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Revision 120 dated 12/20/2019

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SECTION	REMOVE and DESTROY	INSERT
In Front of TRM Manual	Title Page Rev 119 05/02/2019	Title Page Rev 120 12/20/2019
Immediately following Title Page	List of Effective Pages LEP-1 through LEP-4 Rev 119 05/02/2019	List of Effective Pages LEP-1 through LEP-4 Rev 120 12/20/2019
TR 3.3 Instrumentation	TRM 3.3-1 Rev 106 03/14	TRM 3.3-1 Rev 120 12/19
TR 3.7 Plant Systems	TRM 3.7-18 Rev 115 10/18	TRM 3.7-18 Rev 120 12/19
Core Operating Limits Report	Cycle 20, Revision 0 26 pages	Cycle 20, Revision 1 27 pages

Note: The changes above reflect those justified and described in LCR# 19-018-TRM, 19-054-TRM, and 19-045-COL.

END

Fermi 2

Technical Requirements Manual

Volume I

DTE Electric

LIST OF EFFECTIVE PAGES

Page	Revision
TRM i	Revision 106
TRM ii	Revision 107
TRM iii	Revision 105
TRM iv	Revision 106
TRM v	Revision 107
TRM vi	Revision 31
TRM 1.0-a	Revision 31
TRM 1.0-1	Revision 31
TRM 2.0-1	Revision 31
TRM 3.0-a	Revision 31
TRM 3.0-1	Revision 63
TRM 3.0-2	Revision 72
TRM 3.0-3	Revision 54
TRM 3.0-4	Revision 72
TRM 3.1-a	Revision 31
TRM 3.1-1	Revision 31
TRM 3.2-1	Revision 31
TRM 3.3-a	Revision 31
TRM 3.3-b	Revision 31
TRM 3.3-c	Revision 106
TRM 3.3-d	Revision 31
TRM 3.3-1	Revision 120
TRM 3.3-2	Revision 116
TRM 3.3-3	Revision 31
TRM 3.3-4	Revision 31
TRM 3.3-5	Revision 31
TRM 3.3-6	Revision 31
TRM 3.3-7	Revision 31
TRM 3.3-8	Revision 106
TRM 3.3-9	Revision 31
TRM 3.3-10	Revision 106
TRM 3.3-11	Revision 31
TRM 3.3-12	Revision 67
TRM 3.3-13	Revision 74
TRM 3.3-13a	Revision 67
TRM 3.3-14	Revision 67
TRM 3.3-15	Revision 31
TRM 3.3-16	Revision 31
TRM 3.3-17	Revision 31
TRM 3.3-18	Revision 100
TRM 3.3-19	Revision 31
TRM 3.3-20	Revision 31
TRM 3.3-21	Revision 116
TRM 3.3-22	Revision 31
TRM 3.3-23	Revision 31
TRM 3.3-24	Revision 31
TRM 3.3-25	Revision 31
TRM 3.3-26	Revision 31
TRM 3.3-27	Revision 31
TRM 3.3-28	Revision 76
TRM 3.3-29	Revision 76
TRM 3.3-30	Revision 31
TRM 3.3-31	Revision 31
TRM 3.3-32	Revision 31
TRM 3.3-33	Revision 31
TRM 3.3-34	Revision 31
TRM 3.3-34a	Revision 106
TRM 3.3-35	Revision 60
TRM 3.3-36	Revision 104
TRM 3.3-37	Revision 72
TRM 3.3-38	Revision 31
TRM 3.3-39	Revision 31
TRM 3.3-40	Revision 56
TRM 3.3-41	Revision 56
TRM 3.3-42	Revision 45
TRM 3.3-43	Revision 62
TRM 3.3-44	Revision 72
TRM 3.3-45	Revision 31
TRM 3.3-46	Revision 31
TRM 3.3-47	Revision 31
TRM 3.3-48	Revision 31
TRM 3.3-49	Revision 31
TRM 3.4-a	Revision 31
TRM 3.4-1	Revision 36
TRM 3.4-1a	Revision 71
TRM 3.4-1b	Revision 71
TRM 3.4-2	Revision 31
TRM 3.4-3	Revision 31
TRM 3.4-4	Revision 31
TRM 3.4-5	Revision 31
TRM 3.4-6	Revision 31
TRM 3.4-7	Revision 31
TRM 3.4-8	Revision 31
TRM 3.4-9	Revision 31
TRM 3.4-10	Revision 31
TRM 3.5-1	Revision 31
TRM 3.6-a	Revision 70
TRM 3.6-1	Revision 60
TRM 3.6-2	Revision 67
TRM 3.6-3	Revision 31
TRM 3.6-4	Revision 109
TRM 3.6-5	Revision 87
TRM 3.6-6	Revision 33
TRM 3.6-7	Revision 31
TRM 3.6-8	Revision 31
TRM 3.6-9	Revision 85
TRM 3.6-10	Revision 31
TRM 3.6-11	Revision 31
TRM 3.6-12	Revision 31
TRM 3.6-13	Revision 71
TRM 3.6-14	Revision 31
TRM 3.6-15	Revision 31
TRM 3.6-16	Revision 31
TRM 3.6-17	Revision 31

