

4.3 Minimum critical power ratio (MCPR):

The MCPR shall be the smallest critical power ratio (CPR) that exists in the core for each type of fuel. The CPR is that power in the assembly that is calculated by application of the appropriate correlation(s) to cause some point in the assembly to experience boiling transition, divided by the actual assembly operating power.

4.4 Rated Recirculation Flow :

That drive flow which produces a core flow of 77.0×10^6 lb/hr.

5.0 RESPONSIBILITIES

NOTE: See EN-LI-113 (Reference 3.1)

5.1 **Shift Manager:**

Assure that the reactor is operated within the limits described herein.

5.2 **Reactor Engineering Supervisor:**

Assure that the limits described herein are properly installed in the 3D-Monicore databank used for thermal limit surveillance (Reference 3.4)

6.0 SPECIAL INSTRUCTIONS/REQUIREMENTS

Evaluations of the licensing analyses documented in the SRLR-Rev.1 (Ref.3.8) were performed to address their applicability for plant operations with the elevated fuel support casting condition in Cycle 22 core location 38-39. The SRLR-Rev.1 evaluations for the four FSC affected bundles determined that if the four FSC affected bundles were specifically modeled to address the elevated fuel support casting, then a small increase in the OLMCPR for those four FSC affected bundles would be needed to ensure that the SLMCPR would be protected in the event of a limiting pressurization transient. The specific OLMCPR limits required per Reference 3.8 are documented in the COLR Table 8.1, Table 8.2, Table 8.3, or Table 8.4. The SRLR-Rev.1 analyses are applicable as long as the impacts of the elevated FSC on bundle flow and core bypass flow are addressed in the 3-D core performance calculations (3DM).

7.0 PROCEDURE

7.1 Operating Limit MCPR

During operation, with thermal power $\geq$ 25% of rated thermal power (RTP), the Operating Limit MCPR shall be equal to or greater than the limits given below.

7.1.1 Technical Specification LCO 3.2.2, Minimum Critical Power Ratio (MCPR)

7.1.2 The Operating Limit MCPR shall be determined based on the following requirement:

7.1.2.1 The average scram time to notch position 36 shall be:

$$\tau_{AVE} \leq \tau_B$$

$$\tau_{AVE} = \frac{\sum_{i=1}^{n} N_i \tau_i}{\sum_{i=1}^{n} N_i}$$

7.1.2.2 The average scram time to notch position 36 is determined as follows:

WHERE:

n = Number of surveillance tests performed to date in the cycle,

N_i = Number of active rods measured in the surveillance i

τ_i = Average scram time to notch position 36 of all rods measured in surveillance test i.

7.1.2.3 The adjusted analysis mean scram time is calculated as follows:

$$\tau_B(\text{sec}) = \mu + 1.65\sigma\left[\frac{N_1}{\sum_{i=1}^{n} N_i}\right]^{1/2}$$

WHERE:

μ = Mean of the distribution for the average scram insertion time to the dropout of notch position 36 = 0.830 sec.

σ = Standard deviation of the distribution for average scram insertion time to the dropout of notch position 36 = 0.019 sec.

N_1 = The total number of active rods measured in Technical Specification SR 3.1.4.4.

The number of rods to be scram tested and the test intervals are given in Technical Specification LCO 3.1.4, Control Rod Scram Times

7.1.3 When requirement of 7.1.2.1 is met, the Operating Limit MCPR shall not be less than that specified in Table 8.1, Table 8.2, Table 8.3, or Table 8.4 as applicable for $\tau = 0$.

7.1.4 **WHEN** the requirement 7.1.2.1 is not met (i.e. $\tau_{AVE} > \tau_B$), **THEN** the Operating Limit MCPR values (as a function of τ) are given in Tables 8.1, 8.2, 8.3, or 8.4 as applicable.

$$\tau = \frac{(\tau_{AVE} - \tau_B)}{(\tau_A - \tau_B)}$$

WHERE:

τ_{AVE} = The average scram time to notch position 36 as defined in 7.1.2.2.

τ_B = The adjusted analysis mean scram time as defined in 7.1.2.3.

τ_A = the scram time to notch position 36 as defined in Technical Specification Table 3.1.4-1.

7.1.5 During single-loop operation, the Operating Limit MCPR shall be increased by 0.03 for conditions given in Tables 8.2, 8.3, or 8.4. No single-loop operation adder of 0.03 is needed for single-loop operation conditions specified in Table 8.1.

7.1.6 The Operating Limit MCPR is the greater of the flow and power dependent MCPR operating limits, MCPR(F) and MCPR(P).

Operating Limit MCPR = MAX (MCPR(P), MCPR(F))

The flow dependent MCPR operating limit, MCPR(F), is provided in Figure 8.1.

For core thermal powers equal to or greater than 25%, MCPR (P) is the product of the rated Operating Limit MCPR presented in Tables 8.1, 8.2, 8.3, or 8.4 and the K (P) factor presented in Figure 8.2.

7.2 **Average Planar Linear Heat Generation Rate (APLHGR)**

7.2.1 Technical Specification LCO 3.2.1, Average Planar Linear Heat Generation Rate (APLHGR)

7.2.2 During operation, with thermal power $\geq$ 25% rated thermal power (RTP), the APLHGR shall be within the limits given in Table 8.5 for the appropriate fuel type.

7.2.3 During single loop operation, the APLHGR for each fuel type shall not exceed the values given in 7.2.2 above multiplied by the appropriate value (0.85 for GNF2 fuel, per Ref. 3.8).

