Entergy

Entergy Nuclear Northeast
Entergy Nuclear Operations, Inc.
James A Fitzpatrick NPP
P O Box 110
Lycoming, NY 13093
Tel 315 349 6024 Fax 315 349 6480

T.A. Sullivan
Vice President, Operations-JAF

September 24, 2002
JAFP-02-0193

United States Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Stop O-P1-17
Washington, DC 20555-0001

Subject: James A. FitzPatrick Nuclear Power Plant
Docket No. 50-333
Core Operating Limits Report
Revision 13 (Cycle 15 update)

Dear Sir;

Attached is Revision 13 to the James A. FitzPatrick Core Operating Limits Report (COLR). This report is submitted in accordance with Technical Specifications 5.6.5.

Revision 13 of the COLR incorporates changes as a result of implementation of Final Feedwater Temperature Reduction (FFTR) during the end of Cycle 15 operations. In addition, editorial corrections and administrative changes are included that do not alter the intent

There are no commitments contained in this report.

Questions concerning this report may be addressed to Mr. William Drews (315) 349-6562.

Very truly yours,

T. A. Sullivan

TAS:GB:las

Attachment as stated

cc: next page

A001

cc: Regional Administrator
U.S. Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406

Office of the Resident Inspector
U.S. Nuclear Regulatory Commission
P.O. Box 136
Lycoming, New York 13093

Mr. Guy Vissing, Project Manager
Project Directorate I
Division of Licensing Project Management
U.S. Nuclear Regulatory Commission
Mail Stop 8C2
Washington, DC 20555

Entergy
Nuclear Northeast

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

CORE OPERATING LIMITS REPORT
REVISION 13

REVIEWED BY: PLANT OPERATING REVIEW COMMITTEE

MEETING NO. 02 - 070 DATE: 9/12/02

APPROVED BY: William Drews DATE: 9/12/02
REACTOR ENGINEERING SUPERINTENDENT

APPROVED BY: Brian O'Grady DATE: 9/13/02
GENERAL MANAGER – PLANT OPERATIONS

TABLE OF CONTENTS

1.0 PURPOSE

This report provides the cycle-specific operating limits for Cycle 15 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) Settings
- 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 violated, the corrective actions specified in the Technical Specifications shall be taken.

3.0 REFERENCES

3.1 JAFNPP Administrative Procedure 12.05, Control of Core Operating Limits Report.

3.2 JAFNPP Technical Specifications.

3.3 FitzPatrick Cycle 15 Core Reload Safety Evaluation, JAF-SE-00-045.

3.4 GE Report, Supplemental Reload Licensing Report for James A. FitzPatrick Reload 13 Cycle14, J11-03359SRL, Rev.1, October 1998

3.5 GE Report, Supplemental Reload Licensing Report for James A. FitzPatrick Reload 12 Cycle13, J11-02914SRL Rev.0, August 1996.

3.6 Design Change Package JD-99-091, Cycle 15 Core Reload

3.7 RAP-7.3.17, Core Monitoring Software and Database Changes.

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

3.9 James A. FitzPatrick Nuclear Power Plant K_f Curve Update, GE-NE-J11-03426-00-01, September 1998.

3.10 General Electric Standard Application for Reload Fuel, NEDE-24011-P-A-14

3.11 GE Letter, J. Baumgartner to P. Lemberg, Exposure Dependent LHGR Limit Curves, JAB-N8076, November 5, 1998.

3.12 GE Lattice Dependent MAPLHGR Report for James A. FitzPatrick, Reload 12 Cycle13, J11-02914MAP, Rev. 0, August 1996.

3.13 GE Lattice Dependent MAPLHGR Report for James A. FitzPatrick, Reload 13, Cycle14, J11-03359MAPL, Rev. 0, October 1998.

3.14 GE Letter, A. Alzaben to P. Lemberg, Revised FitzPatrick Cycle 14 Exclusion Region, AFA-00-N005, February 7, 2000.

3.15 JAF-SE-00-032, Rev.0, Extended Loadline Limit Analysis (ELLLA) Implementation.

3.16 JAF-RPT-MISC-04054, Rev.0, Operation under Extended Loadline Limit Analysis (ELLLA) and Power Uprate

3.17 GNF Report, Supplemental Reload Licensing Report for James A. FitzPatrick Reload 14 Cycle15, J11-037579SRL, Rev.0, Class I, August, 2000.

3.18 GNF Report, Lattice Dependent MAPLHGR Report for James A. FitzPatrick, Reload 14, Cycle15, J11-03757MAPL, Rev. 0, Class III, August, 2000.

3.19 GE Letter, FitzPatrick APRM Flow Biased Rod Block and Scram Setpoints, NSA01-273, July 3, 2001

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

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

3.22 JD-02-122, Final Feedwater Temperature Reduction Implementation

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 Fraction of Limiting Power Density:

The ratio of the linear heat generation rate (LHGR) existing at a given location to the design LHGR. The design LHGR is given in Table 8.2.

4.3 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.

4.4 Maximum Fraction of Limiting Power Density (MFLPD):

The MFLPD shall be the largest value of the fraction of limiting power density in the core. The fraction of limiting power density shall be the LHGR existing at a given location divided by the specified LHGR limit for that bundle type.

4.5 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.

4.6 Rated Recirculation Flow :
That drive flow which produces a core flow of 77.0 x 10^6 lb/hr.

5.0 RESPONSIBILITIES

NOTE: See AP-12.05 (Reference 3.1).

5.1 Shift Manager:

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

5.2 Reactor Engineering Superintendent:

Assure that the limits described herein are properly installed in the 3D-Monicore databank used for thermal limit surveillance (Reference 3.7)

6.0 SPECIAL INSTRUCTIONS/REQUIREMENTS

Not Applicable

7.0 PROCEDURE

7.1 Operating Limit MCPR

During operation, with thermal power ≥ 25% rated thermal power, 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:

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

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

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

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:

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

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 8.1.A, Table 8.1.B or Table 8.1.C as applicable.

7.1.4 **WHEN** the requirement 7.1.2.1 is not met (i.e. $\tau_B < \tau_{AVE}$), **THEN** the Operating Limit MCPR values (as a function of τ) are given in Figure 8.1, Figure 8.1.A, Figure 8.1.B or Figure 8.1.C 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.

NOTE: **IF** the operating limit MCPR obtained from these figures is determined to be less than the operating limit MCPR found in 7.1.3, **THEN** 7.1.3 shall apply.

7.1.5 During single-loop operation, the Operating Limit MCPR shall be increased by 0.01.

7.1.6 During reactor power operation with core flow less than 100 percent of rated, the Operating Limit MCPR shall be multiplied by the appropriate K_f specified 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 ≥ 25% rated thermal power, the APLHGR for each fuel type as a function of axial location and average planar exposure shall be within limits based on applicable APLHGR limit values which have been approved for the respective fuel and lattice types.

7.2.3 When hand calculations are required, the APLHGR for each type of fuel as a function of average planar exposure shall not exceed the limiting value for the most limiting lattice shown in Figures 8.3.A through F.

7.2.4 During single loop operation, the APLHGR for each fuel type shall not exceed the values given in 7.2.2 or 7.2.3 above multiplied by the appropriate value (0.78 for GE12 fuel).

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, the LHGR for each fuel type as a function of axial location and average planar exposure shall be within limits based on applicable LHGR limit values which have been approved for the respective fuel and lattice types.

7.3.3 When hand calculations are required, the LHGR for each type of fuel as a function of average planar exposure shall not exceed the limiting value for the most limiting lattice as specified in Table 8.2 and shown in Figure 8.5.

7.4 APRM Trip Settings

7.4.1 APRM Flow Referenced Flux Scram Trip Setting (Run Mode)

7.4.1.1. Technical Specifications:
LCO 3.2.4, Average Power Range Monitor (APRM) Gain and Setpoint
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) Trip setting shall be:

$S \leq 0.58W + 66\%$ for two loop operation;

$S \leq 0.58W + 66\% - 0.58\,\Delta W$ for single loop operation;

WHERE:

S = Setting in percent of rated thermal power;

W = Recirculation flow in percent of rated;

ΔW = Difference between two loop and single-loop effective drive flow at the same core flow.

