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JAFP-01-0141

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 10 (Cycle 15 update)

Dear Sir;

Attached is Revision 10 to the James A. FitzPatrick Core Operating Limits Report (COLR). This report is submitted in accordance with Technical Specifications Section 6.9.A.4.d.

Revision 10 of the COLR revises the APRM flow referenced flux scram and rod block trip settings to conform with the Extended Load Line Limit Analyses (ELLLA) settings. ELLLA settings were the basis by which power uprate was analyzed and approved in Technical Specifications Amendment 239. This revision allows adjustment of the APRM electronics and should result in additional reactor reactivity control flexibility and better fuel utilization. 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. Francisco Rodriguez-Vera at (315) 349-6310.

Very truly yours,

T. A. Sullivan

TAS:GB:las

Attachment as stated

cc: next page

A001

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

CORE OPERATING LIMITS REPORT
REVISION 10

REVIEWED BY: PLANT OPERATIONS REVIEW COMMITTEE

MEETING NO. 01-015 DATE 4/20/01

APPROVED BY: Francisco Rodríguez DATE 04-20-01
REACTOR ANALYST SUPERVISOR

APPROVED BY: _____ DATE 4/20/01
GENERAL MANAGER-PLANT OPERATIONS

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

Maximum Average Planar Linear Heat Generation Rate (MAPLHGR)

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 License Appendix A, Operating 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 Reference removed.

3.7 Reference removed.

3.8 Cycle 15 Core Reload, JD-99-091.

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

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

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

3.12 Reference removed

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

3.14 Reference removed.

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

3.16 Reference removed

3.17 Reference removed.

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

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

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

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

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

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

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

4.0 DEFINITIONS

4.1 Minimum critical power ratio (MCPR) - Minimum value of the ratio of that power in a fuel assembly which is calculated to cause some point in that fuel assembly to experience boiling transition to the actual assembly operating power as calculated by application of the GEXL correlation (Reference NEDE-10958).

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 Maximum Fraction of Limiting Power Density - The Maximum Fraction of Limiting Power Density (MFLPD) is the highest value existing in the core of the Fraction of Limiting Power Density (FLPD).

4.4 Rated Recirculation Flow - that drive flow, which produces a core flow of 77.0×10^6 lb/hr.

5.0 RESPONSIBILITIES

5.1 See AP-12.05 (Reference 3.1).

5.2 It is the responsibility of the Shift Manager to assure that the reactor is operated within the limits described herein.

5.3 It is the responsibility of the Reactor Analyst Supervisor to assure that the limits described herein are properly installed in the 3D-Monicore databank used for thermal limit surveillance (Reference 3.9)

6.0 SPECIAL INSTRUCTIONS/REQUIREMENTS

Not applicable.

7.0 PROCEDURE

7.1 Operating Limit MCPR

During power operation, The Operating Limit MCPR shall be equal to or greater than the limits given below.

7.1.1 Technical Specification Reference: 3.1.B

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 38 shall be:

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

7.1.2.2 The average scram time to notch position 38 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 38 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 pickup of notch position 38 = 0.706 sec.

σ = standard deviation of the distribution for average scram insertion time to the pickup of notch position 38 = 0.016 sec.

N_1 = the total number of active rods measured in Technical Specification 4.3.C.1.

The number of rods to be scram tested and the test intervals are given in Technical Specification 4.3.C.

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, or Table 8.1.A if operating above 75% of rated thermal power with three steam lines in service.

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, or Figure 8.1.A if operating above 75% of rated thermal power with three steam lines in service.

Where: $\tau = (\tau_{AVE} - \tau_B)/(\tau_A - \tau_B)$

and

τ_{AVE} = the average scram time to notch position 38 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 38 as defined in Technical Specification 3.3.C.1.

NOTE: Should the operating limit MCPR obtained from these figures 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 Maximum Average Planar Linear Heat Generation Rate (MAPLHGR)

7.2.1 Technical Specification Reference: 3.5.H

7.2.2 During power operation, 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).

7.3 Linear Heat Generation Rate (LHGR)

7.3.1 Technical Specification Reference: 3.5.I.

7.3.2 During power operation, 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 Specification References: 2.1.A.1.c, Table 3.1-1, 3.1.A

7.4.1.2 When the Mode Switch is in the RUN position, the APRM flow referenced flux scram trip setting shall be:

$S \leq 0.58W + 62\%$ for two loop operation;

$S \leq 0.58W + 62\% - 0.58\Delta W$ 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.

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:

$S \leq (0.58W + 62\%)(FRP/MFLPD)$ for two loop operation;

$S \leq (0.58W + 62\% - 0.58\Delta W)(FRP/MFLPD)$ for single-loop operation;

where:

FRP = fraction of rated thermal power;

MFLPD = Maximum fraction of limiting power density, see Definition 4.3.

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 Flow Biased Rod Block Setting

7.4.2.1 Technical Specification References: 2.1.A.1.d, Table 3.2-3, 3.2.C

7.4.2.2 The APRM rod block trip setting shall be:

$S \leq 0.58W + 50\%$ for two loop operation;

$S \leq 0.58W + 50\% - 0.58\Delta W$ for single loop operation;

where:

S = rod block 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.

7.4.2.3 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:

$S \leq (0.58W + 50\%)(FRP/MFLPD)$ for two loop operation;

$S \leq (0.58W + 50\% - 0.58\Delta W)(FRP/MFLPD)$ for single loop operation;

where:

FRP = fraction of rated thermal power;

MFLPD = maximum fraction of limiting power density, Definition 4.3

7.5 RBM Flow Biased Rod Block Setting

7.5.1 Technical Specification Reference: 3.2.C

7.5.2 The RBM flow biased 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 that for Cycle 15 the RBM intercept value does not effect the MCPR Operating Limit for K values $\leq$ 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 Reference 3.5.J

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 3.11):

$$K_F = MAX [1.0, A - SLOPE*WT]$$

where:

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

$$SLOPE = \left(A_F/100/OLMCPR \right) * \left(SLMCPR/SLMCPR_{generic} \right)$$

$$A = \left(B_F/OLMCPR \right) * \left(SLMCPR/SLMCPR_{generic} \right)$$

$SLMCPR_{generic} = 1.07$

SLMCPR = Technical Specification Reference 1.1.A

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

FIGURE 8.6.A Cycle 15 Loading Pattern,
Upper Left Quadrant, Bundle Design

FIGURE 8.6.B Cycle 15 Loading Pattern,
Upper Right Quadrant, Bundle Design

FIGURE 8.6.C Cycle 15 Loading Pattern,
Lower Right Quadrant, Bundle Design

FIGURE 8.6.D Cycle 15 Loading Pattern,
Lower Left Quadrant, Bundle Design

FIGURE 8.7 Users Guide

9.0 EXHIBITS

Not Applicable.