7.3 **Linear Heat Generation Rate (LHGR)**

7.3.1 Technical Specification LCO 3.2.3, Linear Heat Generation Rate (LHGR)

7.3.2 During operation, with thermal power ≥ 25% rated thermal power (RTP), the applicable limiting LHGR values for each fuel rod as a function of axial location and exposure shall be the smaller of the power and flow dependent LHGR limits multiplied by the applicable power and flow adjustment or the LHGR limit multiplied by 0.85 (for GNF2) when in single loop operation.

LHGR limit = MIN (LHGR (P), LHGR (F)).

Power-dependent LHGR limit, LHGR (P), is the product of the LHGR power dependent LHGR limit adjustment factor, LHGRFAC (P), shown in Figure 8.4 and the $LHGR_{std}$ in Table 8.6.

LHGR (P) = LHGRFAC(P) x $LHGR_{std}$

The flow-dependent LHGR limit, LHGR (F), is the product of the LHGR flow dependent LHGR limit adjustment factor, LHGRFAC (F), shown in Figure 8.3 and the $LHGR_{std}$ in Table 8.6.

LHGR (F) = LHGRFAC(F) x $LHGR_{std}$

7.4 **APRM Allowable Values (Digital Flow Cards)**

7.4.1 **APRM Flow Referenced Flux Scram Allowable Value (Run Mode)**

7.4.1.1 Technical Specifications:
LCO 3.3.1.1, Reactor Protection System (RPS) Instrumentation

7.4.1.2 When operating in Mode 1, the APRM Neutron Flux-High (Flow Biased) Allowable Value shall be

for two loop operation:

S≤ (% RTP) = 0.38*W+61.0%	0< W ≤ 24.7%
S≤ (% RTP) = 1.15*W+42.0%	24.7< W ≤ 47.0%
S≤ (% RTP) = 0.63*W+73.7%	47.0< W ≤ 68.7%
S≤ (% RTP) = 117.00% (Clamp)	W > 68.7%

for single loop operation:

S≤ (% RTP) = 0.38*W+57.9%	0< W ≤ 32.7%
S≤ (% RTP) = 1.15*W+32.8%	32.7< W ≤ 50.1%
S≤ (% RTP) = 0.58*W+61.3%	50.1< W ≤ 95.9%
S≤ (% RTP) = 117.00% (Clamp)	W > 95.9%

WHERE:

S = Allowable value in percent of rated thermal power;

W = Recirculation flow in percent of rated;

7.4.2 APRM Neutron Flux-High (Flow Biased) Rod Block Allowable Value (Relocated to the Technical Requirements Manual)

7.5 **RBM Upscale Rod Block Allowable Value**

7.5.1 Technical Specification LCO 3.3.2.1, Control Rod Block Instrumentation

7.5.2 The RBM upscale rod block allowable value shall be:

$S \leq 0.66W + K$ for two loop operation;

$S \leq 0.66W + K - 0.66\,\Delta W$ for single loop operation;

WHERE:

S	=	rod block allowable value in percent of initial;
W	=	Loop flow in percent of rated
K	=	Any intercept value may be used because the RBM intercept value does not affect the MCPR Operating Limit and the RBM is not assumed to function to protect the Safety Limit MCPR.
ΔW	=	Difference between two loop and single loop effective drive flow at the same core flow.

NOTE: If K can be any value, then $K - 0.66\Delta W$ can also be any value, and the allowable value adjustment for single loop operation is not necessary.

7.6 **Stability Option 1-D Exclusion Region and Buffer Zone.**

7.6.1 Technical Specification LCO 3.4.1, Recirculation Loops Operating

7.6.2 The reactor shall not be intentionally operated within the Exclusion Region given in Figure 8.5 when the SOLOMON Code is operable.

7.6.3 The reactor shall not be intentionally operated within the Buffer Zone given in Figure 8.5 when the SOLOMON Code is inoperable.

8.0 TABLES AND FIGURES

8.1 Following pages present Tables 8.1 through 8.6, and Figures 8.1 through 8.6. Exact tables and figures names are listed in the Table of Content on page 3.

TABLE 8.1
MCPR Operating Limit For Incremental Cycle Core Average Exposure

		GNF2		GNF2 fuel in Cell 38-39	
τ		BOC to MOC	MOC to EOC	BOC to MOC	MOC to EOC
= 0		1.43	1.49	1.47	1.53
>0.0	≤0.1	1.44	1.50	1.48	1.54
>0.1	≤0.2	1.45	1.51	1.49	1.55
>0.2	≤0.3	1.46	1.52	1.50	1.56
>0.3	≤0.4	1.47	1.53	1.51	1.57
>0.4	≤0.5	1.48	1.54	1.52	1.58
>0.5	≤0.6	1.49	1.55	1.53	1.59
>0.6	≤0.7	1.50	1.56	1.54	1.60
>0.7	≤0.8	1.51	1.57	1.55	1.61
>0.8	≤0.9	1.52	1.58	1.56	1.62
>0.9	≤1	1.53	1.59	1.57	1.63

----------Single Loop Operation ONLY----------

		GNF2		GNF2 fuel in Cell 38-39	
τ		BOC to MOC	MOC to EOC	BOC to MOC	MOC to EOC
= 0		1.48	1.52	1.50	1.56
>0.0	≤0.1	1.48	1.53	1.51	1.57
>0.1	≤0.2	1.48	1.54	1.52	1.58
>0.2	≤0.3	1.49	1.55	1.53	1.59
>0.3	≤0.4	1.50	1.56	1.54	1.60
>0.4	≤0.5	1.51	1.57	1.55	1.61
>0.5	≤0.6	1.52	1.58	1.56	1.62
>0.6	≤0.7	1.53	1.59	1.57	1.63
>0.7	≤0.8	1.54	1.6	1.58	1.64
>0.8	≤0.9	1.55	1.61	1.59	1.65
>0.9	≤1	1.56	1.62	1.60	1.66