NOTE: Concerning APRM Neutron Flux-High (Flow Biased) Rod Block and Scram Trip settings: Reference 3.19 establishes Equivalent Analytical Limits for these settings. The nominal trip setpoint $S \leq 0.58W + 62\%$ (with clamp at 117%) for the Scram. Compliance with the "Allowed Region of Operation" on the Power-Flow Map, Figure 3.7-1 of the FSAR is defined by the equation 0.58W + 50% and is individually controlled and assures boundaries are not exceeded during normal operation.

7.4.1.3. In the event of operation with a Maximum Fraction of Limiting Power Density (MFLPD) greater than the Fraction of Rated Power (FRP), the setting shall be modified as follows:

$S \leq (0.58W + 66\%)(FRP/MFLPD)$ for two loop operation;

$S \leq (0.58W + 66\% - 0.58\,\Delta W)(FRP/MFLPD)$ for single-loop operation;

WHERE:

FRP = Fraction of Rated Power;

MFLPD = Maximum Fraction Of Limiting Power Density, see Definition 4.4.

The ratio of FRP to MFLPD shall be set equal to 1.0 unless the actual operating value is less than the design value of 1.0, in which case the actual operating value will be used.

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

7.5 RBM Upscale Rod Block Trip Setting

7.5.1 Technical Specification LCO 3.3.2.1, Control Rod Block Instrumentation

7.5.2 The RBM upscale rod block trip setting 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 setting in percent of initial;

W = Loop flow in percent of rated

K = Intercept values of 39%, 40%, 41%, 42%, 43%, and 44% can be used with the appropriate MCPR Operating Limit from Table 8.1 (note for Cycle 15 the RBM intercept value does not effect the MCPR Operating Limit for K values ≤ 44%)

ΔW = Difference between two loop and single loop effective drive flow at the same core flow.

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 8.4 when the SOLOMON Code is operable.

7.6.3 The reactor shall not be intentionally operated within the Buffer Zone given in Figure 8.4 when the SOLOMON Code is inoperable.

7.7 K_f – Flow Dependent MCPR Limit

Figure 8.2 is the K_f limit. Values of K_f are obtained using the following equation (see Reference 3.9):

$$K_f = \text{MAX}\ [1.0, A - \text{SLOPE} * \text{WT}]$$

WHERE:

WT = Core Flow as % of Rated, 30% $\leq$ WT $\leq$ 100%

SLOPE = $(A_F/100/\text{OLMCPR}) * (\text{SLMCPR} / \text{SLMCPR}_{generic})$

A = $(B_F/\text{OLMCPR}) * (\text{SLMCPR} / \text{SLMCPR}_{generic})$

$\text{SLMCPR}_{generic}$ = 1.07

SLMCPR = Technical Specification LCO 2.1.1, Reactor Core SLs

OLMCPR = The highest value obtained from Figures 8.1, and 8.1.A as per 7.1.4, or, if the note in 7.1.4 applies, then 7.1.3 requirement must be met.

A_F, B_F = Coefficients for the K_f curve listed below:

Scoop Tube Setpoint %	A_F	B_F
102.5	0.571	1.655
107.0	0.586	1.697
112.0	0.602	1.747
117.0	0.632	1.809

All coefficients apply to Manual Flow Control Mode

8.0 FIGURES AND TABLES

8.1 FIGURES

8.2 TABLES

9.0 EXHIBITS

NONE

TABLE 8.1

MCPR Operating Limit For Incremental Cycle Core Average Exposure

Cycle 15 Exposure Range	ALL Fuel Types
BOC to <EOC – 1.0 GWD/ST	1.36
EOC - 1.0 GWD/ST to EOC	1.38

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

For single loop operation, these limits shall be increased by 0.01.

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 values of $K \leq 44\%$, see Step 7.5.2

TABLE 8.1.A

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

Cycle 15 Exposure Range	ALL Fuel Types
BOC to <EOC -- 1.0 GWD/ST	1.38
EOC - 1.0 GWD/ST to EOC	1.40

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

For single loop operation, these limits shall be increased by 0.01.

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 values of $K \leq 44\%$, see Step 7.5.2

TABLE 8.1.B

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

Cycle 15 Exposure Range	ALL Fuel Types
ALL	1.41

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 by 0.01.

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 values of $K \leq 44\%$, see Step 7.5.2

TABLE 8.1.C

MCPR Operating Limit for Operation with Final Feedwater Temperature Reduction

Cycle 15 Exposure Range	ALL Fuel Types
At EOC only (see below)	1.40

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

For single loop operation, these limits shall be increased by 0.01.

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 values of K ≤ 44%, 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 for further information.

TABLE 8.2

Maximum LHGR

Fuel Type	Fuel Bundle Design	Maximum LHGR (kW/ft)
ALL	GE12	See Figure 8.5

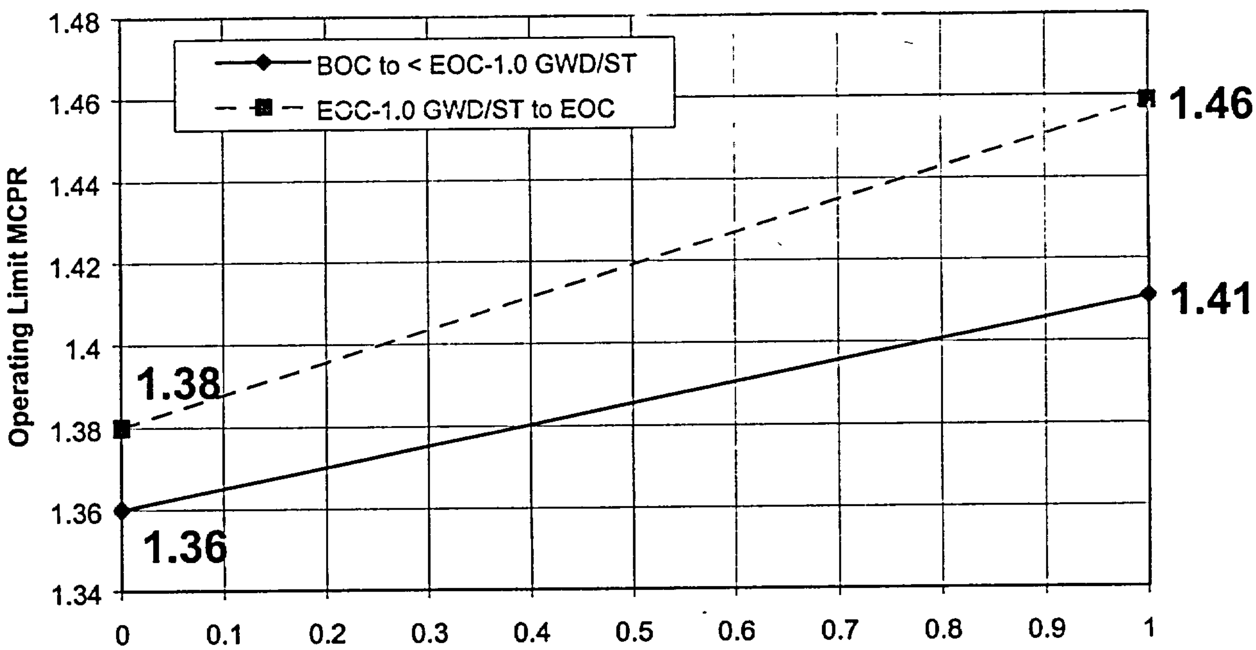
Technical Specification LCO 3.2.3, Linear Heat Generation Rate (LHGR)

Design features of the fuel assemblies in the Cycle 15 core are provided in Reference 3.6

NOTE: Exposure Dependent Limits will be used in the 3D-MONICORE software.