LIST OF EFFECTIVE PAGES

Page	Revision
TRM 3.6-18	Revision 31
TRM 3.6-19	Revision 31
TRM 3.6-20	Revision 31
TRM 3.6-21	Revision 31
TRM 3.6-22	Revision 116
TRM 3.6-23	Revision 31
TRM 3.6-24	Revision 115
TRM 3.6-25	Revision 31
TRM 3.6-26	Revision 31
TRM 3.6-27	Revision 31
TRM 3.6-28	Revision 31
TRM 3.6-29	Revision 31
TRM 3.6-30	Revision 31
TRM 3.6-31	Revision 31
TRM 3.6-32	Revision 70
TRM 3.6-33	Revision 31
TRM 3.6-34	Revision 31
TRM 3.6-35	Revision 31
TRM 3.7-a	Revision 107
TRM 3.7-1	Revision 60
TRM 3.7-2	Revision 107
TRM 3.7-3	Revision 70
TRM 3.7-4	Revision 73
TRM 3.7-5	Revision 31
TRM 3.7-6	Revision 31
TRM 3.7-7	Revision 31
TRM 3.7-8	Revision 31
TRM 3.7-9	Revision 31
TRM 3.7-10	Revision 44
TRM 3.7-11	Revision 31
TRM 3.7-12	Revision 72
TRM 3.7-13	Revision 31
TRM 3.7-14	Revision 31
TRM 3.7-15	Revision 115
TRM 3.7-16	Revision 115
TRM 3.7-17	Revision 115
TRM 3.7-18	Revision 120
TRM 3.7-19	Revision 31
TRM 3.7-20	Revision 79
TRM 3.8-a	Revision 31
TRM 3.8-1	Revision 31
TRM 3.8-2	Revision 31
TRM 3.8-3	Revision 96
TRM 3.8-4	Revision 113
TRM 3.8-5	Revision 31
TRM 3.8-6	Revision 50
TRM 3.8-7	Revision 114
TRM 3.8-8	Revision 50
TRM 3.8-9	Revision 50
TRM 3.8-10	Revision 50
TRM 3.8-11	Revision 50
TRM 3.8-12	Revision 31
TRM 3.8-13	Revision 61
TRM 3.8-14	Revision 46
TRM 3.8-15	Revision 31
TRM 3.8-16	Revision 31
TRM 3.8-17	Revision 43
TRM 3.8-18	Revision 33
TRM 3.9-a	Revision 31
TRM 3.9-1	Revision 31
TRM 3.9-2	Revision 65
TRM 3.9-3	Revision 80
TRM 3.9-4	Revision 88
TRM 3.9-5	Revision 31
TRM 3.10-1	Revision 31
TRM 3.11-a	Revision 31
TRM 3.11-1	Revision 31
TRM 3.12-a	Revision 31
TRM 3.12-1	Revision 75
TRM 3.12-2	Revision 31
TRM 3.12-3	Revision 31
TRM 3.12-4	Revision 102
TRM 3.12-5	Revision 108
TRM 3.12-6	Revision 53
TRM 3.12-7	Revision 31
TRM 3.12-8	Revision 112
TRM 3.12-9	Revision 40
TRM 3.12-10	Revision 31
TRM 3.12-11	Revision 49
TRM 3.12-12	Revision 31
TRM 3.12-13	Revision 75
TRM 3.12-14	Revision 31
TRM 3.12-15	Revision 31
TRM 3.12-16	Revision 75
TRM 3.12-17	Revision 31
TRM 3.12-18	Revision 75
TRM 3.12-19	Revision 31
TRM 3.12-20	Revision 75
TRM 3.12-21	Revision 31
TRM 3.12-22	Revision 31
TRM 3.12-23	Revision 31
TRM 3.12-24	Revision 31
TRM 3.12-25	Revision 31
TRM 3.12-26	Revision 75
TRM 3.12-27	Revision 31
TRM 3.12-28	Revision 31
TRM 3.12-29	Revision 78
TRM 3.12-30	Revision 31
TRM 4.0-1	Revision 31
TRM 5.0-a	Revision 105
TRM 5.0-1	Revision 119
TRM 5.0-2	Revision 105

LIST OF EFFECTIVE PAGES

Page	Revision
TRM B1.0-1	Revision 31
TRM B2.0-1	Revision 31
TRM B3.0-1	Revision 63
TRM B3.0-2	Revision 63
TRM B3.0-2a	Revision 72
TRM B3.0-2b	Revision 72
TRM B3.0-2c	Revision 72
TRM B3.0-3	Revision 31
TRM B3.0-4	Revision 31
TRM B3.0-5	Revision 54
TRM B3.0-6	Revision 72
TRM B3.0-7	Revision 72
TRM B3.1-1	Revision 31
TRM B3.2-1	Revision 31
TRM B3.3.1-1	Revision 31
TRM B3.3.1-2	Revision 31
TRM B3.3.2-1	Revision 31
TRM B3.3.2-2	Revision 31
TRM B3.3.3-1	Revision 67
TRM B3.3.4-1	Revision 31
TRM B3.3.4-2	Revision 84
TRM B3.3.5-1	Revision 31
TRM B3.3.5-2	Revision 31
TRM B3.3.6-1	Revision 116
TRM B3.3.6-2	Revision 31
TRM B3.3.6-3	Revision 31
TRM B3.3.6-4	Revision 31
TRM B3.3.6-5	Revision 76
TRM B3.3.6-6	Revision 76
TRM B3.3.7-1	Revision 31
TRM B3.3.7-2	Revision 31
TRM B3.3.7-3	Revision 106
TRM B3.3.8-1	Revision 31
TRM B3.3.9-1	Revision 31
TRM B3.3.10-1	Revision 56
TRM B3.3.11-1	Revision 45
TRM B3.3.12-1	Revision 62
TRM B3.3.13-1	Revision 31
TRM B3.3.14-1	Revision 31
TRM B3.4.1-1	Revision 31
TRM B3.4.1-2	Revision 71
TRM B3.4.1-3	Revision 71
TRM B3.4.1-4	Revision 71
TRM B3.4.1-5	Revision 71
TRM B3.4.2-1	Revision 31
TRM B3.4.3-1	Revision 31
TRM B3.4.4-1	Revision 31
TRM B3.4.5-1	Revision 31
TRM B3.4.6-1	Revision 31
TRM B3.4.7-1	Revision 31
TRM B3.5-1	Revision 31
TRM B3.6.1-1	Revision 31