Technical Specification LCO 3.2.2, Minimum Critical Power Ratio (MCPR)

The MCPR limits in this Table are subject to Power and Flow dependent adjustment per Section 7.1.6

NOTE: 1. When entering a new Exposure Range, check the current value of τ to assure adjustment per Step 7.1.4

2. Applicable for any value of K, see Step 7.5.2

TABLE 8.2
MCPR Operating Limit for Incremental Cycle Core Average Exposure for Operation above 75% of Rated Thermal Power with Three Steam Lines in Service

τ		GNF2		GNF2 fuel in Cell 38-39	
		BOC to MOC	MOC to EOC	BOC to MOC	MOC to EOC
= 0		1.45	1.51	1.49	1.55
>0.0	≤0.1	1.46	1.52	1.50	1.56
>0.1	≤0.2	1.47	1.53	1.51	1.57
>0.2	≤0.3	1.48	1.54	1.52	1.58
>0.3	≤0.4	1.49	1.55	1.53	1.59
>0.4	≤0.5	1.50	1.56	1.54	1.60
>0.5	≤0.6	1.51	1.57	1.55	1.61
>0.6	≤0.7	1.52	1.58	1.56	1.62
>0.7	≤0.8	1.53	1.59	1.57	1.63
>0.8	≤0.9	1.54	1.60	1.58	1.64
>0.9	≤1	1.55	1.61	1.59	1.65

Technical Specification LCO 3.2.2, Minimum Critical Power Ratio (MCPR)

For single loop operation, these limits shall be increased as given in Section 7.1.5.

The MCPR limits in this Table are subject to Power and Flow dependent adjustment per Section 7.1.6

NOTE: 1. When entering a new Exposure Range, check the current value of τ to assure adjustment per Step 7.1.4

2. Applicable for any value of K, see Step 7.5.2

TABLE 8.3
MCPR Operating Limit for Operation with Turbine Bypass Valves Out of Service

τ		GNF2	GNF2 fuel in Cell 38-39
τ		BOC to EOC	BOC to EOC
= 0		1.54	1.57
>0.0	≤0.1	1.55	1.58
>0.1	≤0.2	1.56	1.59
>0.2	≤0.3	1.57	1.60
>0.3	≤0.4	1.58	1.61
>0.4	≤0.5	1.59	1.62
>0.5	≤0.6	1.60	1.63
>0.6	≤0.7	1.61	1.64
>0.7	≤0.8	1.62	1.65
>0.8	≤0.9	1.63	1.66
>0.9	≤1	1.64	1.67

Technical Specification LCO 3.2.2, Minimum Critical Power Ratio (MCPR)

Technical Specification LCO 3.7.6, Main Turbine Bypass System

For single loop operation, these limits shall be increased as given in Section 7.1.5.

The MCPR limits in this Table are subject to Power and Flow dependent adjustment per Section 7.1.6

NOTE: 1. When entering a new Exposure Range, check the current value of τ to assure adjustment per Step 7.1.4

2. Applicable for any value of K, see Step 7.5.2

TABLE 8.4
MCPR Operating Limit for Operation with Final Feedwater Temperature Reduction

		GNF2	GNF2 fuel in Cell 38-39
τ		BOC to EOC	BOC to EOC
= 0		1.48	1.53
>0.0	≤0.1	1.49	1.54
>0.1	≤0.2	1.50	1.55
>0.2	≤0.3	1.51	1.56
>0.3	≤0.4	1.52	1.57
>0.4	≤0.5	1.53	1.58
>0.5	≤0.6	1.54	1.59
>0.6	≤0.7	1.55	1.60
>0.7	≤0.8	1.56	1.61
>0.8	≤0.9	1.57	1.62
>0.9	≤1	1.58	1.63

Technical Specification LCO 3.2.2, Minimum Critical Power Ratio (MCPR)

For single loop operation, these limits shall be increased as given in Section 7.1.5.

The MCPR limits in this Table are subject to Power and Flow dependent adjustment per Section 7.1.6

NOTE: 1. When entering a new Exposure Range, check the current value of τ to assure adjustment per Step 7.1.4

2. Applicable for any value of K, see Step 7.5.2

MCPR Operating Limits in this table apply when at reduced feedwater temperature near end-of-cycle, see JD-02-122 (Reference 3.13) for further information. Not applicable for operation with Turbine Bypass Valves Out of Service.

TABLE 8.5
Exposure Dependent APLHGR Limits

All GNF2 Fuel Types

Average Planar Exposure	APLHGR Limit
GWd/ST	**kW/ft**
0.00	13.78
13.24	13.78
17.52	13.78
60.78	7.50
63.50	6.69

Technical Specification LCO 3.2.1, Average Planar Linear Heat Generation Rate (APLHGR)

For single loop operation these APLHGR values shall be multiplied by 0.85 for GNF2 fuel.

Linearly interpolate for APLHGR at intermediate exposure.