TABLE 8.1
MCPR Operating Limit for Incremental Cycle
Core Average Exposure

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

Technical Specification Reference: 3.1.B

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

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

NOTE: Applicable for values of $K \leq 44\%$, see section 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
BOC to <EOC - 1.0 GWD/ST	1.38
EOC - 1.0 GWD/ST to EOC	1.40

Technical Specification Reference: 3.1.B

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

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

NOTE: Applicable for values of K $\leq$ 44%, see section 7.5.2

TABLE 8.2
Maximum LHGR

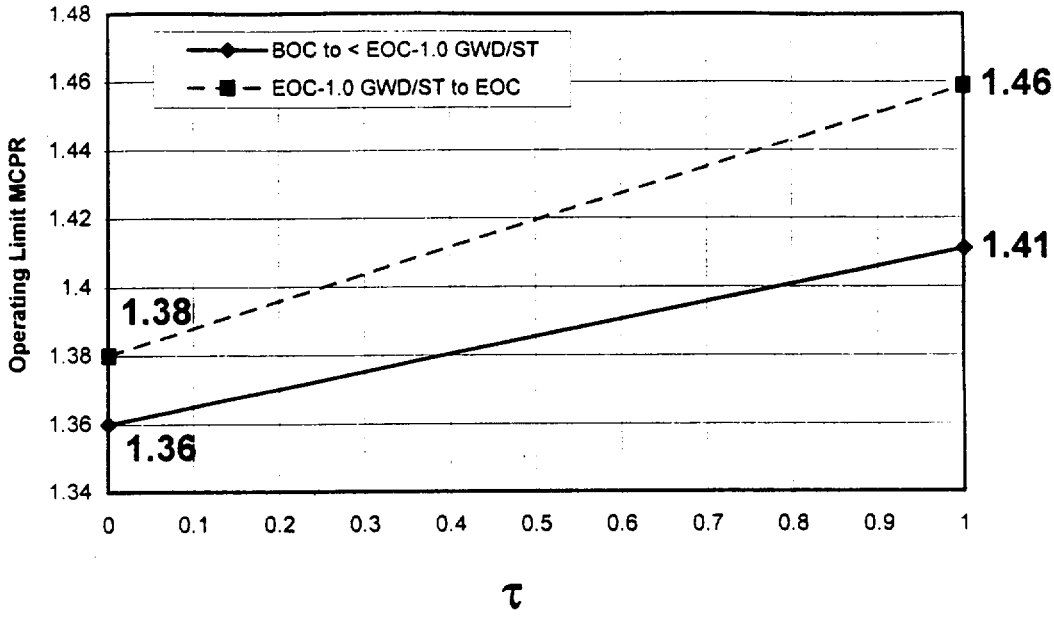
Fuel Type	Fuel Bundle Design	Maximum LHGR (kW/ft)
ALL	GE12	See Figure 8.5

Technical Specification Reference: 3.5.I

Design features of the fuel assemblies in the Cycle 15 core are provided in Reference 3.8

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

FIGURE 8.1
MCPR Operating Limit Versus τ for
All Fuel Types

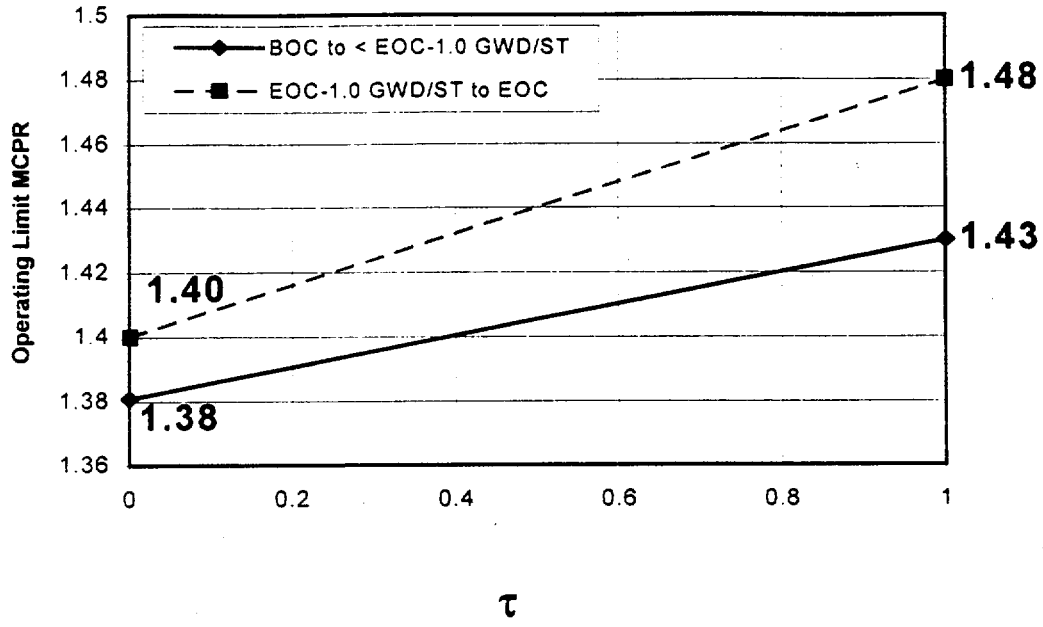


Technical Specification Reference: 3.1.B

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 trip level setting then 7.1.3 shall apply (Not applicable in Cycle 15).

FIGURE 8.1.A
MCPR Operating Limit Versus τ
For Operation above 75% of Rated Thermal
Power with Three Steam Lines in Service
For All Fuel Types