Page	Revision
TRM B3.6.2-1	Revision 67
TRM B3.6.3-1	Revision 87
TRM B3.6.4-1	Revision 31
TRM B3.6.5-1	Revision 31
TRM B3.6.6-1	Revision 70
TRM B3.6.7-1	Revision 31
TRM B3.6.8-1	Revision 31
TRM B3.7.1-1	Revision 31
TRM B3.7.2-1	Revision 107
TRM B3.7.3-1	Revision 73
TRM B3.7.4-1	Revision 31
TRM B3.7.4-2	Revision 31
TRM B3.7.5-1	Revision 31
TRM B3.7.6-1	Revision 31
TRM B3.7.7-1	Revision 99
TRM B3.7.8-1	Revision 31
TRM B3.7.9-1	Revision 79
TRM B3.8.1-1	Revision 31
TRM B3.8.2-1	Revision 31
TRM B3.8.3-1	Revision 96
TRM B3.8.4-1	Revision 31
TRM B3.8.5-1	Revision 31
TRM B3.8.6-1	Revision 43
TRM B3.9.1-1	Revision 31
TRM B3.9.2-1	Revision 65
TRM B3.9.3-1	Revision 31
TRM B3.9.4-1	Revision 31
TRM B3.10-1	Revision 31
TRM B3.11.1-1	Revision 31
TRM B3.12.1-1	Revision 31
TRM B3.12.2-1	Revision 112
TRM B3.12.3-1	Revision 31
TRM B3.12.4-1	Revision 31
TRM B3.12.5-1	Revision 31
TRM B3.12.6-1	Revision 31
TRM B3.12.7-1	Revision 31
TRM B3.12.8-1	Revision 118

LIST OF EFFECTIVE PAGES

CORE OPERATING LIMITS REPORT
COLR 20, Revision 1

Page	Revision
Notation Page	
1	1
2	1
3	1
4	1
5	1
6	1
7	1
8	1
9	1
10	1
11	1
12	1
13	1
14	1
15	1
16	1
17	1
18	1
19	1
20	1
21	1
22	1
23	1
24	1
25	1
26	1
27	1

TR 3.3 INSTRUMENTATION

TR 3.3.1.1 Reactor Protection System (RPS) Instrumentation

The RPS instrumentation trip setpoints and response times are listed in Table TR3.3.1.1-1.

TABLE TR3.3.1.1-1 (Page 1 of 2)
Reactor Protection System Instrumentation

FUNCTION	TRIP SETPOINT	RESPONSE TIME (seconds)
1. Intermediate Range Monitors		
a. Neutron Flux - High	≤ 120/125 divisions of full scale	NA
b. Inop	NA	NA
2. Average Power Range Monitors[a]		
a. Neutron Flux-Upscale (Setdown)	≤ 15% RTP	NA
b. Simulated Thermal Power - Upscale		NA
1. Flow Biased[g]	≤ 0.62 $(W-\Delta W)^{(b)}$ + 60.2%,	
2. High Flow Clamped	with a maximum of ≤ 113.5% of RTP	
c. Neutron Flux - Upscale	≤ 118% RTP	NA
d. Inop	NA	NA
e. 2-out-of-4 Voters	NA	≤ 0.05[a]
f. OPRM-Upscale		NA
1. Confirmation Count and	16	
2. Amplitude	1.15	
3. Growth	1.3	
4. Amplitude	1.3	

(continued)

(a) Neutron detectors, APRM channel, and 2-out-of-4 Trip Voter digital electronics are exempt from response time testing. Response time shall be measured from activation of the 2-out-of-4 Trip Voter output relay.

(b) ΔW = 0% for two loop operation. ΔW = 8% for single loop operation.

TABLE TR3.7.7-1 (Page 4 of 4)
Appendix R Alternative Shutdown Control Circuits

	FUNCTION	CONTROL CIRCUIT	SWITCH LOCATION
82.	43S-2C Transfer Switch Valve E1150-F015A	Transfer	H21-P627
83.	43S-3A Transfer Switch Valve E1150-F017A	Transfer	H21-P627
84.	Recirculation Pump A Discharge Valve B31-F031A	Push-button	H21-P627
85.	Cross-Tie Header Valve E11-F010	Push-button	H21-P627
86.	RHR to Recirculation Inboard Isolation Valve E11-F015A	Push-button	H21-P627
87.	RHR Recirculation Outboard Isolation Valve E11-F017A	Push-button	H21-P627
88.	43S-4B Transfer Switch Valve P44-F616	Transfer	H21-P628
89.	EECW from Drywell Inboard Isolation P44-F616	Selector	H21-P628
90.	Dedicated Shutdown System	Push-button	H11-P811
91.	43S-4CR Transfer Switch Valve P44-F607A	Transfer	H21-P632
92.	EECW from Drywell Outboard Isolation P44-F607A	Pushbutton	H21-P632
93.	Alternate QA IM (BOP) power to 72F-4A position 4C-R, throwover switch valve P44-F607A	Transfer	R1600S148
94.	72M-3B position 5BR transfer switch BOP Battery Charger 2C-1	Transfer	R1600S011D
95.	72S-2A position 5C transfer switch BOP Battery Charger 2C1-2	Transfer	R1600S015A

FERMI 2

CORE OPERATING LIMITS REPORT

CYCLE 20

REVISION 1

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November 2019

TABLE OF CONTENTS

1.0 INTRODUCTION AND SUMMARY 4

2.0 SAFETY LIMIT MINIMUM CRITICAL POWER RATIO 5
- 2.1 Definition 5
- 2.2 Determination of SLMCPR Limit 5

3.0 AVERAGE PLANAR LINEAR HEAT GENERATION RATE 6
- 3.1 Definition 6
- 3.2 Determination of MAPLHGR Limit 6
  - 3.2.1 Calculation of MAPFAC(P) 8
  - 3.2.2 Calculation of MAPFAC(F) 10