TABLE 8.6
Maximum LHGR

Maximum LHGR – All GNF2 Fuel Types

Peak Pellet Exposure, GWD/ST	UO_2 LHGR Limit, kW/ft
[[	
	]]

Peak Pellet Exposure, GWd/ST	Most Limiting Gadolinia LHGR Limit, kW/ft
[[	
	]]

Technical Specification LCO 3.2.3, Linear Heat Generation Rate (LHGR)

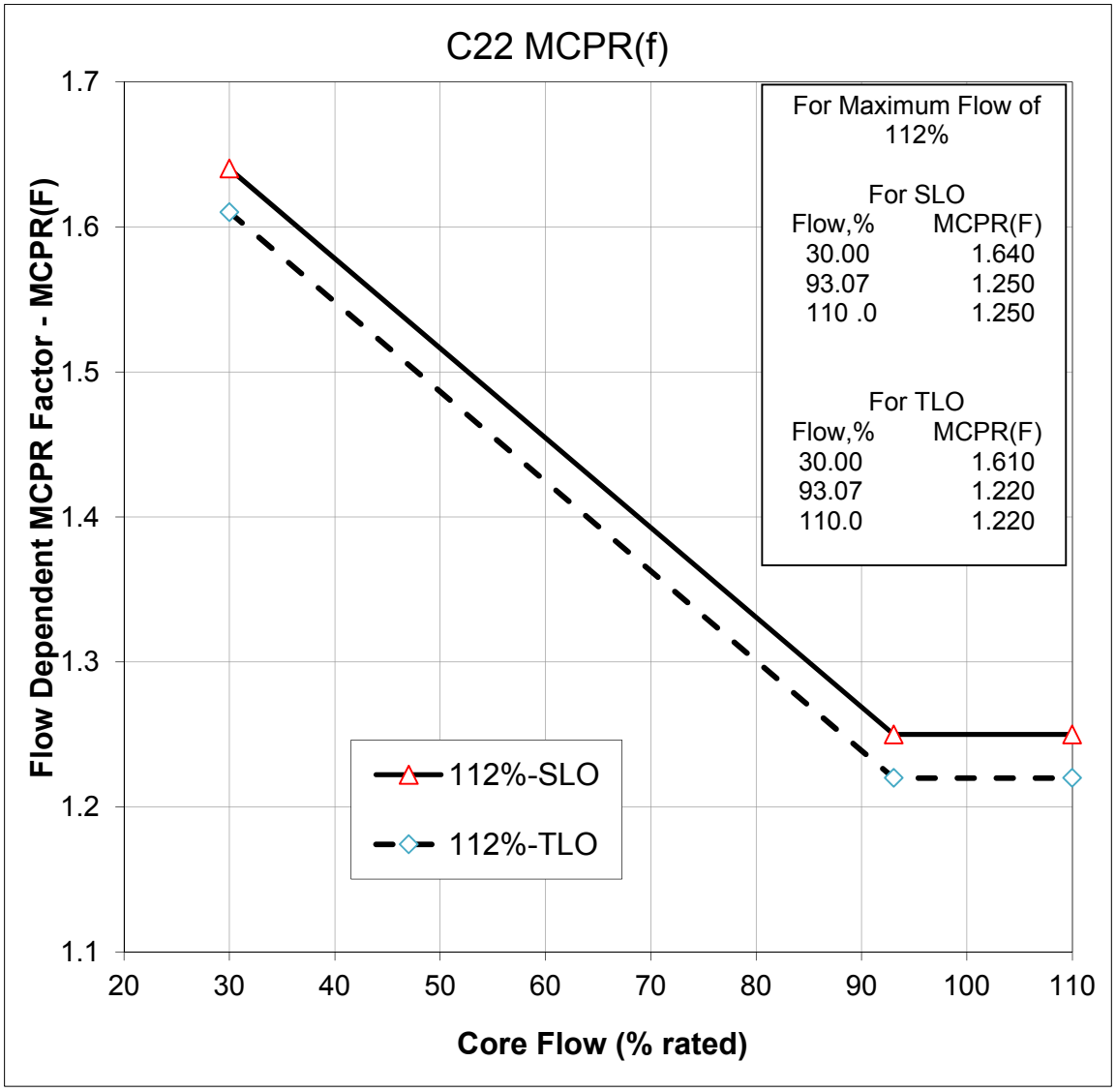
Design features of the fuel assemblies in the Cycle 22 core are provided in References 3.3, 3.14, and 3.15

$LHGR_{std}$ values in the above Table 8.6 are subject to Power and Flow dependent adjustments per Section 7.3

For single loop operation these LHGR values shall be multiplied by 0.85 (for GNF2 fuel)