FIGURE 8.1

MCPR Operating Limit Versus τ
For All Fuel Types



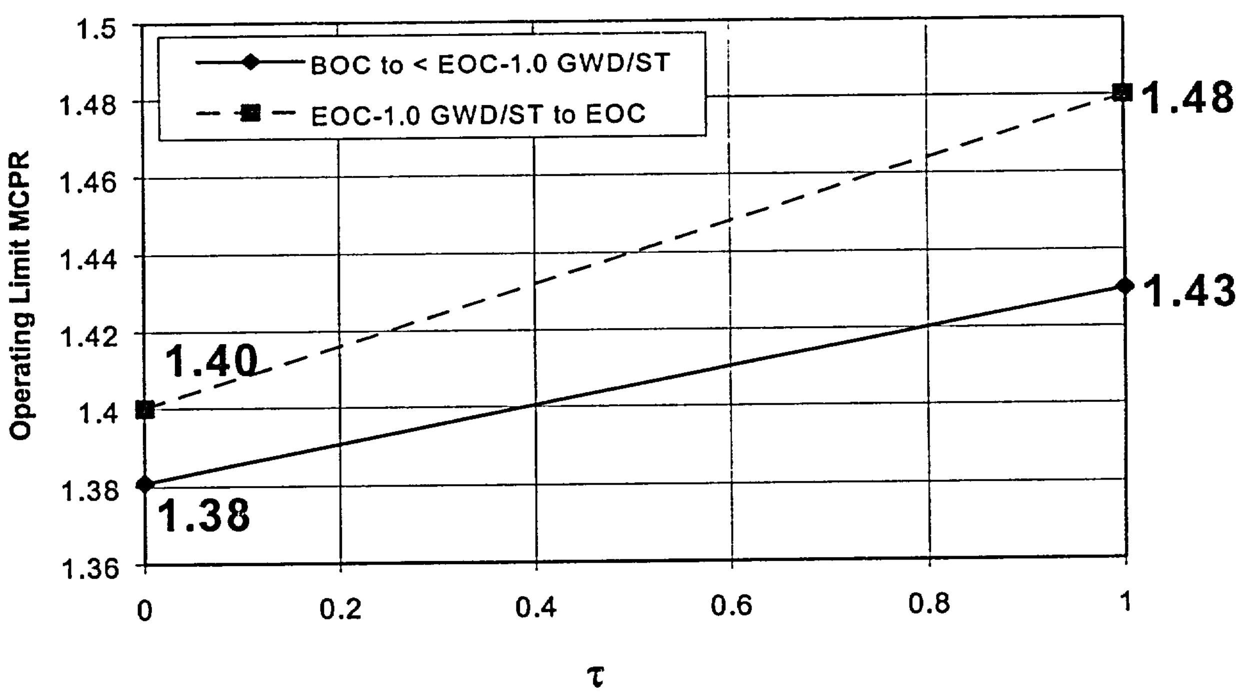
Technical Specification LCO 3.2.2, Minimum Critical Power Ratio (MCPR)

For single loop operation, these limits shall be increased by 0.01.

NOTE: Should the operating limit MCPR obtained from this figure be less than the operating limit MCPR found in 7.1.3 for the applicable RBM Upscale Rod Block trip level setting then 7.1.3 shall apply (Not applicable in Cycle 15).

FIGURE 8.1.A

MCPR Operating Limit Versus τ
For Operating Above 75% of Rated
Thermal Power with Three Steam
Lines in Service For all Fuel Types



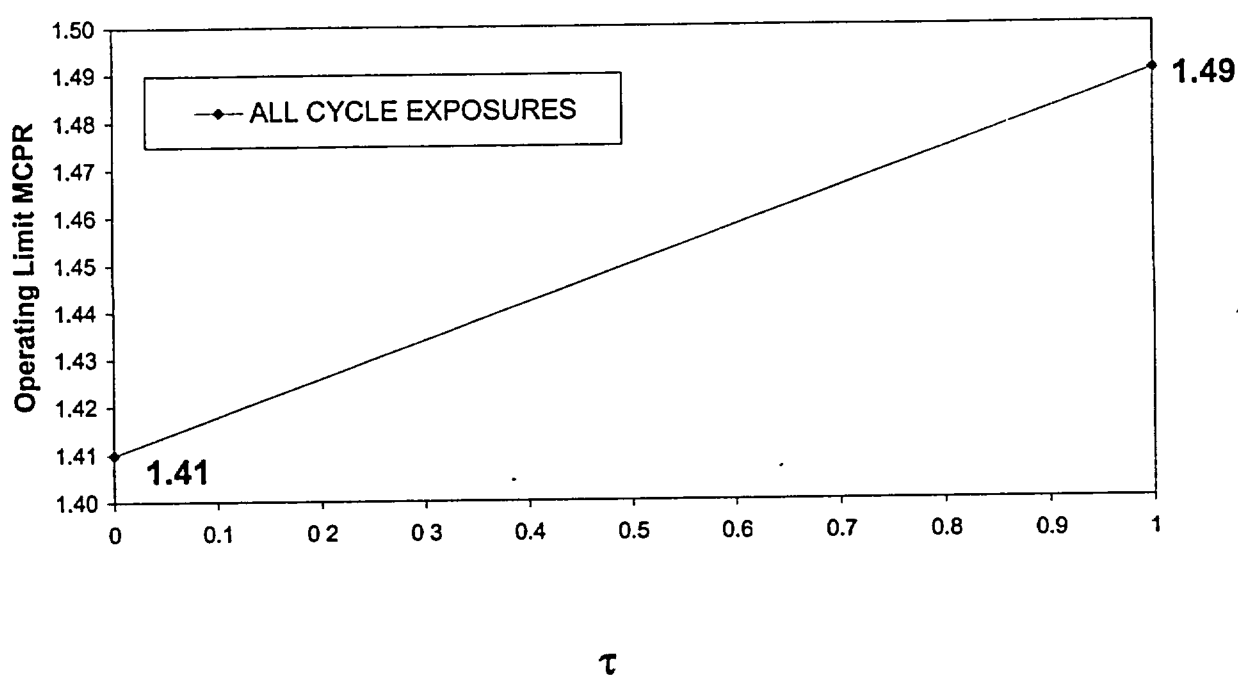
Technical Specification LCO 3.2.2, Minimum Critical Power Ratio (MCPR)

For single loop operation, these limits shall be increased by 0.01.

NOTE: Should the operating limit MCPR obtained from this figure be less than the operating limit MCPR found in 7.1.3 for the applicable RBM Upscale Rod Block trip level setting then 7.1.3 shall apply (Not applicable in Cycle 15).

FIGURE 8.1.B

MCPR Operating Limit Versus τ for Operation with Turbine Bypass Valves Out of Service



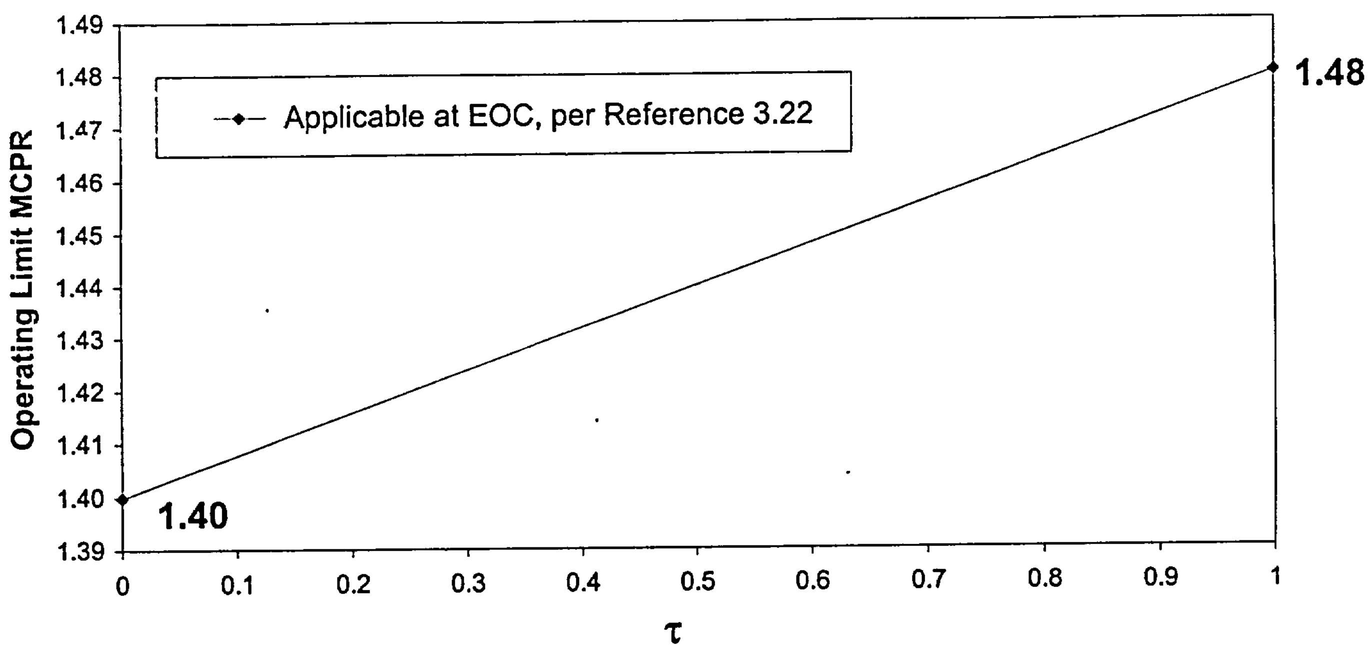
Technical Specification LCO 3.2.2, Minimum Critical Power Ratio (MCPR)