4.0 MINIMUM CRITICAL POWER RATIO 11
- 4.1 Definition 11
- 4.2 Determination of Operating Limit MCPR 11
- 4.3 Calculation of MCPR(P) 13
  - 4.3.1 Calculation of K_P 13
  - 4.3.2 Calculation of τ 15
- 4.4 Calculation of MCPR(F) 16

5.0 LINEAR HEAT GENERATION RATE 17
- 5.1 Definition 17
- 5.2 Determination of LHGR Limit 17
  - 5.2.1 Calculation of LHGRFAC(P) 19
  - 5.2.2 Calculation of LHGRFAC(F) 21

6.0 CONTROL ROD BLOCK INSTRUMENTATION 22
- 6.1 Definition 22

7.0 BACKUP STABILITY PROTECTION REGIONS 23
- 7.1 Definition 23

8.0 REFERENCES 26

LIST OF TABLES

TABLE 1 FUEL TYPE-DEPENDENT STANDARD MAPLHGR LIMITS 7

TABLE 2 FLOW-DEPENDENT MAPLHGR LIMIT COEFFICIENTS 10

TABLE 3 $OLMCPR_{100/105}$ AS A FUNCTION OF EXPOSURE AND τ 12

TABLE 4 FLOW-DEPENDENT MCPR LIMIT COEFFICIENTS 16

TABLE 5 STANDARD LHGR LIMITS FOR VARIOUS FUEL TYPES 18

TABLE 6 FLOW-DEPENDENT LHGR LIMIT COEFFICIENTS 21

TABLE 7 CONTROL ROD BLOCK INSTRUMENTATION SETPOINTS WITH FILTER 22

LIST OF FIGURES

FIGURE 1 BSP REGIONS FOR NOMINAL FEEDWATER TEMPERATURE 24

FIGURE 2 BSP REGIONS FOR REDUCED FEEDWATER TEMPERATURE 25

1.0 INTRODUCTION AND SUMMARY

This report provides the cycle specific plant operating limits, which are listed below, for Fermi 2, Cycle 20, as required by Technical Specification 5.6.5. The analytical methods used to determine these core operating limits are those previously reviewed and approved by the Nuclear Regulatory Commission in GESTAR II (Reference 7).

The cycle specific limits contained within this report are valid for the full range of the licensed operating domain.

OPERATING LIMIT	TECHNICAL SPECIFICATION
$SLMCPR_{95/95}$	2.1.1.2
APLHGR	3.2.1
MCPR	3.2.2
LHGR	3.2.3
RBM	3.3.2.1
BSP REGIONS	3.3.1.1

SLMCPR = SAFETY LIMIT MINIMUM CRITICAL POWER RATIO

APLHGR = AVERAGE PLANAR LINEAR HEAT GENERATION RATE

MCPR = MINIMUM CRITICAL POWER RATIO

LHGR = LINEAR HEAT GENERATION RATE

RBM = ROD BLOCK MONITOR

BSP = BACKUP STABILITY PROTECTION

2.0 SAFETY LIMIT MINIMUM CRITICAL POWER RATIO

2.1 Definition

TECH SPEC IDENT	OPERATING LIMIT
2.1.1.2	$SLMCPR_{95/95}$

The Technical Specification SAFETY LIMIT MINIMUM CRITICAL POWER RATIO ($SLMCPR_{95/95}$) shall be the smallest critical power ratio that exists in the core for each fuel product. The Technical Specification Safety Limit value is dependent on the fuel product line and the corresponding MCPR correlation, which is cycle independent. The value is based on the Critical Power Ratio data statistics and a 95% probability with 95% confidence that rods are not susceptible to boiling transition. (Reference 20)

The Cycle Specific $SLMCPR_{99.9}$ presented here is that power in the bundle that is statistically calculated by application of the appropriate correlations and uncertainties to cause some point in the bundle to experience boiling transition, divided by the actual bundle operating power.

2.2 Determination of Cycle Specific SLMCPR

The Cycle Specific SLMCPR, which is also known as $SLMCPR_{99.9}$, is cycle dependent and ensures 99.9% of the fuel rods in the core are not susceptible to boiling transition. (Reference 20) The Operating Limit MCPR is set by adding the $SLMCPR_{99.9}$ and the change in MCPR for the most limiting anticipated operational occurrence such that fuel cladding will not sustain damage because of normal operation and anticipated operational occurrences.

The $SLMCPR_{99.9}$ is set such that no significant fuel damage is calculated to occur if the limit is not violated. Since the parameters that result in fuel damage are not directly observable during reactor operation, the thermal and hydraulic conditions that result in the onset of transition boiling are used to mark the beginning of the region in which fuel damage could occur. Although the onset of transition boiling would not result in damage to BWR fuel rods, the critical power at which boiling transition is calculated to occur has been adopted as a convenient limit.

For this cycle, the Two Loop and Single Loop $SLMCPR_{99.9}$ values (Reference 2) are:

Two Loop SLMCPR = 1.08

Single Loop SLMCPR = 1.09

3.0 AVERAGE PLANAR LINEAR HEAT GENERATION RATE

3.1 Definition

TECH SPEC IDENT	OPERATING LIMIT
3.2.1	APLHGR

The AVERAGE PLANAR LINEAR HEAT GENERATION RATE (APLHGR) shall be applicable to a specific planar height and is equal to the sum of the LINEAR HEAT GENERATION RATEs (LHGRs) for all the fuel rods in the specified bundle at the specified height divided by the number of fuel rods in the bundle at the height.

3.2 Determination of MAPLHGR Limit

The maximum APLHGR (MAPLHGR) limit is a function of reactor power, core flow, fuel type, and average planar exposure. The limit is developed, using NRC approved methodology described in References 7 and 8, to ensure gross cladding failure will not occur following a loss of coolant accident (LOCA). The MAPLHGR limit ensures that the peak clad temperature during a LOCA will not exceed the limits as specified in 10CFR50.46(b)(1) and that the fuel design analysis criteria defined in References 7 and 8 will be met.