Linearly interpolate for LHGR at intermediate exposure

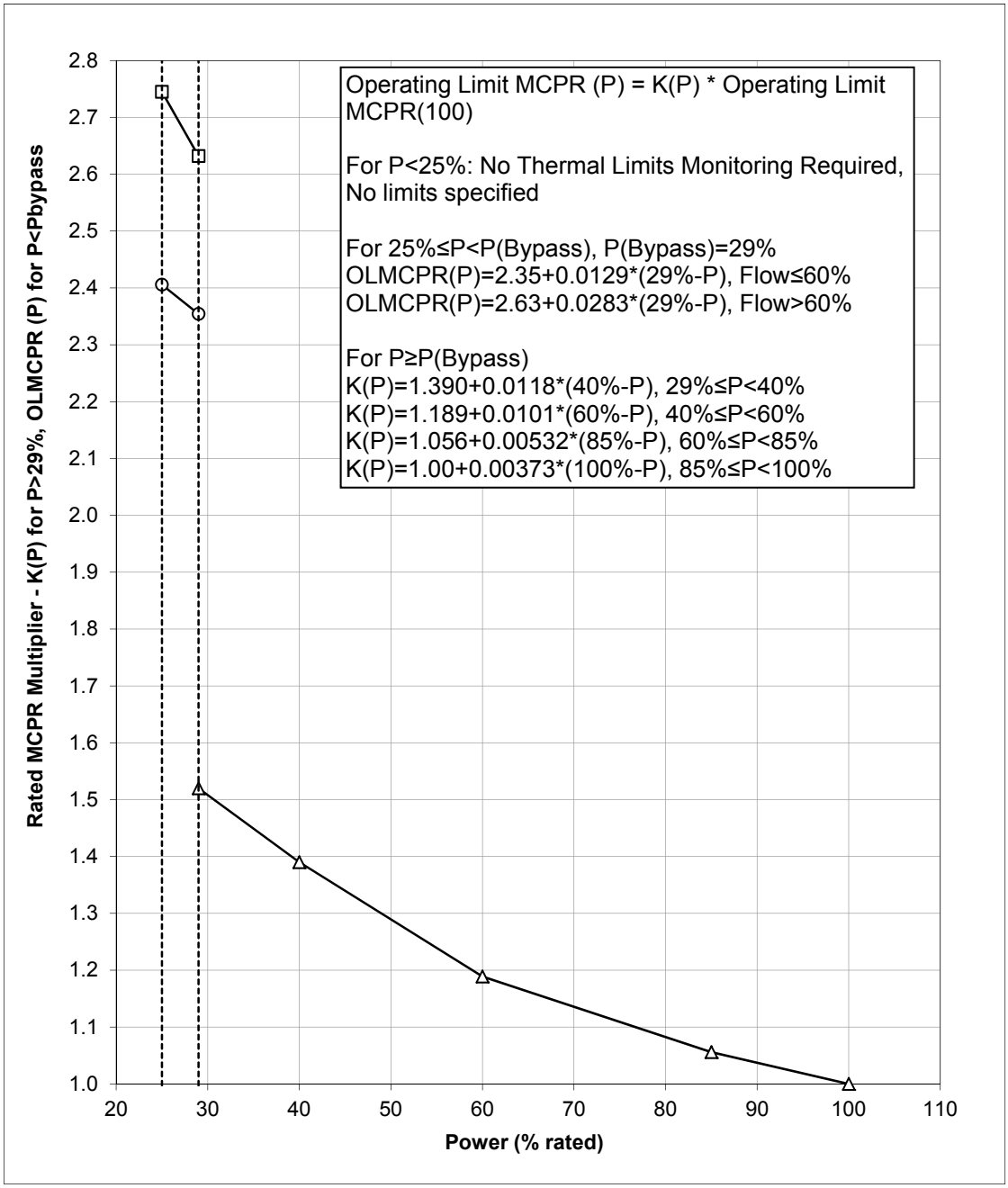
Figure 8.1
MCPR(F) Factor



Technical Specification LCO 3.2.2, Minimum Critical Power Ratio (MCPR)