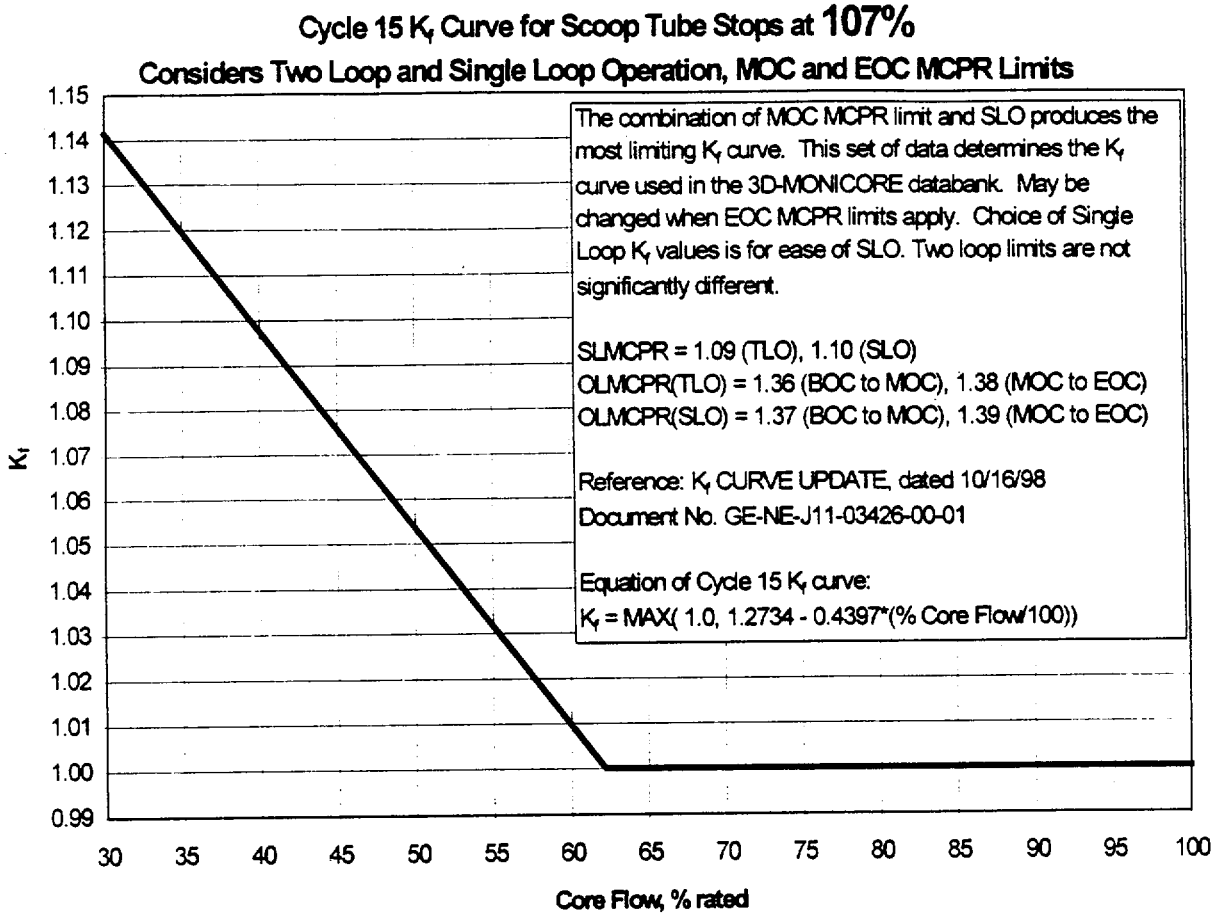


Technical Specification Reference: 3.1.B

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 trip level setting then 7.1.3 shall apply (Not applicable in Cycle 15).

FIGURE 8.2
K_f Factor

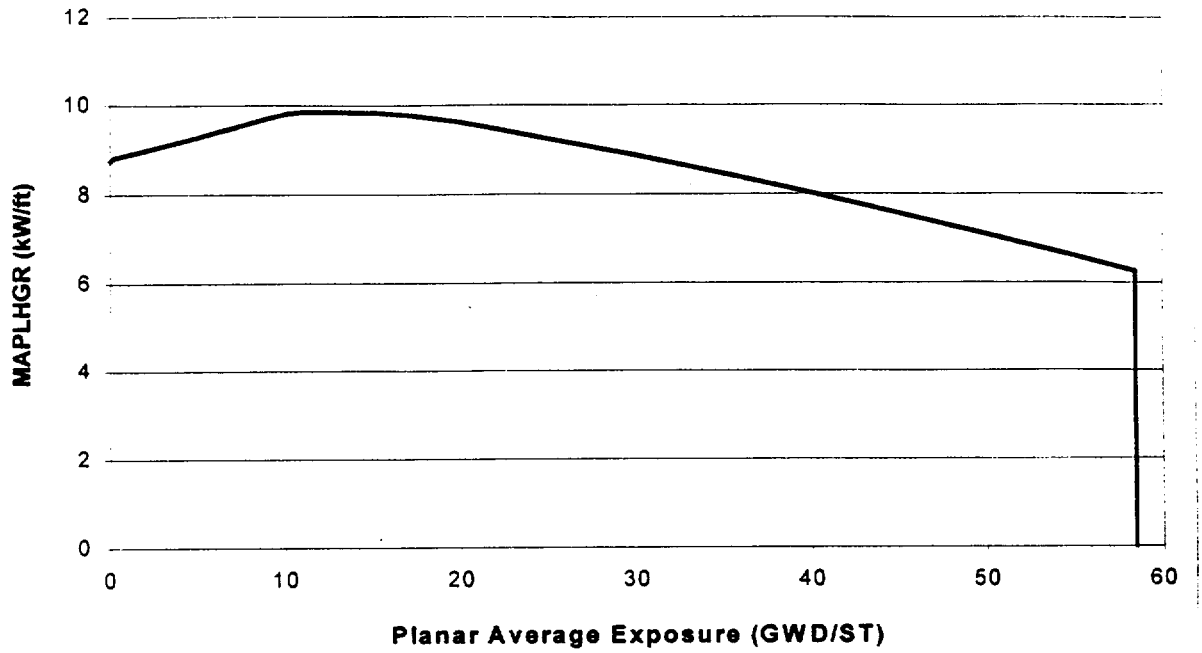


Technical Specification Reference: 3.1.B

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

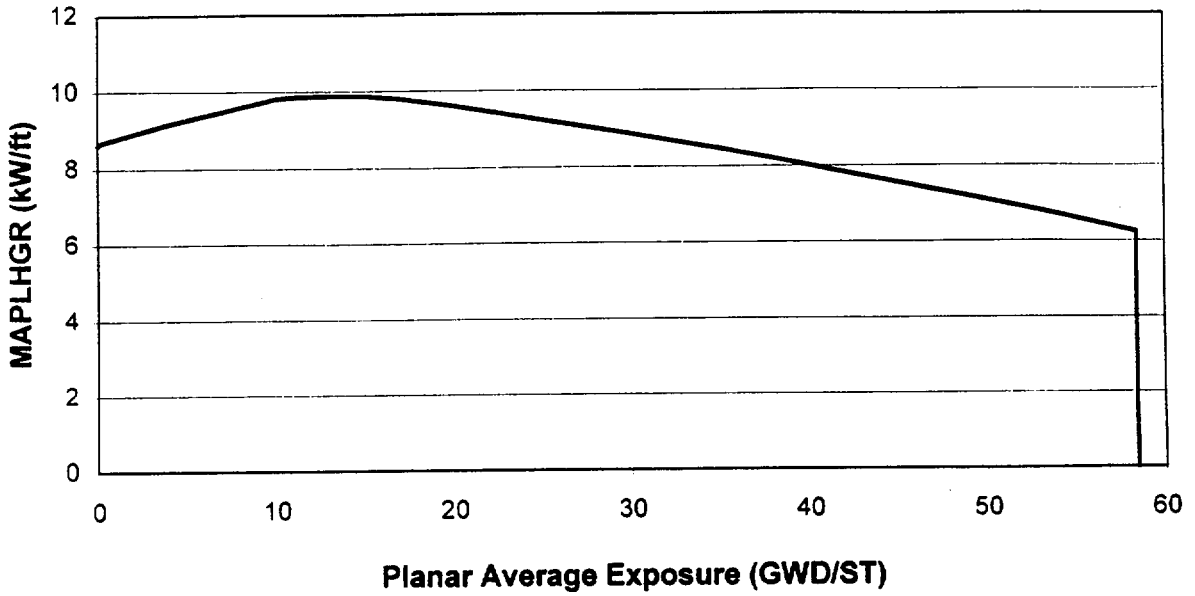


This curve represents the limiting exposure dependent MAPLHGR values per Reference 3.23 and 3.24.