For single loop operation, these limits shall be increased by 0.01.

NOTE: Should the operating limit MCPR obtained from this figure be less than the operating limit MCPR found in 7.1.3 for the applicable RBM Upscale Rod Block trip level setting then 7.1.3 shall apply (Not applicable in Cycle 15).

FIGURE 8.1.C

MCPR Operating Limit Versus τ for Operation with Final Feedwater Temperature Reduction



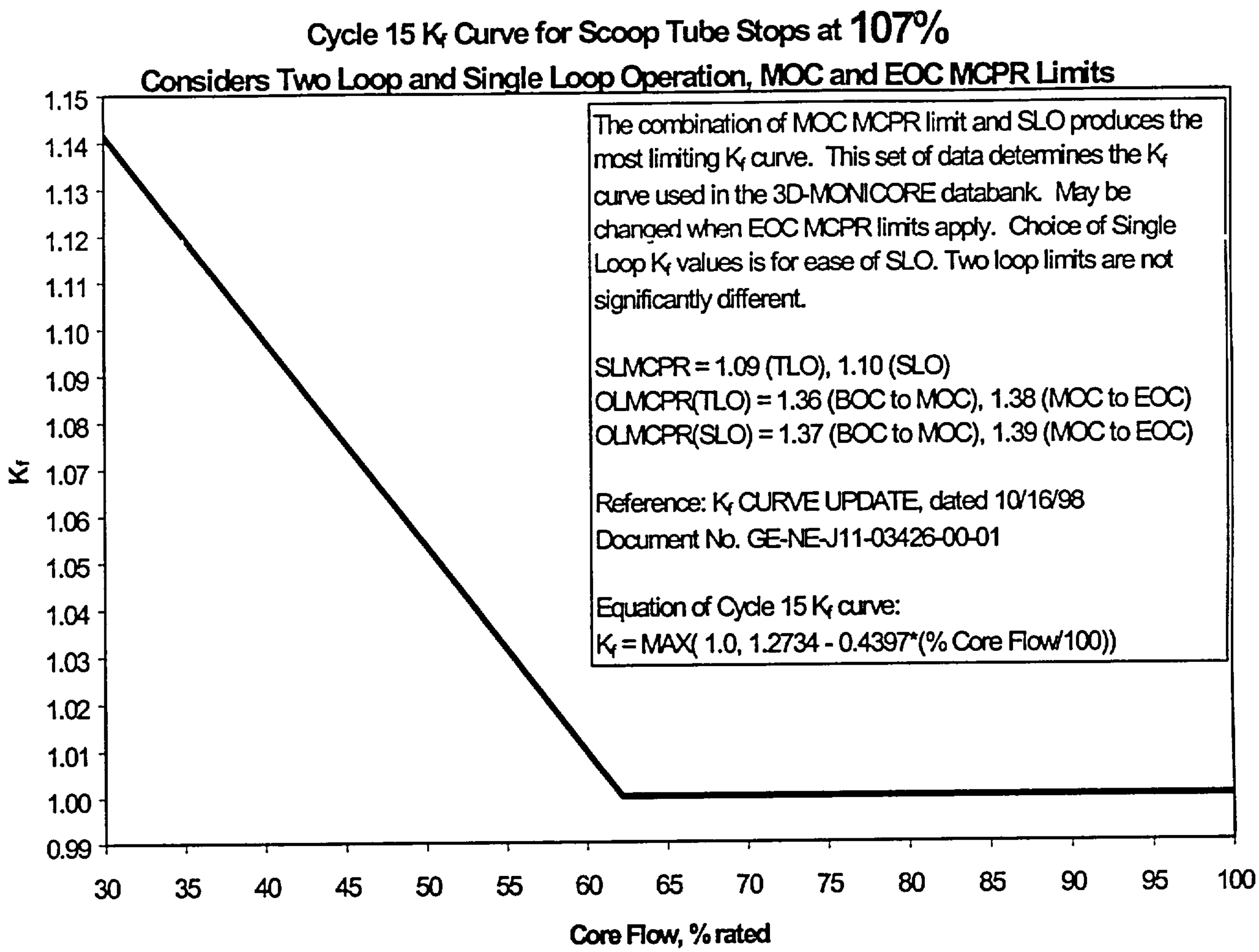
Technical Specification LCO 3.2.2, Minimum Critical Power Ratio (MCPR)

For single loop operation, these limits shall be increased by 0.01.

NOTE: Should the operating limit MCPR obtained from this figure be less than the operating limit MCPR found in 7.1.3 for the applicable RBM Upscale Rod Block trip level setting then 7.1.3 shall apply (Not applicable in Cycle 15).

FIGURE 8.2

K_f Factor



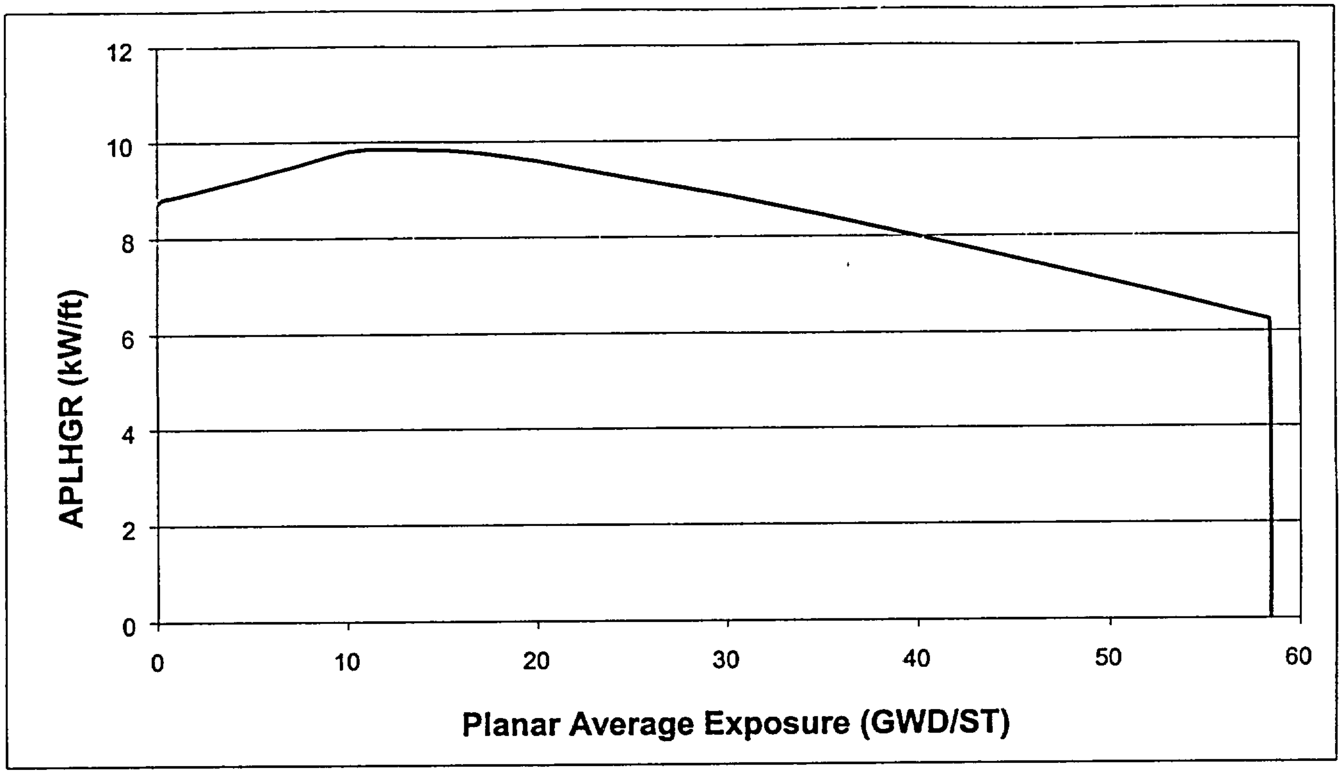
Technical Specification LCO 3.2.2, Minimum Critical Power Ratio (MCPR)