The MAPLHGR limit during dual loop operation is calculated by the following equation:

$$MAPLHGR_{LIMIT} = \text{MIN}\ (MAPLHGR\ (P),\ MAPLHGR\ (F))$$

where:

$$MAPLHGR\ (P) = MAPFAC\ (P) \times MAPLHGR_{STD}$$

$$MAPLHGR\ (F) = MAPFAC\ (F) \times MAPLHGR_{STD}$$

Within four hours after entering single loop operation, the MAPLHGR limit is calculated by the following equation:

$$MAPLHGR_{LIMIT} = \text{MIN}\ (MAPLHGR\ (P),\ MAPLHGR\ (F))$$

where:

$$MAPLHGR\ (P) = MAPFAC\ (P) \times MAPLHGR_{STD}$$

$$MAPLHGR\ (F) = MAPFAC\ (F) \times MAPLHGR_{STD}$$

$$MAPFAC\ (P)\ and\ MAPFAC\ (F)\ are\ limited\ to\ 0.80$$

The Single Loop multiplier limit is 0.80 (Reference 2) based on assuring a LOCA while in single loop will be bounded by the two loop LOCA. (Reference 12)

$MAPLHGR_{STD}$, the standard MAPLHGR limit, is defined at a power of 3486 MWth and flow of 105 Mlbs/hr for each fuel type as a function of average planar exposure and is presented in Table 1. (Reference 2 and 25) When hand calculations are required, $MAPLHGR_{STD}$ shall be determined by interpolation from Table 1. MAPFAC(P), the core power-dependent MAPLHGR limit adjustment factor, shall be calculated by using Section 3.2.1. MAPFAC(F), the core flow-dependent MAPLHGR limit adjustment factor, shall be calculated by using Section 3.2.2.

TABLE 1
FUEL TYPE-DEPENDENT
STANDARD MAPLHGR LIMITS

GE14 Exposure GWD/ST	GE14 MAPLHGR kW/ft
0.0	12.82
19.13	12.82
57.61	8.00
63.50	5.00

Fuel Types

2 = GE14-P10CNAB381-4G6.0/11G5.0-100T-150-T6-4372
3 = GE14-P10CNAB381-4G6.0/9G5.0-100T-150-T6-4371
4 = GE14-P10CNAB381-15G5.0-100T-150-T6-4373
5 = GE14-P10CNAB381-6G6.0/9G5.0-100T-150-T6-4374
6 = GE14-P10CNAB385-13GZ-100T-150-T6-4571
7 = GE14-P10CNAB384-15GZ-100T-150-T6-4572
8 = GE14-P10CNAB383-13GZ-100T-150-T6-4573
9 = GE14-P10CNAB377-15GZ-100T-150-T6-4574
14 = GE14-P10CNAB376-4G6.0/9G5.0/2G2.0-100T-150-T6-4061
15 = GE14-P10CNAB373-7G5.0/6G4.0-100T-150-T6-4064
16 = GE14-P10CNAB376-15GZ-100T-150-T6-4063
17 = GE14-P10CNAB379-14GZ-100T-150-T6-4259
18 = GE14-P10CNAB381-4G6.0/11G5.0-100T-150-T6-4260
19 = GE14-P10CNAB381-4G6.0/12G5.0-100T-150-T6-4261
20 = GE14-P10CNAB379-15GZ-100T-150-T6-4262
21 = GE14-P10CNAB383-8G6.0/5G5.0-100T-150-T6-4478
22 = GE14-P10CNAB383-8G6.0/7G5.0-100T-150-T6-4479
23 = GE14-P10CNAB383-2G6.0/11G5.0-100T-150-T6-4480
24 = GE14-P10CNAB383-10G6.0/5G5.0-100T-150-T6-4481

3.2.1 Calculation of MAPFAC(P)

The core power-dependent MAPLHGR limit adjustment factor, MAPFAC(P) (Reference 2, 3, 11, & 15), shall be calculated by one of the following equations:

For $0 \leq P < 25$:

No thermal limits monitoring is required.

For $25 \leq P \leq 29.5$:

With Turbine Bypass OPERABLE,

For core flow < 50 Mlbs/hr,

$$MAPFAC\ (P) = 0.604 + 0.0038\ (P - 29.5)$$

For core flow ≥ 50 Mlbs/hr,

$$MAPFAC\ (P) = 0.584 + 0.0038\ (P - 29.5)$$

With Turbine Bypass INOPERABLE,

For core flow < 50 Mlbs/hr,

$$MAPFAC\ (P) = 0.488 + 0.0051\ (P - 29.5)$$

For core flow ≥ 50 Mlbs/hr,

$$MAPFAC\ (P) = 0.436 + 0.0051\ (P - 29.5)$$

For $29.5 < P \leq 100$:

$$MAPFAC\ (P) = 1.0 + 0.005233\ (P - 100)$$

where: P = Core power (fraction of rated power times 100).

Note: This range applies with pressure regulator in service and, for power >85%, it also applies with the pressure regulator out of service (PROOS).

MAPFAC(P) for Pressure Regulator Out of Service Limits

With one Turbine Pressure Regulator Out of Service and Reactor Power Greater Than or Equal to 29.5% and Less Than or Equal to 85% and both Turbine Bypass and Moisture Separator Reheater Operable:

For $25 \leq P \leq 29.5$:

For core flow < 50 Mlbs/hr,

$$MAPFAC\ (P) = 0.604 + 0.0038\ (P - 29.5)$$

For core flow ≥ 50 Mlbs/hr,

$$MAPFAC\ (P) = 0.583 + 0.0036\ (P - 29.5)$$

For $29.5 < P < 45$:

$$MAPFAC\ (P) = 0.680 + 0.00627\ (P - 45)$$

For $45 \leq P < 60$:

$$MAPFAC\ (P) = 0.758 + 0.0052\ (P - 60)$$

For $60 \leq P \leq 85$:

$$MAPFAC\ (P) = 0.831 + 0.00292\ (P - 85)$$

where: P = Core power (fraction of rated power times 100).