Technical Specification Reference: 3.5.H

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

FIGURE 8.3.B
MAPLHGR versus Planar Average Exposure:
GE12-P10DSB405-17GZ-100T-150-T-2395.

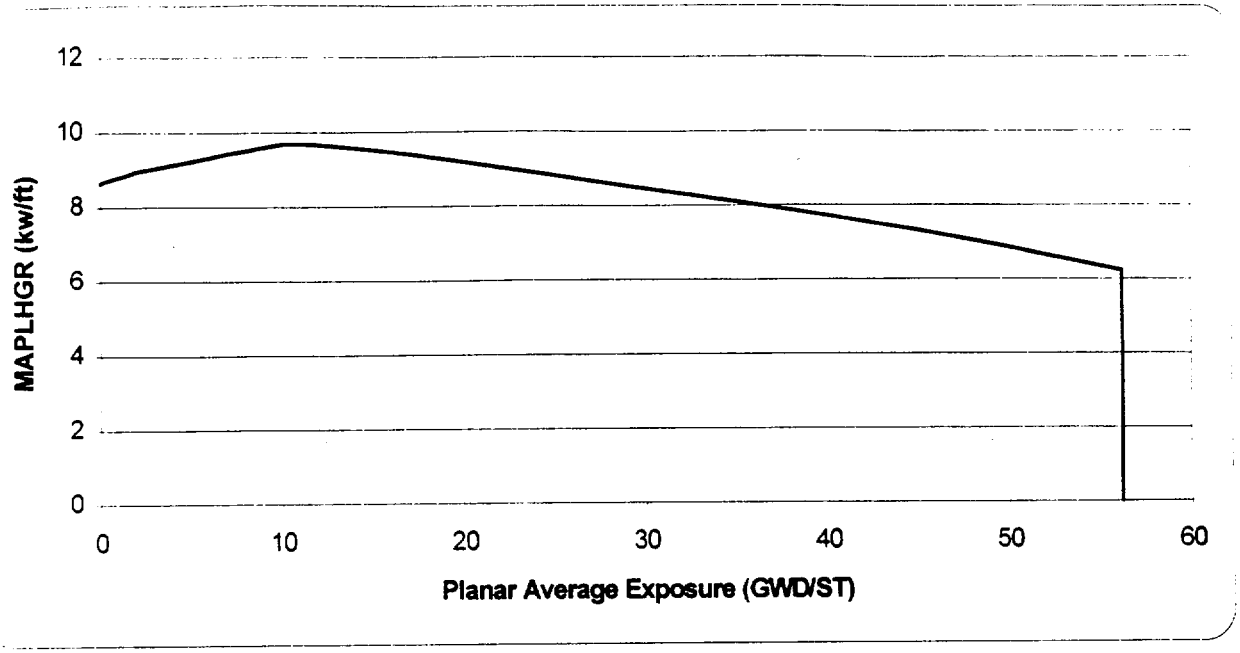


This curve represents the limiting exposure dependent MAPLHGR values per Reference 3.23 and 3.24.

Technical Specification Reference: 3.5.H

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

FIGURE 8.3.C
MAPLHGR versus Planar Average Exposure:
GE12-P10DSB417-15GZ-100T-150-T



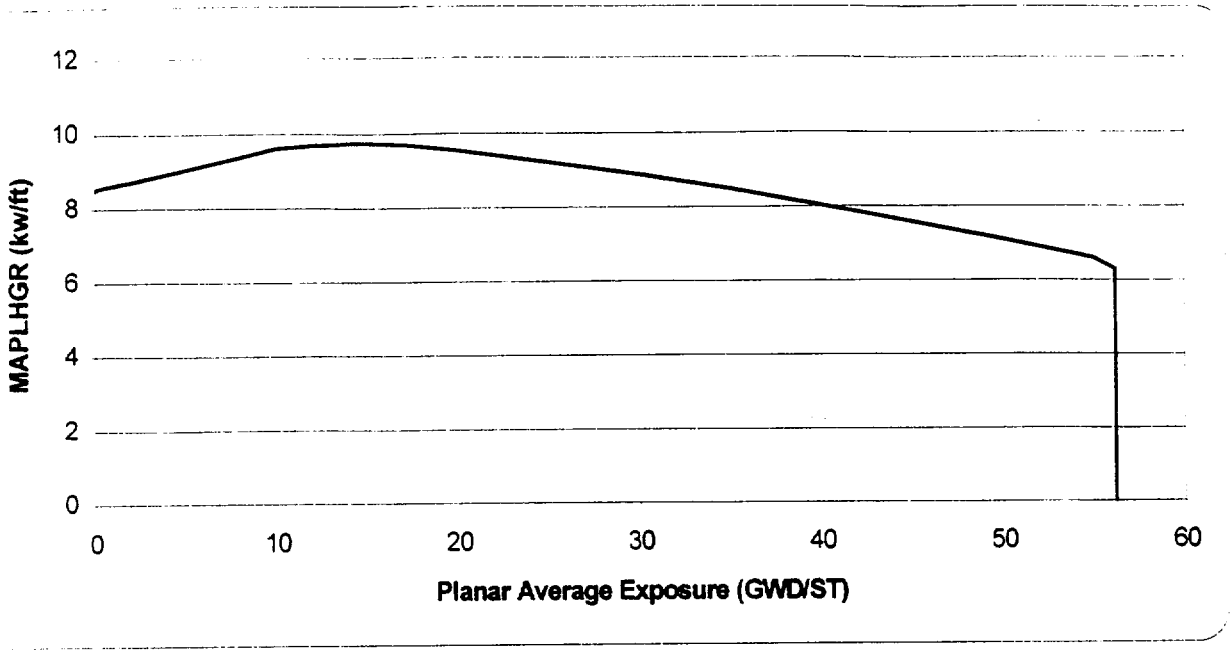
This curve represents the limiting exposure dependent MAPLHGR values per Reference 3.5 and 3.18.