See Section 7.7

NOTE: K_f for Single Loop Operation is slightly greater than for Dual Loop Operation limits. Therefore, K_f calculated for Single Loop Operation is more conservative and will be applied to Dual Loop Operation as well.

FIGURE 8.3.A

APLHGR versus Planar Average Exposure:
GE12-P10DSB405-16GZ-100T-150-T-2396



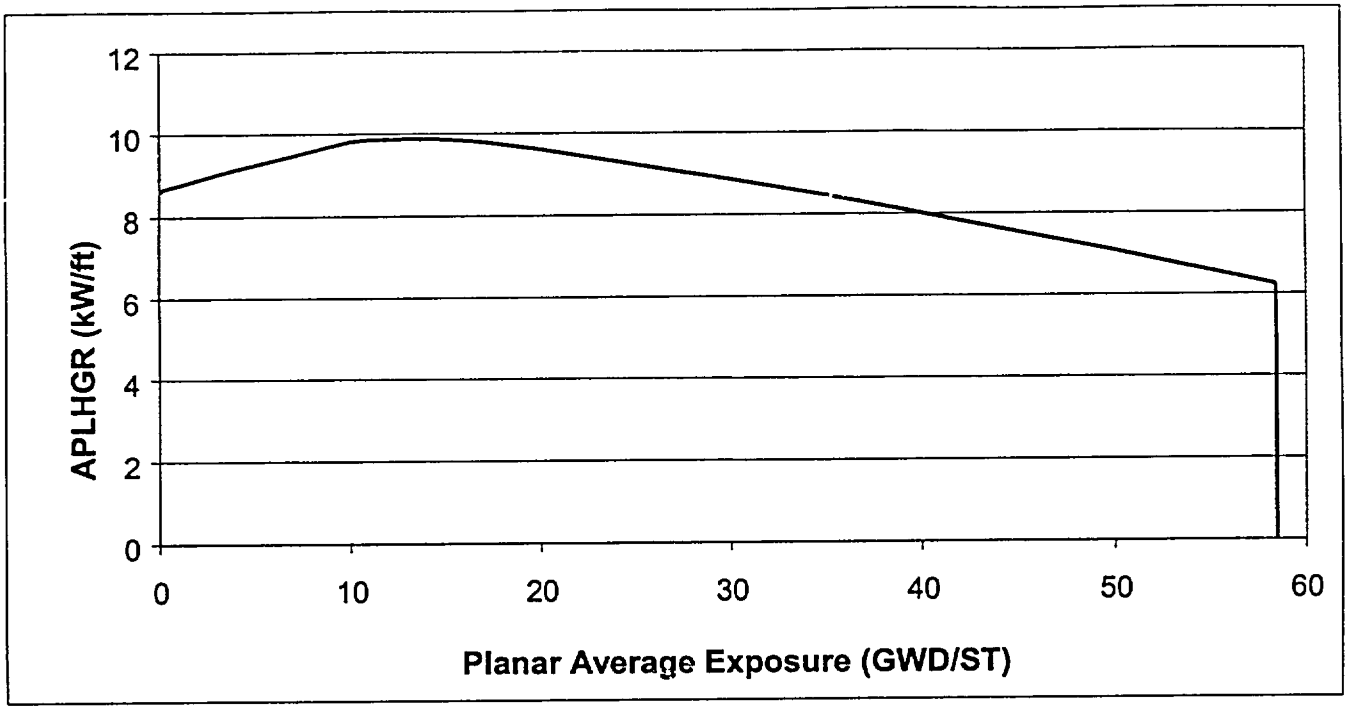
This curve represents the limiting exposure dependent APLHGR values per Reference 3.17 and 3.18.

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

For single loop operation these APLHGR values shall be multiplied by 0.78.

FIGURE 8.3.B

APLHGR versus Planar Average Exposure:
GE12-P10DSB405-17GZ-100T-150-T-2395



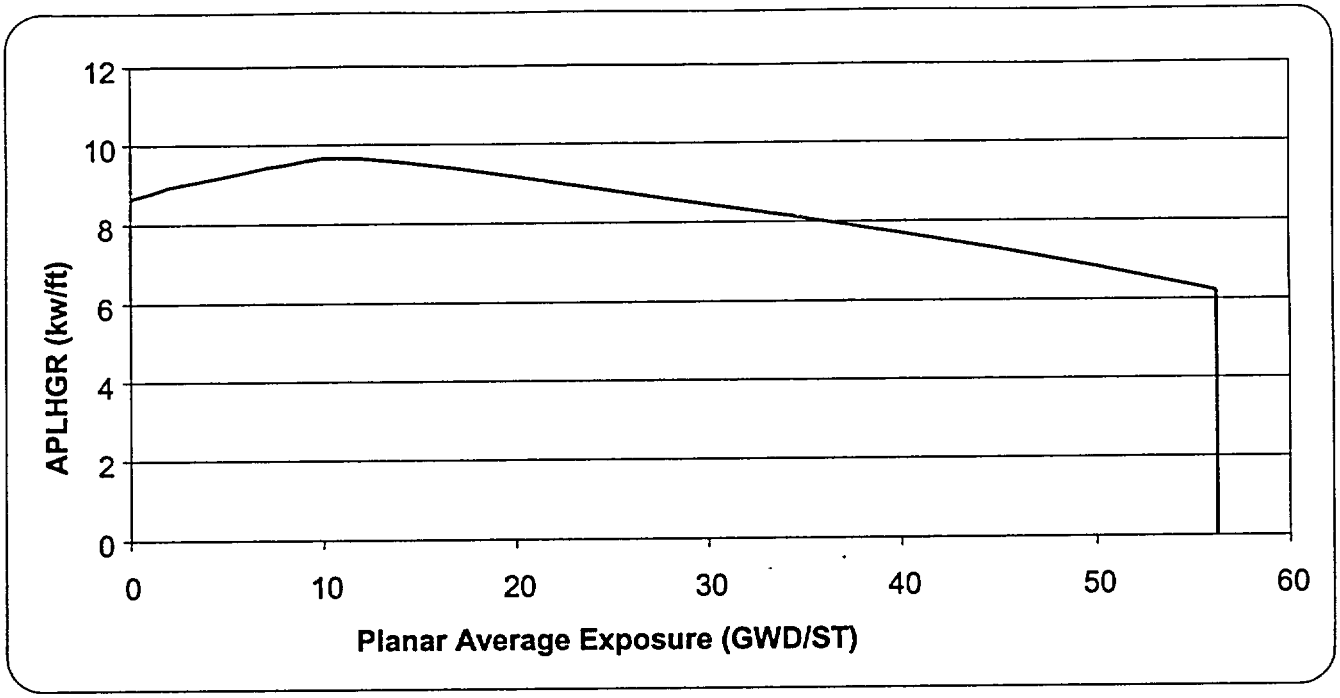
This curve represents the limiting exposure dependent APLHGR values per Reference 3.17 and 3.18.

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

For single loop operation these APLHGR values shall be multiplied by 0.78.