3.2.2 Calculation of MAPFAC(F)

The core flow-dependent MAPLHGR limit adjustment factor, MAPFAC(F) (Reference 2 & 3), shall be calculated by the following equation:

$$MAPFAC(F) = \mathrm{MIN}(C, A_F \times \frac{WT}{100} + B_F)$$

where:

WT = Core flow (Mlbs/hr).
A_F = Given in Table 2.
B_F = Given in Table 2.
C = 1.0 in Dual Loop and 0.80 in Single Loop.

TABLE 2 FLOW-DEPENDENT MAPLHGR LIMIT COEFFICIENTS

Maximum Core Flow* (Mlbs/hr)	A_F	B_F
110	0.6787	0.4358

*As limited by the Recirculation System MG Set mechanical scoop tube stop setting.

4.0 MINIMUM CRITICAL POWER RATIO

TECH SPEC IDENT	OPERATING LIMIT
3.2.2	MCPR

4.1 Definition

The MINIMUM CRITICAL POWER RATIO (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 bundle that is calculated by application of the appropriate correlation(s) to cause some point in the bundle to experience boiling transition, divided by the actual bundle operating power.

4.2 Determination of Operating Limit MCPR

The required Operating Limit MCPR (OLMCPR) (Reference 2) at steady-state rated power and flow operating conditions is derived from the established fuel cladding integrity Safety Limit MCPR and an analysis of abnormal operational transients. To ensure that the Safety Limit MCPR is not exceeded during any anticipated abnormal operational transient, the most limiting transients have been analyzed to determine which event will cause the largest reduction in CPR. Three different core average exposure conditions are evaluated. The result is an Operating Limit MCPR which is a function of exposure and τ. τ is a measure of scram speed and is defined in Section 4.3.2.

The limiting OLMCPR shall be represented by the following equation:

$$OLMCPR = \mathrm{MAX}(MCPR(P), MCPR(F))$$

The process to calculate MCPR(P), the core power-dependent MCPR operating limit, is illustrated in Section 4.3.

The process to calculate MCPR(F), the core flow-dependent MCPR operating limit, is illustrated in Section 4.4.

In case of **Single Loop Operation,** the Safety Limit MCPR (Reference 2) is increased to account for increased uncertainties in core flow measurement and TIP measurement. For Single Loop Operation, the OLMCPR is increased by 0.03 from the Two Loop OLMCPR.

In case of operation with one Turbine Pressure Regulator out of service, OLMCPR limits are bounding when reactor power is less than 29.5% or greater than 85%. When reactor power is greater than or equal to 29.5% and less than or equal to 85%, then operation with one Turbine Pressure Regulator out of service is permitted if both Turbine Bypass Valves and the Moisture Separator Reheater are operable. (Reference 2 and 11)

TABLE 3 $OLMCPR_{100/105}$ AS A FUNCTION OF EXPOSURE AND τ

CONDITION	EXPOSURE (MWD/ST)		$OLMCPR_{100/105}$ Two Loop	$OLMCPR_{100/105}$ Single Loop
BOTH Turbine Bypass Valves **AND** Moisture Separator Reheater **OPERABLE**	BOC to EOR-4991	$\tau = 0$	1.26	1.29
		$\tau = 1$	1.38	1.41
	EOR-4991 to EOR-2991	$\tau = 0$	1.27	1.30
		$\tau = 1$	1.44	1.47
	EOR-2991 to EOC	$\tau = 0$	1.32	1.35
		$\tau = 1$	1.49	1.52
ONE Turbine Pressure Regulator Out of Service **AND** Reactor Power between 29.5% and 85% **AND** BOTH Turbine Bypass Valves and Moisture Separator Reheater Operable	BOC to EOC	$\tau = 0$	1.32	1.35
		$\tau = 1$	1.49	1.52
Moisture Separator Reheater **INOPERABLE**	BOC to EOC	$\tau = 0$	1.36	1.39
		$\tau = 1$	1.53	1.56
Turbine Bypass Valve **INOPERABLE**	BOC to EOC	$\tau = 0$	1.36	1.39
		$\tau = 1$	1.53	1.56
BOTH Turbine Bypass Valve **AND** Moisture Separator Reheater **INOPERABLE**	BOC to EOC	$\tau = 0$	1.42	1.45
		$\tau = 1$	1.59	1.62

BOC = Beginning of Cycle EOC = End of Cycle EOR = End of Rated Conditions.
EOR is defined as 100% power, 100% core flow, and all control rods fully withdrawn.
EOR-4991 means 4991 MWD/ST before End of Rated Conditions.

4.3 Calculation of MCPR(P)

MCPR(P), the core power-dependent MCPR operating limit (Reference 2, 3, 11, & 15), shall be calculated by the following equation:

$$MCPR(P) = K_P \times OLMCPR_{100/105}$$

K_P, the core power-dependent MCPR Operating Limit adjustment factor, shall be calculated by using Section 4.3.1. $OLMCPR_{100/105}$ shall be determined by interpolation on τ from Table 3, and τ shall be calculated by using Section 4.3.2.

4.3.1 Calculation of K_P

The core power-dependent MCPR operating limit adjustment factor, K_P (Reference 2, 3, 11, & 15), shall be calculated by using one of the following equations:

Note: P = Core power (fraction of rated power times 100) for all calculation of K_P

For $0 \leq P < 25$ No thermal limits monitoring is required.