Technical Specification Reference: 3.5.H

Reference: 23A7114 Rev 1

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

FIGURE 8.3.D
MAPLHGR versus Planar Average Exposure:
GE12-P10DSB412-17GZ-100T-150-T



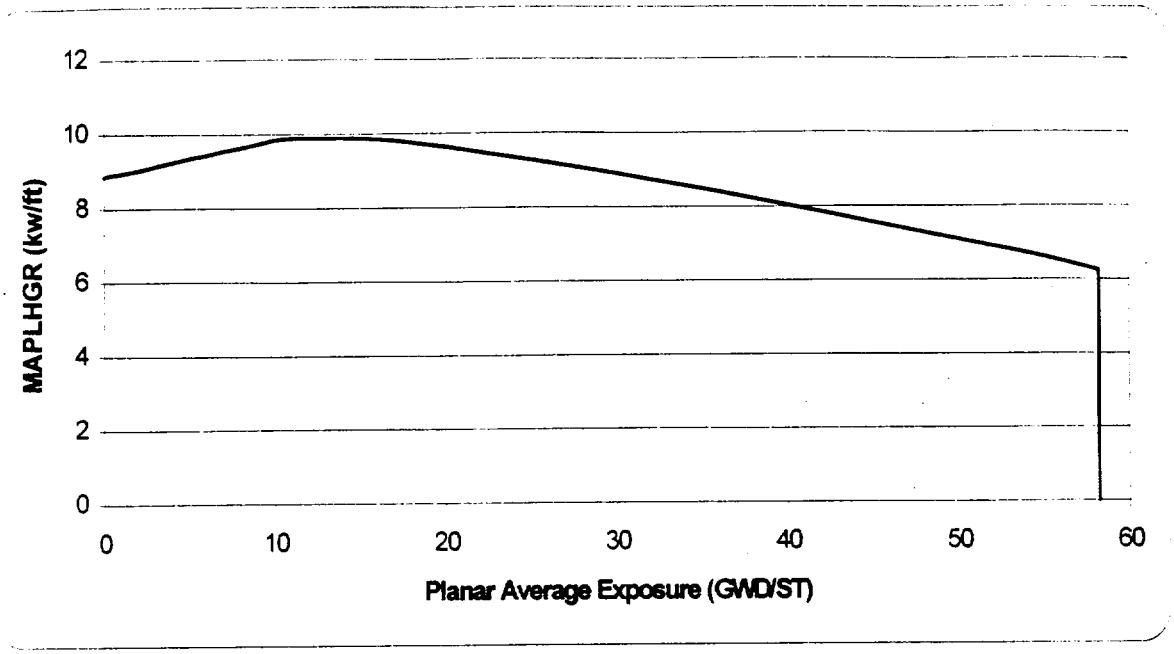
This curve represents the limiting exposure dependent MAPLHGR values per Reference 3.5 and 3.18.

Technical Specification Reference: 3.5.H

Reference: 24A5167 Rev. 0

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

FIGURE 8.3.E
MAPLHGR versus Planar Average Exposure:
GE12-P10DSB407-14G6.0-100T-150-T

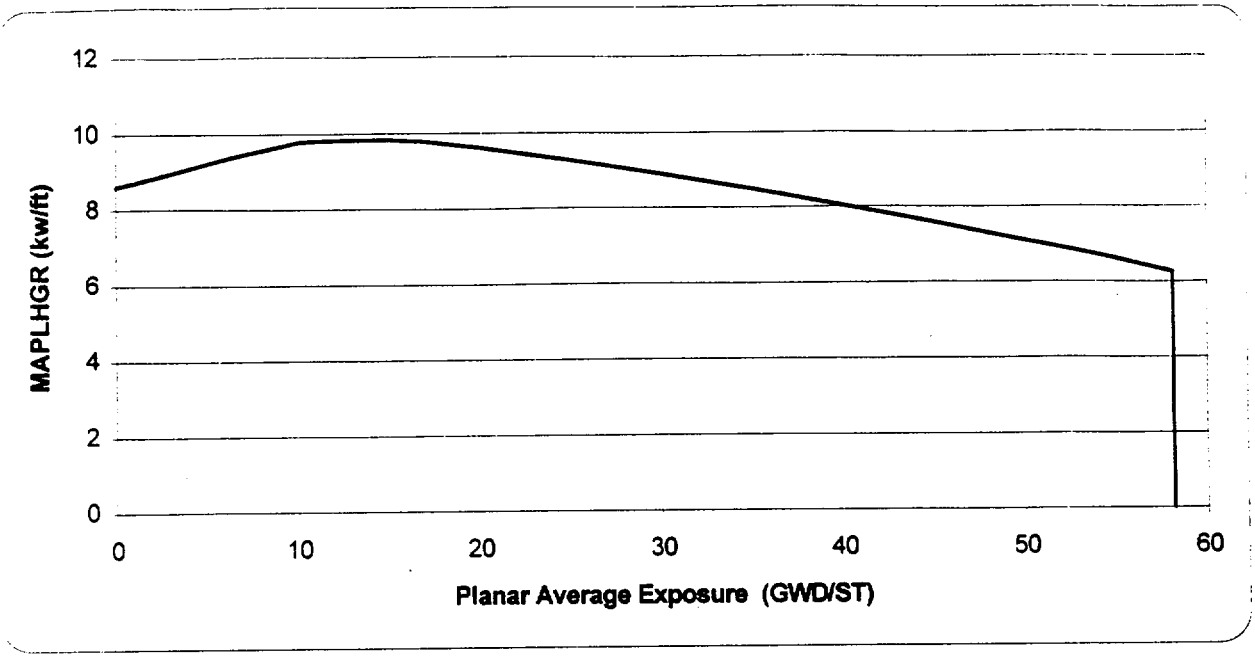


This curve represents the limiting exposure dependent MAPLHGR values per Reference 3.4 and 3.19.