FIGURE 8.3.C

APLHGR versus Planar Average Exposure:
GE12-P10DSB417-15GZ-100T-150-T



This curve represents the limiting exposure dependent APLHGR values per Reference 3.5 and 3.12.

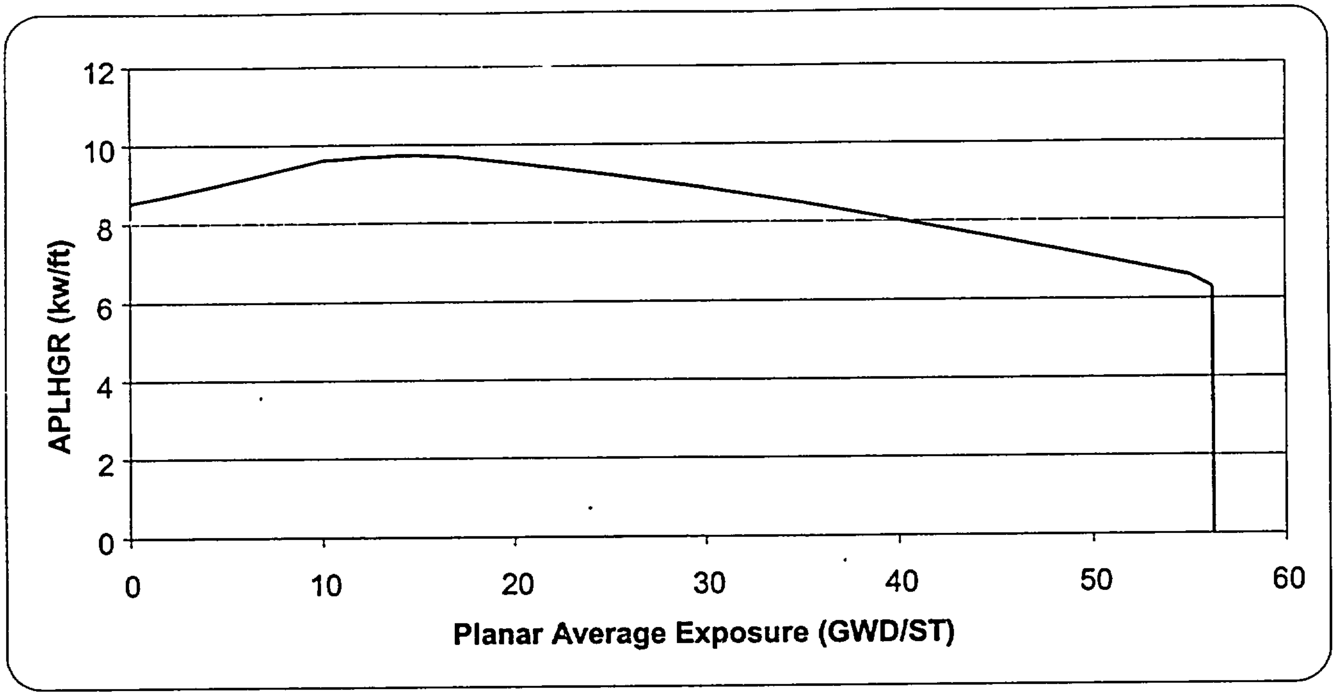
Technical Specification LCO 3.2.1, Average Planar Linear Heat Generation Rate (APLHGR)

Reference: 23A7114 Rev 1

For single loop operation these APLHGR values shall be multiplied by 0.78.

FIGURE 8.3.D

**APLHGR versus Planar Average Exposure:
GE12-P10DSB412-17GZ-100T-150-T**



This curve represents the limiting exposure dependent APLHGR values per Reference 3.5 and 3.12.

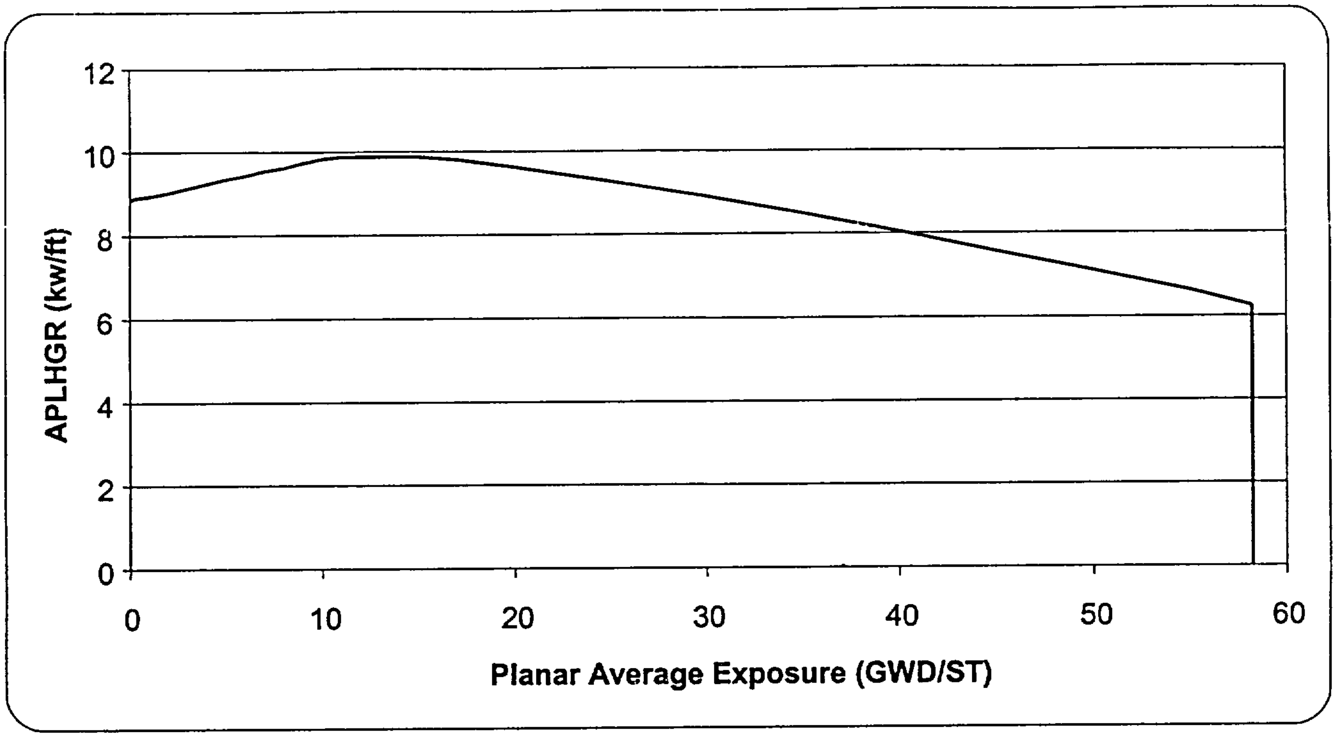
Technical Specification LCO 3.2.1, Average Planar Linear Heat Generation Rate (APLHGR)

Reference: 24A5167 Rev. 0

For single loop operation these APLHGR values shall be multiplied by 0.78.