Reference 3.8

Figure 8.2
K(P), OLMCPR(P) Factor

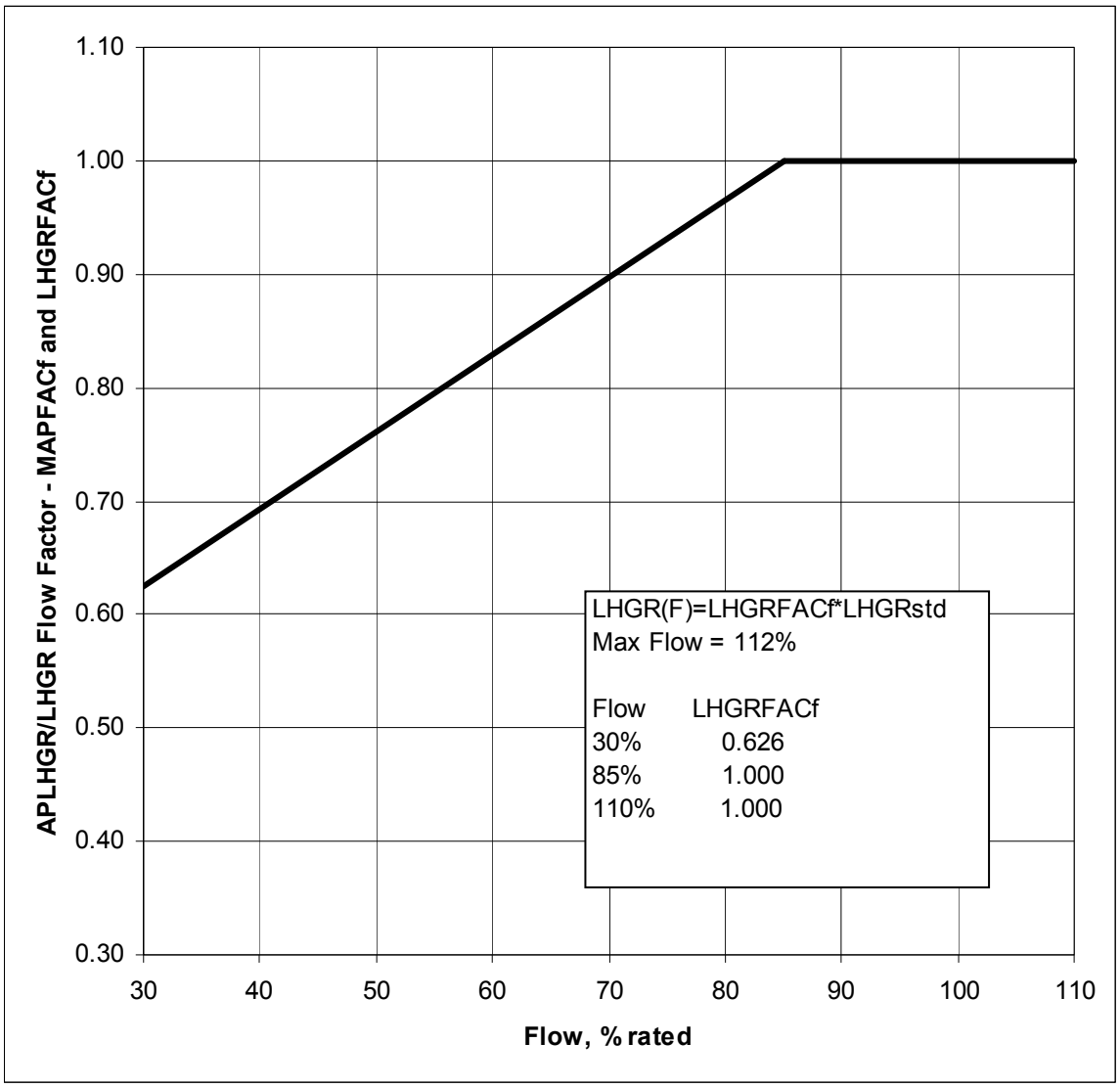


See Table 8.1, 8.2, 8.3, and Table 8.4 for Operating Limit MCPR(100)

Technical Specification LCO 3.2.2, Minimum Critical Power Ratio (MCPR)

Reference 3.8, 3.9

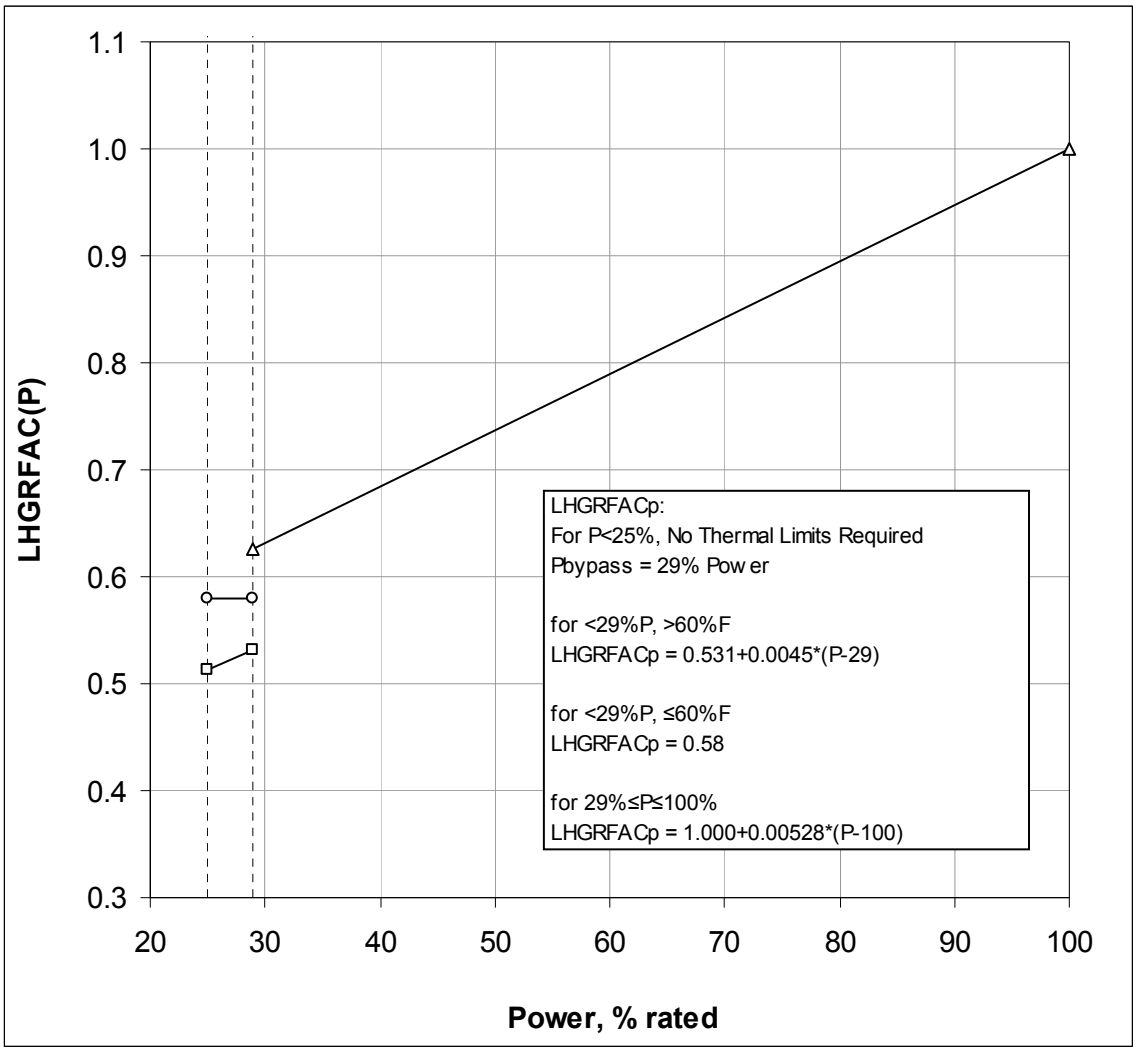
Figure 8.3
Flow-Dependent LHGR Multiplier, LHGRFAC(F)