Technical Specification Reference: 3.5.H

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

FIGURE 8.3F
MAPLHGR versus Planar Average Exposure:
GE12-P10DSB407-17GZ-100T-150-T

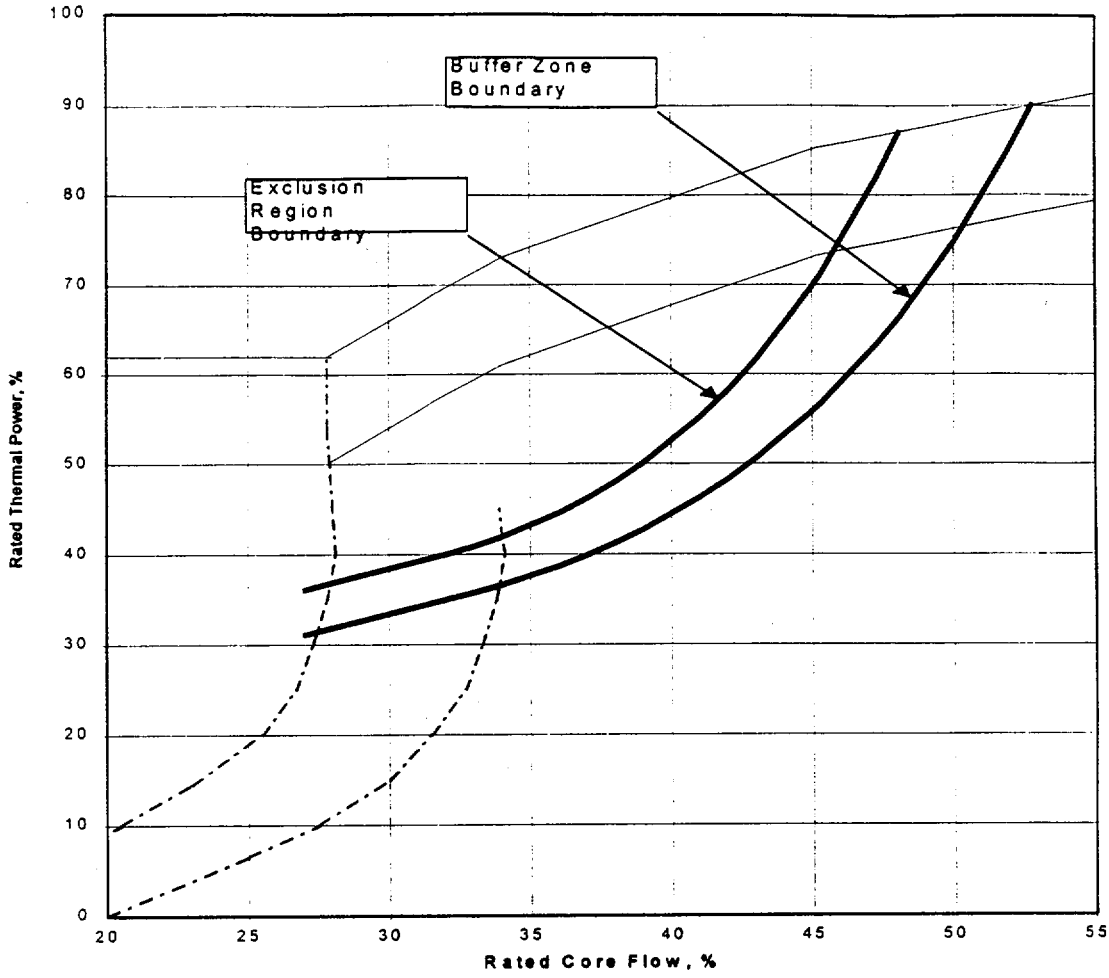


This curve represents the limiting exposure dependent MAPLHGR values per Reference 3.4 and 3.19.

Technical Specification Reference: 3.5.H

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

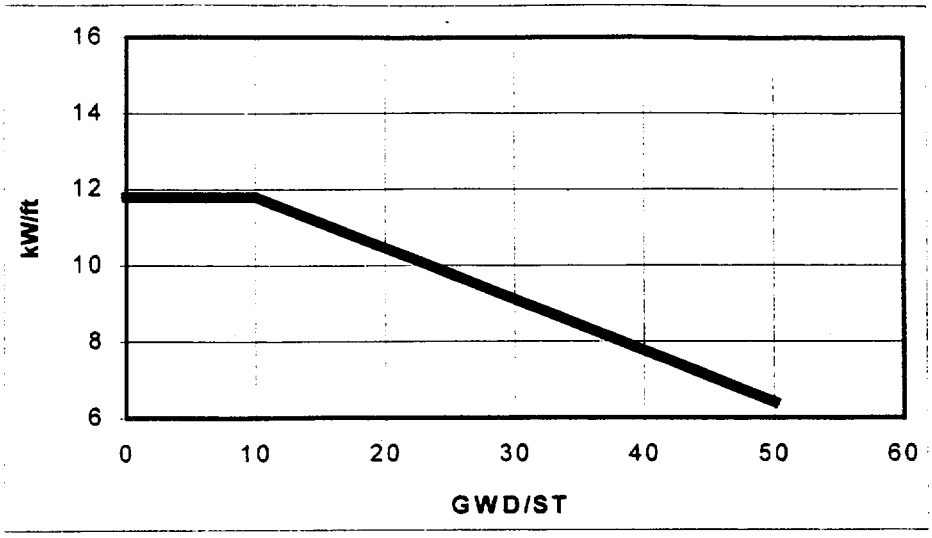
Figure 8.4
Stability Option 1-D Exclusion Region



Technical Specification Reference 3.5.J

Reference 3.20

FIGURE 8.5
Exposure Dependent LHGR Limit for GE12 Fuel



Technical Specification Reference: 3.5.I

This curve represents the limiting exposure dependent LHGR values per Reference 3.15

Design features of the fuel assemblies in the Cycle 15 core are provided in Reference 3.8