For $25 \leq P < 29.5$:

When Turbine Bypass is OPERABLE,

$$K_P = \frac{(K_{BYP} + (0.032 \times (29.5 - P)))}{OLMCPR_{100/105}}$$

For two loop operation, where: K_{BYP} = 2.18 **for core flow < 50 Mlbs/hr**
= 2.46 **for core flow ≥ 50 Mlbs/hr**

For single loop operation, where: K_{BYP} = 2.21 **for core flow < 50 Mlbs/hr**
= 2.49 **for core flow ≥ 50 Mlbs/hr**

When Turbine Bypass is INOPERABLE,

$$K_P = \frac{(K_{BYP} + (0.076 \times (29.5 - P)))}{OLMCPR_{100/105}}$$

For two loop operation, where: K_{BYP} = 2.65 **for core flow < 50 Mlbs/hr**
= 3.38 **for core flow ≥ 50 Mlbs/hr**

For single loop operation, where: K_{BYP} = 2.68 **for core flow < 50 Mlbs/hr**
= 3.41 **for core flow ≥ 50 Mlbs/hr**

For $29.5 < P < 45$:

$$K_P = 1.28 + (0.0134 \times (45 - P))$$

For $45 \leq P < 60$:

$$K_P = 1.15 + (0.00867 \times (60 - P))$$

K_P for Moisture Separator Reheater Operable and Turbine Bypass Valves Operable or Inoperable

For $60 \leq P < 85$:

$$K_P = 1.065 + (0.0034 \times (85 - P))$$

For $85 \leq P \leq 100$:

$$K_P = 1.0 + (0.004333 \times (100 - P))$$

K_P for Moisture Separator Reheater Inoperable and Turbine Bypass Valves Operable or Inoperable

For $60 \leq P < 85$:

$$K_P = 1.076 + (0.00296 \times (85 - P))$$

For $85 \leq P \leq 100$:

$$K_P = 1.0 + (0.00507 \times (100 - P))$$

K_P for Pressure Regulator Out of Service Limits

With one Turbine Pressure Regulator Out of Service, Reactor Power greater than 29.5%, and both Turbine Bypass and Moisture Separator Reheater Operable:

For $29.5 \leq P < 45$:

$$K_P = 1.52 + (0.01193 \times (45 - P))$$

For $45 \leq P < 60$:

$$K_P = 1.362 + (0.01053 \times (60 - P))$$

For $60 \leq P \leq 85$:

$$K_P = 1.217 + (0.0058 \times (85 - P))$$

For $85 \leq P \leq 100$:

For Reactor Power > 85%, the Pressure Regulator Out of Service condition is not limiting (Reference 11). Calculate K_P using the applicable equations above based on Moisture Separator Reheater and Turbine Bypass Valve operability.

4.3.2 Calculation of τ

The value of τ, which is a measure of the conformance of the actual control rod scram times to the assumed average control rod scram time in the reload licensing analysis (References 4 & 24), shall be calculated by using the following equation:

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

where: τ_A = 1.096 seconds

$$\tau_B = 0.830 + 0.019 \text{ x } 1.65 \sqrt{\frac{N_1}{\sum_{i=1}^{n} N_i}} \text{ seconds}$$

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

n = number of surveillance tests performed to date in cycle,

N_i = number of active control rods measured in the i[th] surveillance test,

τ_i = average scram time to notch 36 of all rods measured in the i[th] surveillance test, and

N_1 = total number of active rods measured in the initial control rod scram time test for the cycle (Technical Specification Surveillance Requirement 3.1.4.4).

The value of τ shall be calculated and used to determine the applicable $OLMCPR_{100/105}$ value from Table 3 within 72 hours of the conclusion of each control rod scram time surveillance test required by Technical Specification Surveillance Requirements 3.1.4.1, 3.1.4.2, and 3.1.4.4.

4.4 Calculation of MCPR(F)

MCPR(F), the core flow-dependent MCPR operating limit (Reference 2 & 3), shall be calculated by using the following equation:

For Two Loop Operation $MCPR(F) = \mathrm{MAX}(1.21, (A_F \times \frac{WT}{100} + B_F))$

For Single Loop Operation $MCPR(F) = \mathrm{MAX}(1.24, (A_F \times \frac{WT}{100} + B_F))$

where:

WT = Core flow (Mlbs/hr).
A_F = Given in Table 4.
B_F = Given in Table 4.

TABLE 4 FLOW-DEPENDENT MCPR LIMIT COEFFICIENTS

	Maximum Core Flow* (Mlbs/hr)	A_F	B_F
Two Loop Operation	110	-0.601	1.743
Single Loop Operation	110	-0.601	1.773

*As limited by the Recirculation System MG Set mechanical scoop tube stop setting.

5.0 LINEAR HEAT GENERATION RATE

TECH SPEC IDENT	OPERATING LIMIT
3.2.3	LHGR

5.1 Definition

The LINEAR HEAT GENERATION RATE (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. By maintaining the operating LHGR below the applicable LHGR limit, it is assured that all thermal-mechanical design bases and licensing limits for the fuel will be satisfied.

5.2 Determination of LHGR Limit

The maximum LHGR limit is a function of reactor power, core flow, fuel and rod type, and fuel rod nodal exposure. The limit is developed, using NRC approved methodology described in Reference 7, to ensure the cladding will not exceed its yield stress and that fuel thermal-mechanical design criteria will not be violated during any postulated transient events. The LHGR limit ensures the fuel mechanical design requirements as defined in References 1 & 21 will be met.