FIGURE 8.3.E

APLHGR versus Planar Average Exposure:
GE12-P10DSB407-14G6.0-100T-150-T



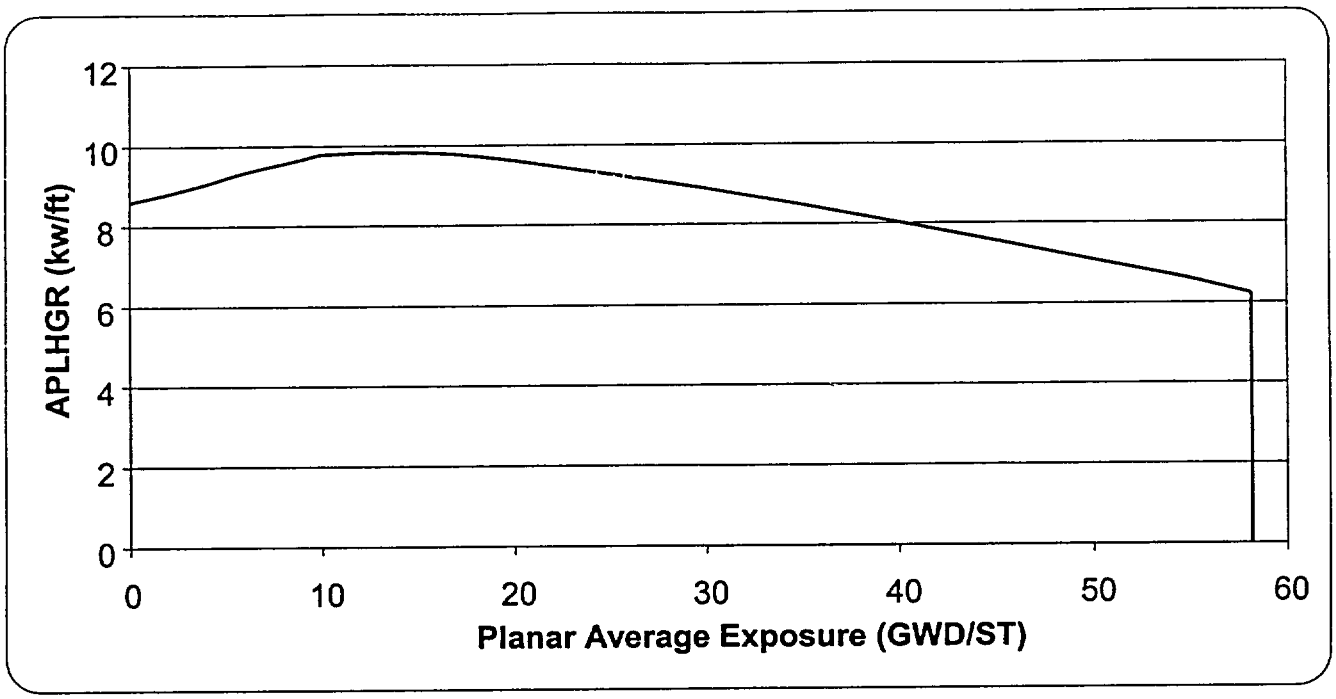
This curve represents the limiting exposure dependent APLHGR values per Reference 3.4 and 3.13.

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

For single loop operation these APLHGR values shall be multiplied by 0.78.

FIGURE 8.3.F

APLHGR versus Planar Average Exposure:
GE12-P10DSB407-17GZ-100T-150-T



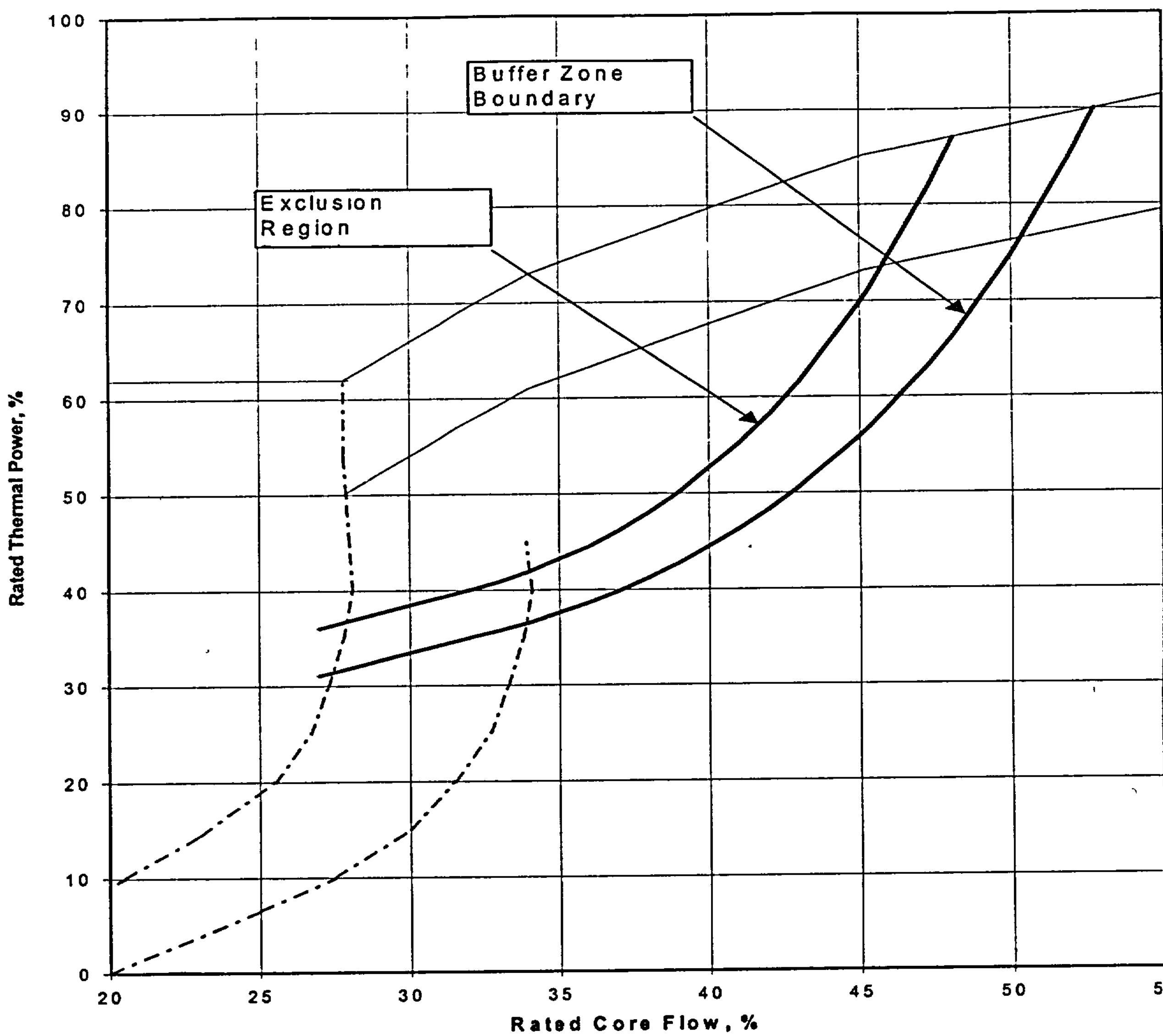
This curve represents the limiting exposure dependent APLHGR values per Reference 3.4 and 3.13.

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

For single loop operation these APLHGR values shall be multiplied by 0.78.