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

FIGURE 8.5A
Cycle 15 Loading Pattern, Upper Left Quadrant, Bundle Design

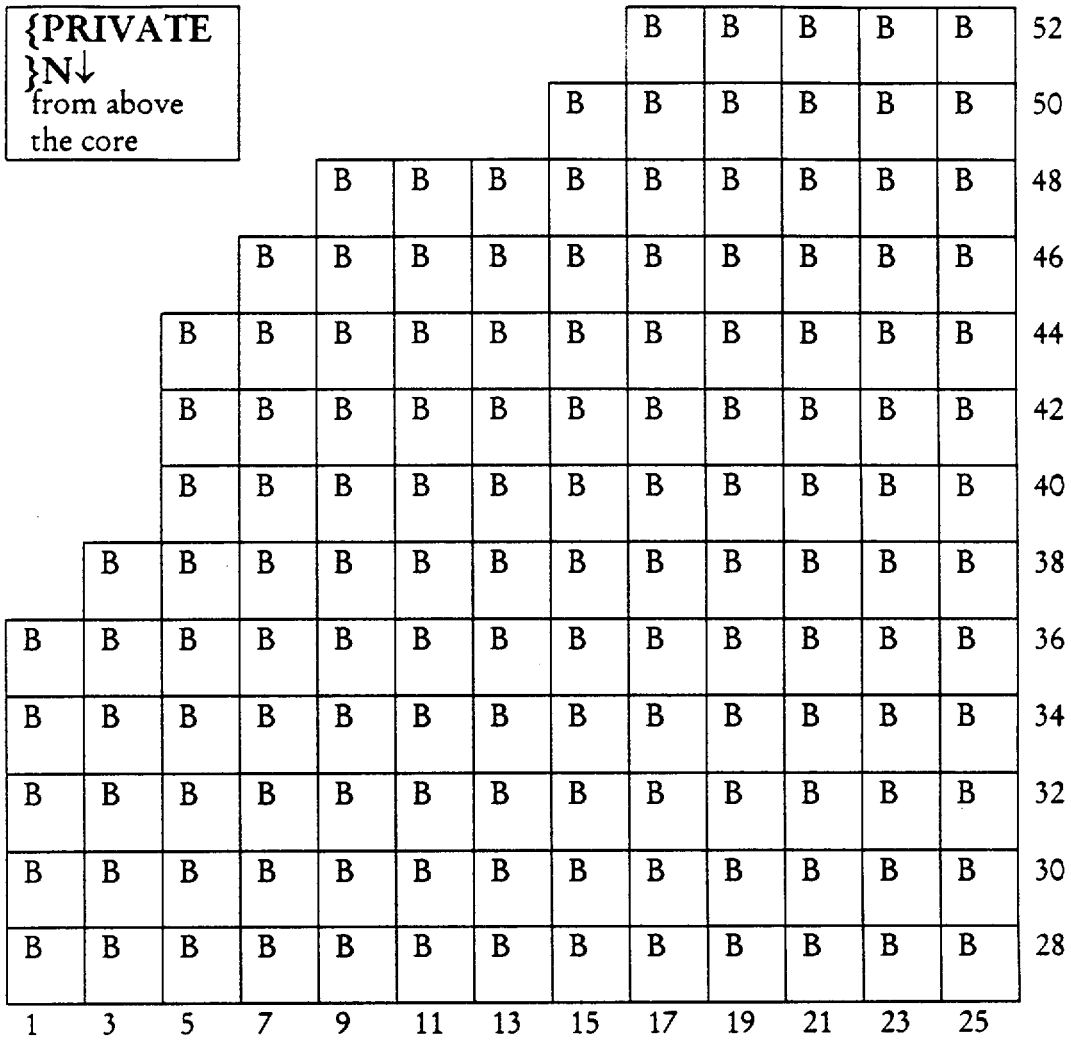
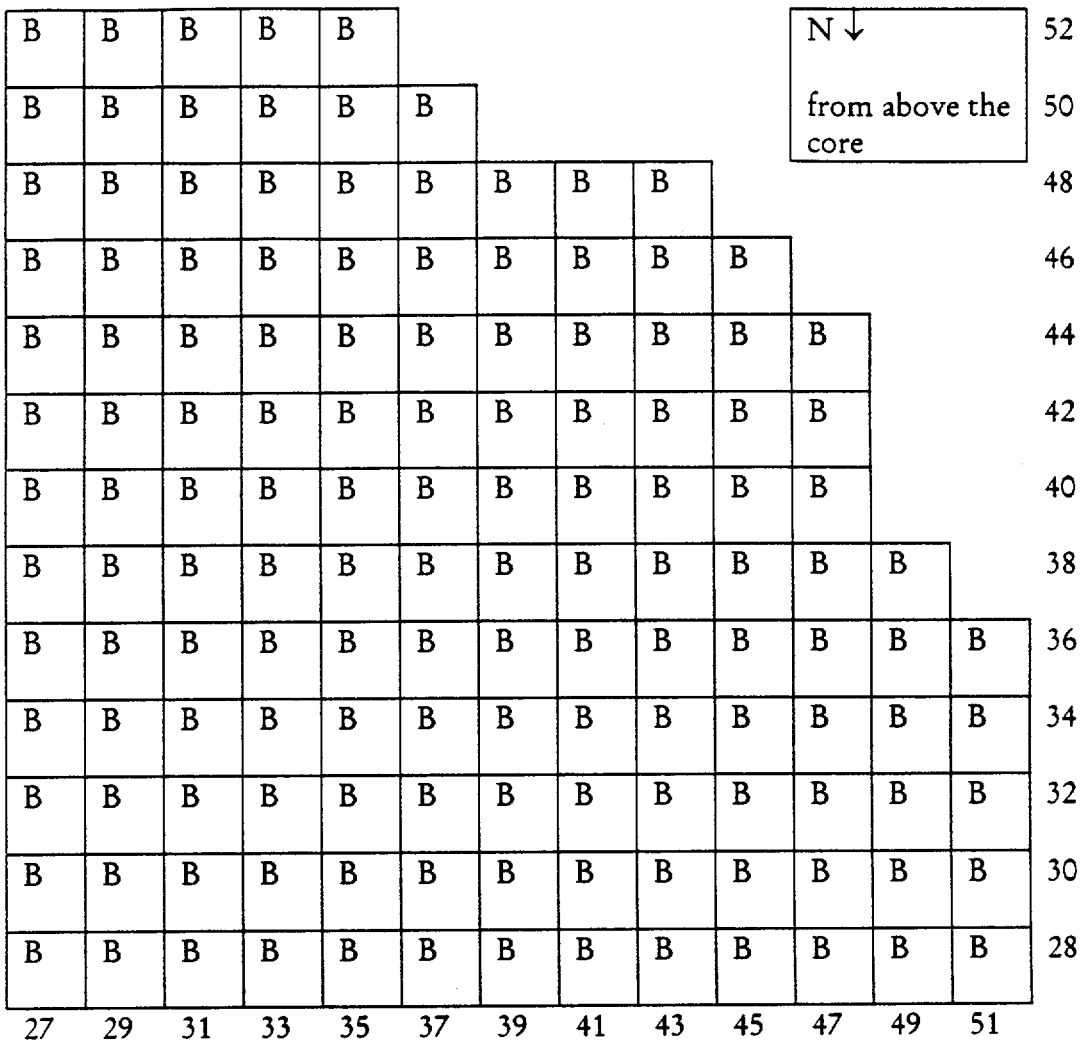
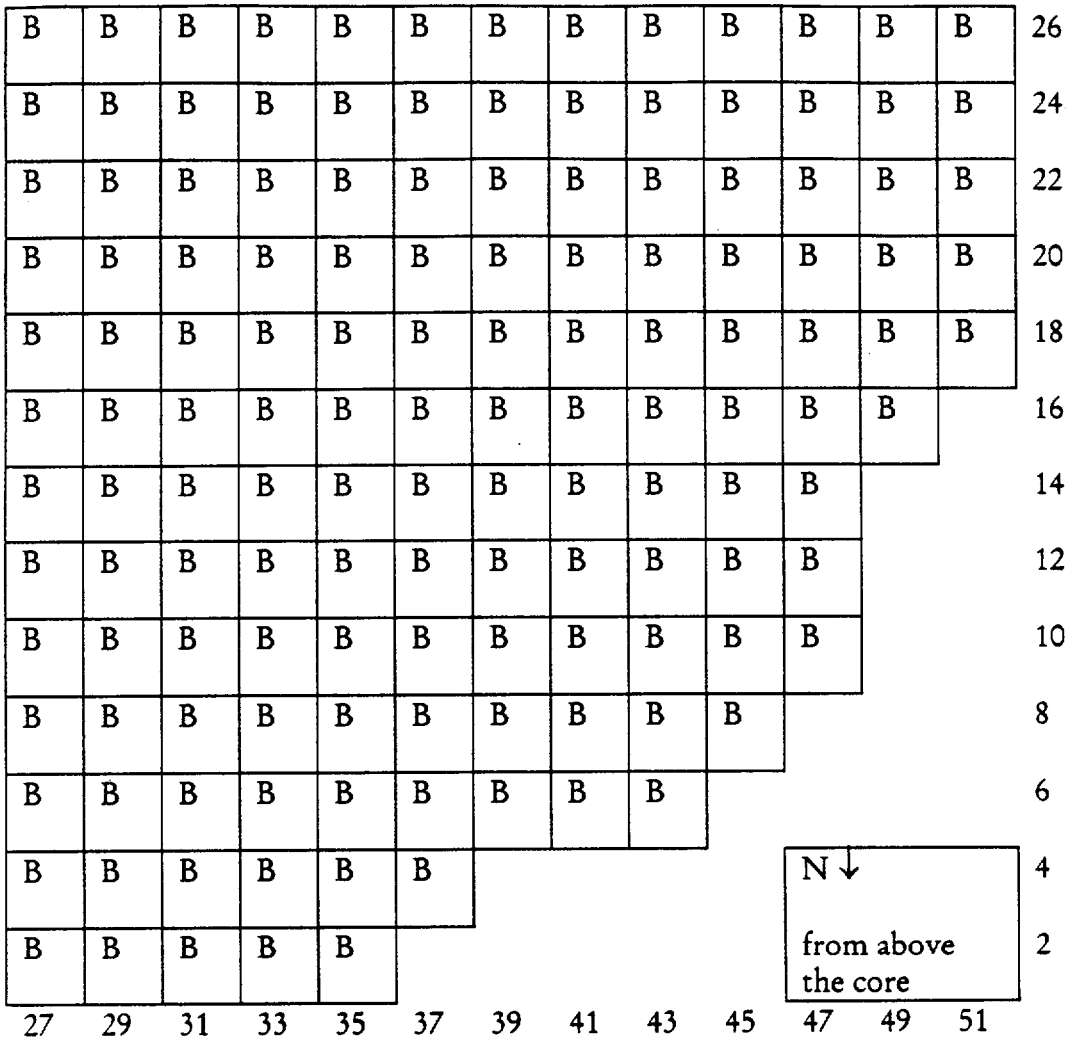