See Table 8.6 for $LHGR_{STD}$ value

Reference 3.8, 3.9

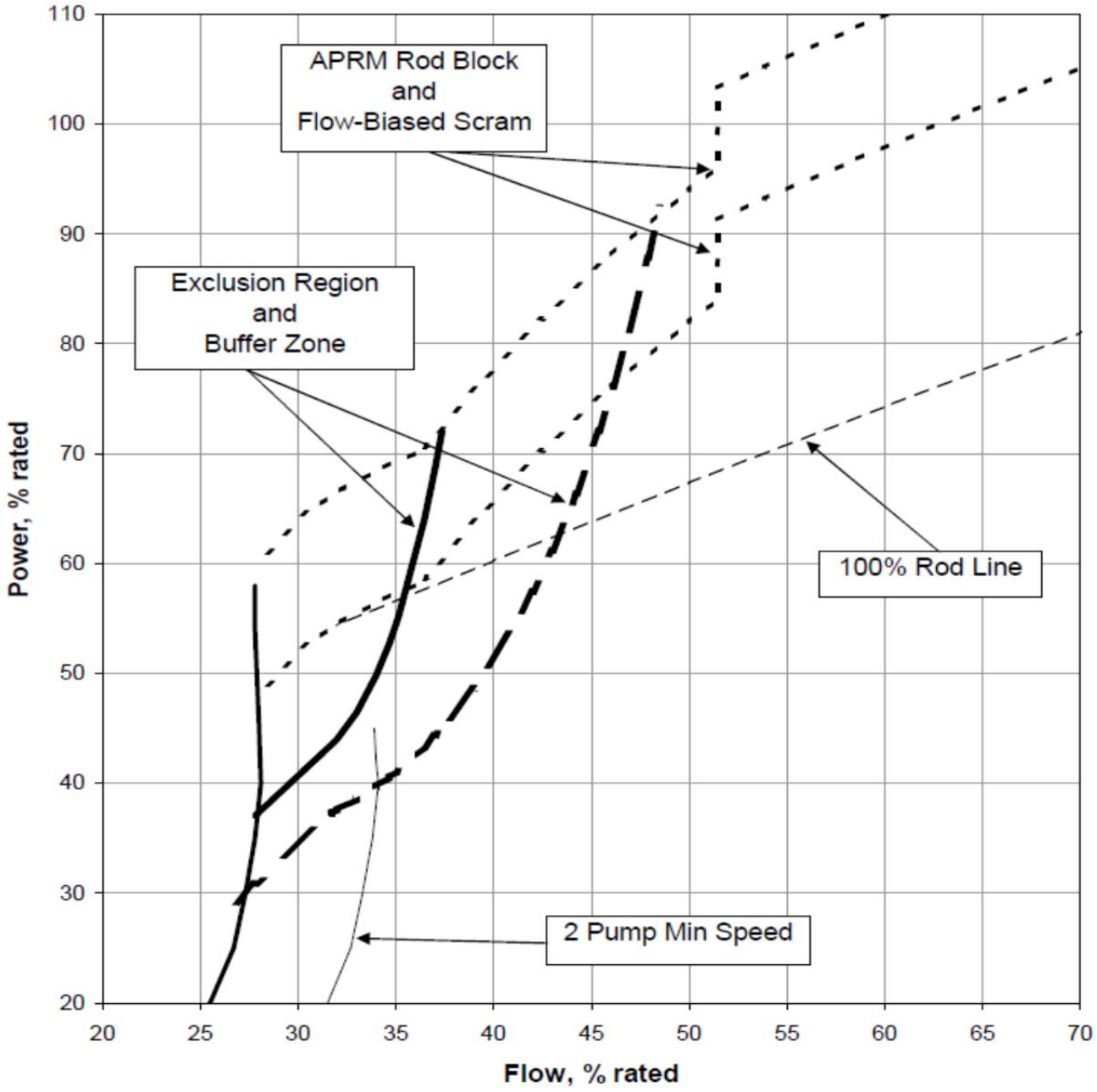
Figure 8.4
Power-Dependent LHGR Multiplier, LHGRFAC(P)



See Table 8.6 for $LHGR_{STD}$ values

Reference 3.8, 3.9

Figure 8.5
Stability Option 1-D Exclusion Region



See References 3.17 and 3.8 for details

Reference 3.18 generically removes cycle exposure limitation statement in the Supplemental Reload Licensing Report stability analysis.

Figure 8.6

Cycle 22 Loading Pattern by Bundle Design with the improperly seated FSC Cell 38-39 GNF2 Fuel Types marked