FIGURE 8.4

Stability Option 1-D Exclusion Region

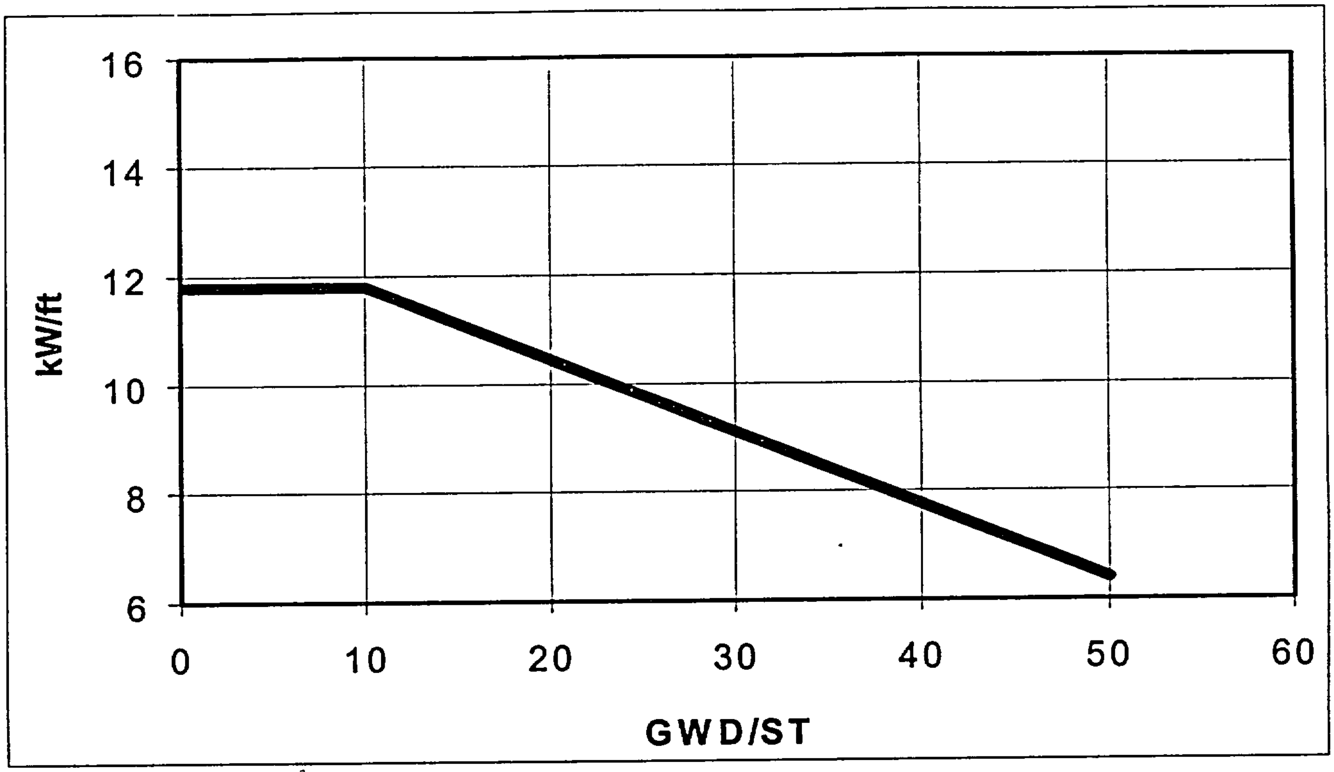


Technical Specification LCO 3.4.1, Recirculation Loops Operating

Reference 3.14

FIGURE 8.5

Exposure Dependent LHGR Limit for GE12 Fuel



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

This curve represents the limiting exposure dependent LHGR values per Reference 3.11

Design features of the fuel assemblies in the Cycle 15 core are provided in Reference 3.6

NOTE: Exposure Dependent Limits will be used in the 3D-MONICORE software.

FIGURE 8.5.A

Cycle 15 Loading Pattern, Upper Left Quadrant, Bundle Design

N ↓
from above the core

								B	B	B	B	B	52
							B	B	B	B	B	B	50
				B	B	B	B	B	B	B	B	B	48
			B	B	B	B	B	B	B	B	B	B	46
		B	B	B	B	B	B	B	B	B	B	B	44
		B	B	B	B	B	B	B	B	B	B	B	42
		B	B	B	B	B	B	B	B	B	B	B	40
	B	B	B	B	B	B	B	B	B	B	B	B	38
B	B	B	B	B	B	B	B	B	B	B	B	B	36
B	B	B	B	B	B	B	B	B	B	B	B	B	34
B	B	B	B	B	B	B	B	B	B	B	B	B	32
B	B	B	B	B	B	B	B	B	B	B	B	B	30
B	B	B	B	B	B	B	B	B	B	B	B	B	28
1	3	5	7	9	11	13	15	17	19	21	23	25	

B = GE12

FIGURE 8.6.B

Cycle 15 Loading Pattern, Upper Right Quadrant, Bundle Design

N ↓
from above the core

B	B	B	B	B									52
B	B	B	B	B	B								50
B	B	B	B	B	B	B	B	B					48
B	B	B	B	B	B	B	B	B	B				46
B	B	B	B	B	B	B	B	B	B	B			44
B	B	B	B	B	B	B	B	B	B	B			42
B	B	B	B	B	B	B	B	B	B	B			40
B	B	B	B	B	B	B	B	B	B	B	B		38
B	B	B	B	B	B	B	B	B	B	B	B	B	36
B	B	B	B	B	B	B	B	B	B	B	B	B	34
B	B	B	B	B	B	B	B	B	B	B	B	B	32
B	B	B	B	B	B	B	B	B	B	B	B	B	30
B	B	B	B	B	B	B	B	B	B	B	B	B	28
27	29	31	33	35	37	39	41	43	45	47	49	51	

B = GE12

FIGURE 8.6.C

Cycle 15 Loading Pattern, Lower Right Quadrant, Bundle Design

	27	29	31	33	35	37	39	41	43	45	47	49	51
26	B	B	B	B	B	B	B	B	B	B	B	B	B
24	B	B	B	B	B	B	B	B	B	B	B	B	B
22	B	B	B	B	B	B	B	B	B	B	B	B	B
20	B	B	B	B	B	B	B	B	B	B	B	B	B
18	B	B	B	B	B	B	B	B	B	B	B	B	B
16	B	B	B	B	B	B	B	B	B	B	B	B	
14	B	B	B	B	B	B	B	B	B	B	B		
12	B	B	B	B	B	B	B	B	B	B	B		
10	B	B	B	B	B	B	B	B	B	B	B		
8	B	B	B	B	B	B	B	B	B	B			
6	B	B	B	B	B	B	B	B	B				
4	B	B	B	B	B	B							
2	B	B	B	B	B								

N↓
from above the core

B = GE12

FIGURE 8.6.D

Cycle 15 Loading Pattern, Lower Left Quadrant, Bundle Design

B	B	B	B	B	B	B	B	B	B	B	B	B	26
B	B	B	B	B	B	B	B	B	B	B	B	B	24
B	B	B	B	B	B	B	B	B	B	B	B	B	22
B	B	B	B	B	B	B	B	B	B	B	B	B	20
B	B	B	B	B	B	B	B	B	B	B	B	B	18
	B	B	B	B	B	B	B	B	B	B	B	B	16
		B	B	B	B	B	B	B	B	B	B	B	14
		B	B	B	B	B	B	B	B	B	B	B	12
		B	B	B	B	B	B	B	B	B	B	B	10
			B	B	B	B	B	B	B	B	B	B	8
				B	B	B	B	B	B	B	B	B	6
							B	B	B	B	B	B	4
								B	B	B	B	B	2
1	3	5	7	9	11	13	15	17	19	21	23	25	

N↓
from above the core

B = GE12

FIGURE 8.7

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 contains limits for;

- Cycle exposure range of BOC to < EOC – 1.0 GWD/ST
- $\tau = 0$
- Dual recirculation pump operation
- Four steam line operation, and
- Operation with Turbine Bypass Valves Out-of-Service
- Final Feedwater Temperature Reduction

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 = EOC – 1.0 GWD/ST OLMCPR changes to EOC values at cycle exposure of 13.447 GWD/ST	See Table 8.1(8.1.A for 3SL) or Figure 8.1 for $\tau \neq 0$(8.1.A for 3SL) for change in MCPR. K_f limit may be changed in recognition of higher OLMCPR.	None
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 Figure 8.1 or 8.1.A for 3SL. K_f limit may be changed in recognition of higher OLMCPR.	RAP-7.4.1
Single Loop Operation The SLMCPR increases by 0.01 and therefore OLMCPR limits increase by 0.01. MAPLHGR is reduced by a multiplier in SLO.	Increase MCPR Limits by 0.01, or change acceptance criterion in ST-5E to 0.99. K_f does not change. Verify that 3D-Monicore has recognized the idle recirculation loop and is applying the GE12 SLO MAPLHGR multiplier of 0.78.	RAP-7.4.2, ST-5E, RAP-7.3.25
Three Steam Line Operation (3SL) OLMCPR values increase by 0.02 when operating on 3SL	Increase OLMCPR according to Table 8.1.A or Figure 8.1.A($\tau \neq 0$). K_f limit may be changed in recognition of higher OLMCPR.	None
Operation with Turbine Bypass Valves Out-of-Service OLMCPR values increase, no LHGR change required	Increase OLMCPR according to Table 8.1.B or Figure 8.1.B($\tau \neq 0$). K_f limit may be changed in recognition of higher OLMCPR.	None
Operation under Final Feedwater Temperature Reduction OLMCPR values increase, no LHGR change required	Increase OLMCPR according to Table 8.1.C or Figure 8.1.C($\tau \neq 0$). K_f limit may be changed in recognition of higher OLMCPR.	None