FIGURE 8.6.B
Cycle 15 Loading Pattern, Upper Right Quadrant, Bundle Design



B = GE12

FIGURE 8.6.C
Cycle 15 Loading Pattern, Lower Right Quadrant, Bundle Design



B = GE12

FIGURE 8.6.D
Cycle 15 Loading Pattern, Lower Left Quadrant, Bundle Design

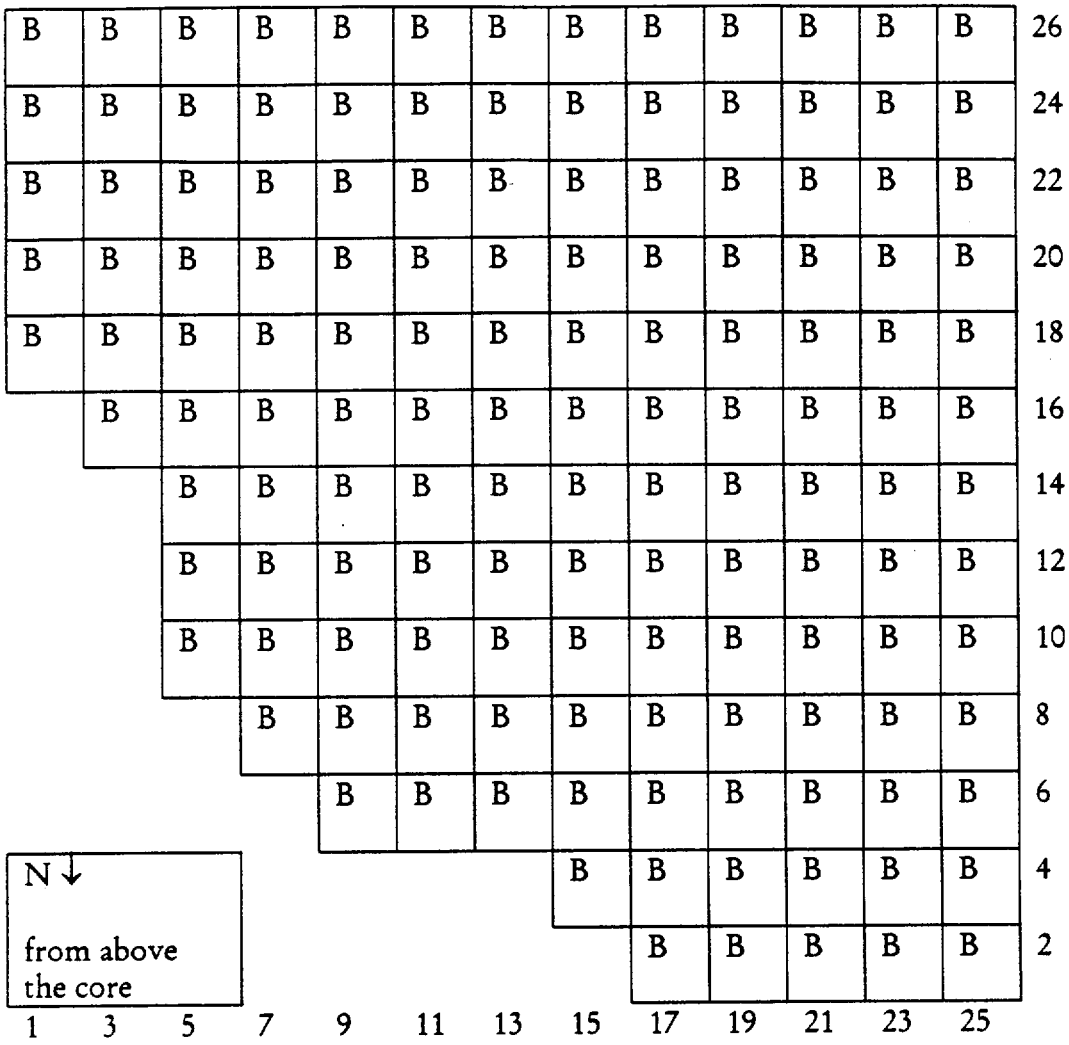


FIGURE 8.7
USERS GUIDE

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, and
- Four steam line operation

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