North ⇓

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52                        16 16 14 16 16 12 16 14 16 16
50                     16 12 13 13 16 13 13 16 13 13 16 16
48                  12 16 16 14 14 17 17 16 17 17 16 17 17 14 14 16 12 12
46               16 16 16 12  4  4  4  4  4  3  3  4  4  4  4  4 12 16 16 16
44            16 16 14  4 20  4 19  3 17  3 19 19  3 17  3 19  4 20  4 14 16 16
42            14 16  4 16  4 18  3 20  3 18  2  2 18  3 20  3 18  4 16  4 16 14
40            16 12 20  4 20  3 18  3 18 17 18 18 17 18  3 18  5 15  4 20 12 16
38         16 14  4  4 18  3 20 20 18  2 18  1  1 18  2 18 20 15  5 18  4  4 14 16
36      16 12 14  4 19  3 18 20 20  3 20  2 20 20  2 20  3 20 20 18  3 19  4 14 16 16
34      16 16 17  4  3 20  3 18  3 20  1 19  2  2 19  1 20  3 18  3 20  3  4 17 16 16
32      13 13 17  4 17  3 18  2 20  1 20  2 20 20  2 20  1 20  2 18  3 17  4 17 13 13
30      16 16 16  4  3 18 17 18  2 19  2 17 14 14 17  2 19  2 18 17 18  3  4 16 16 16
28      14 13 17  3 19  2 18  1 20  2 20 14 20 20 14 20  2 20  1 18  2 19  3 17 13 14
26      14 13 17  3 19  2 18  1 20  2 20 14 20 20 14 20  2 20  1 18  2 19  3 17 13 14
24      16 16 16  4  3 18 17 18  2 19  2 17 14 14 17  2 19  2 18 17 18  3  4 16 16 16
22      14 13 17  4 17  3 18  2 20  1 20  2 20 20  2 20  1 20  2 18  3 17  4 17 13 16
20      16 16 17  4  3 20  3 18  3 20  1 19  2  2 19  1 20  3 18  3 20  3  4 17 16 16
18      16 12 14  4 19  3 18 20 20  3 20  2 20 20  2 20  3 20 20 18  3 19  4 14 12 16
16         16 14  4  4 18  3 20 20 18  2 18  1  1 18  2 18 20 20  3 18  4  4 14 16
14            16 12 20  4 20  3 18  3 18 17 18 18 17 18  3 18  3 20  4 20 12 16
12            14 16  4 16  4 18  3 20  3 18  2  2 18  3 20  3 18  4 16  4 16 14
10            16 16 14  4 20  4 19  3 17  3 19 19  3 17  3 19  4 20  4 14 16 16
 8               16 16 16 12  4  4  4  4  4  3  3  4  4  4  4  4 12 16 16 16
 6                  12 16 16 14 14 17 17 16 17 17 16 17 17 14 14 16 16 12
 4                        16 12 13 13 16 13 13 16 13 13 12 16
 2                           16 16 16 16 13 16 16 14 13 16

      1  3  5  7  9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49 51
```

Fuel Type			
1=GNF2-P10DG2B371-14GZ-100T2-150-T6-4280	(Cycle 22)	14=GNF2-P10DG2B404-12GZ-100T2-150-T6-3297	(Cycle 20)
2=GNF2-P10DG2B378-16GZ-100T2-150-T6-4281	(Cycle 22)	16=GNF2-P10DG2B390-14GZ-100T2-150-T6-3300	(Cycle 20)
3=GNF2-P10DG2B378-14GZ-100T2-150-T6-4282	(Cycle 22)	17=GNF2-P10DG2B404-12GZ-100T2-150-T6-3297	(Cycle 21)
4=GNF2-P10DG2B408-13G5.0-100T2-150-T6-4283	(Cycle 22)	18=GNF2-P10DG2B378-16GZ-100T2-150-T6-3299	(Cycle 21)
12=GNF2-P10DG2B378-16GZ-100T2-150-T6-3299	(Cycle 20)	19=GNF2-P10DG2B390-14GZ-100T2-150-T6-3300	(Cycle 21)
13=GNF2-P10DG2B380-16GZ-100T2-150-T6-3298	(Cycle 20)	20=GNF2-P10DG2B388-14GZ-100T2-150-T6-4114	(Cycle 21)
5=GNF2-P10DG2B378-14GZ-100T2-150-T6-4282	(Cycle 22)	15=GNF2-P10DG2B388-14GZ-100T2-150-T6-4114	(Cycle 21)

Reference 3.21

9.0 USERS GUIDE

The COLR defines thermal limits for the various operating conditions expected during the cycle. At the start of the cycle the 3D-Monicore databank limits are set for;

- Cycle exposure range of BOC to MOC
- $\tau = 0$
- Dual recirculation pump operation
- Four steam line operation, and
- Normal Feedwater Temperature

The following is a table that offers a check to assure the correct limits are applied when operating states or conditions change.

Change in Operating State	Change in Limits	Procedure Reference
Cycle Exposure = EOR22– 3.483 GWD/ST OLMCPR changes to EOC values at cycle exposure of 10.517 GWD/ST. Installed databank will use SRLR R1 10.517 GWD/ST.	See Table 8.1 for $\tau \neq 0$ for change in MCPR.	EN-DC-503 transition to EOC limits will occur automatically
Scram Time Test Results such that $\tau \neq 0$ Option B limits for OLMCPR must be interpolated with Option A limits	Use new τ and see Table 8.1, 8.2, 8.3, and Table 8.4.	RAP-7.4.1
Single Loop Operation The SLMCPR increases by 0.03 for OLMCPR, therefore OLMCPR limits increase by 0.03, except when ≤1.48 (Rated Equivalent SLO Pump Seizure event is limiting for BOC-MOC). Cell 38-39 GNF2 Fuel type OLMCPR limit arrays are added to core-wide GNF2 thermal limits. LHGR and MAPLHGR are reduced by a multiplier in SLO.	Switch to C22_OPTB_SLO_FSC.INP, (or C22_OPTA_SLO_FSC.INP). Afterwards, 3DM v6.59.06 will display and use correct SLO OLMCPR. Verify that 3D-Monicore has recognized the idle recirculation loop and is applying the SLO GNF2 LHGR and MAPLHGR multipliers of 0.85.	ST-40D
Three Steam Line Operation (3SL)	Increase OLMCPR according to Table 8.2.	None
Operation with Turbine Bypass Valves Out-of-Service OLMCPR values increase, no LHGR change required	Increase OLMCPR according to Table 8.3.	None
Operation under Final Feedwater Temperature Reduction	Increase OLMCPR according to Table 8.4.	None