The LHGR limit during dual loop operation is calculated by the following equation:

$$LHGR_{LIMIT} = \text{MIN}\ (LHGR\ (P), LHGR\ (F))$$

where:

$$LHGR\ (P) = LHGRFAC\ (P) \times LHGR_{STD}$$

$$LHGR\ (F) = LHGRFAC\ (F) \times LHGR_{STD}$$

Within four hours after entering single loop operation, the LHGR limit is calculated by the following equation:

$$LHGR_{LIMIT} = \text{MIN}\ (LHGR\ (P), LHGR\ (F))$$

where:

$$LHGR\ (P) = LHGRFAC\ (P) \times LHGR_{STD}$$

$$LHGR\ (F) = LHGRFAC\ (F) \times LHGR_{STD}$$

LHGRFAC (P) and LHGRFAC (F) are limited to 0.80

The Single Loop multiplier limit is 0.80 (Reference 2) based on assuring a LOCA in single loop will be bounded by the two loop LOCA (Reference 12).

$LHGR_{STD}$, the standard LHGR limit, is defined at a power of 3486 MWth and flow of 105 Mlbs/hr for each fuel and rod type as a function of fuel rod nodal exposure. $LHGR_{STD}$ is found in the reference cited in Table 5. When hand calculations are required, $LHGR_{STD}$ shall be determined by interpolation of the limits provided in the Table 5 reference. LHGRFAC(P), the core power-dependent LHGR limit adjustment factor, shall be calculated by using Section 5.2.1. LHGRFAC(F), the core flow-dependent LHGR limit adjustment factor, shall be calculated by using Section 5.2.2.

TABLE 5
STANDARD LHGR LIMITS FOR VARIOUS FUEL TYPES

For GE14 fuel listed below, the most limiting LHGR for Uranium Only fuel rod is found in NEDC-32868P Revision 6 Table D-2 (References 1 & 21).

For GE14 fuel listed below, the most limiting LHGR for Gadolinia Bearing fuel rods is found in NEDC-32868P Revision 6 Table D-4 (References 1 & 21). Utilize the row for 6% Rod/Section wt-% Gd_2O_3.

Fuel Types

2 = GE14-P10CNAB381-4G6.0/11G5.0-100T-150-T6-4372
3 = GE14-P10CNAB381-4G6.0/9G5.0-100T-150-T6-4371
4 = GE14-P10CNAB381-15G5.0-100T-150-T6-4373
5 = GE14-P10CNAB381-6G6.0/9G5.0-100T-150-T6-4374
6 = GE14-P10CNAB385-13GZ-100T-150-T6-4571
7 = GE14-P10CNAB384-15GZ-100T-150-T6-4572
8 = GE14-P10CNAB383-13GZ-100T-150-T6-4573
9 = GE14-P10CNAB377-15GZ-100T-150-T6-4574
14 = GE14-P10CNAB376-4G6.0/9G5.0/2G2.0-100T-150-T6-4061
15 = GE14-P10CNAB373-7G5.0/6G4.0-100T-150-T6-4064
16 = GE14-P10CNAB376-15GZ-100T-150-T6-4063
17 = GE14-P10CNAB379-14GZ-100T-150-T6-4259
18 = GE14-P10CNAB381-4G6.0/11G5.0-100T-150-T6-4260
19 = GE14-P10CNAB381-4G6.0/12G5.0-100T-150-T6-4261
20 = GE14-P10CNAB379-15GZ-100T-150-T6-4262
21 = GE14-P10CNAB383-8G6.0/5G5.0-100T-150-T6-4478
22 = GE14-P10CNAB383-8G6.0/7G5.0-100T-150-T6-4479
23 = GE14-P10CNAB383-2G6.0/11G5.0-100T-150-T6-4480
24 = GE14-P10CNAB383-10G6.0/5G5.0-100T-150-T6-4481

5.2.1 Calculation of LHGRFAC(P)

The core power-dependent LHGR limit adjustment factor, LHGRFAC(P) (Reference 2, 3, 11, & 15), shall be calculated by one of the following equations:

For $0 \leq P < 25$:

No thermal limits monitoring is required.

For $25 \leq P \leq 29.5$:

<u>With Turbine Bypass OPERABLE,</u>

For core flow < 50 Mlbs/hr,

$$LHGRFAC\ (P) = 0.604 + 0.0038\ (P - 29.5)$$

For core flow ≥ 50 Mlbs/hr,

$$LHGRFAC\ (P) = 0.584 + 0.0038\ (P - 29.5)$$

<u>With Turbine Bypass INOPERABLE,</u>

For core flow < 50 Mlbs/hr,

$$LHGRFAC\ (P) = 0.488 + 0.0051\ (P - 29.5)$$

For core flow ≥ 50 Mlbs/hr,

$$LHGRFAC\ (P) = 0.436 + 0.0051\ (P - 29.5)$$

For $29.5 < P \leq 100$:

$$LHGRFAC\ (P) = 1.0 + 0.005233\ (P - 100)$$

where: P = Core power (fraction of rated power times 100).

Note: This range applies with pressure regulator in service and, for power >85%, it also applies with the pressure regulator out of service.

LHGRFAC(P) for Pressure Regulator Out of Service Limits

With one Turbine Pressure Regulator Out of Service and Reactor Power Greater Than or Equal to 29.5% and Less Than or Equal to 85% and both Turbine Bypass and Moisture Separator Reheater Operable:

For $25 \leq P \leq 29.5$:

For core flow < 50 Mlbs/hr,

$$MAPFAC\ (P) = 0.604 + 0.0038\ (P - 29.5)$$

For core flow ≥ 50 Mlbs/hr,

$$MAPFAC\ (P) = 0.583 + 0.0036\ (P - 29.5)$$

For $29.5 < P < 45$:

$$LHGRFAC\ (P) = 0.680 + 0.00627\ (P - 45)$$

For $45 \leq P < 60$:

$$LHGRFAC\ (P) = 0.758 + 0.0052\ (P - 60)$$

For $60 \leq P \leq 85$:

$$LHGRFAC\ (P) = 0.831 + 0.00292\ (P - 85)$$

where: P = Core power (fraction of rated power times 100).

5.2.2 Calculation of LHGRFAC(F)

The core flow-dependent LHGR limit adjustment factor, LHGRFAC(F) (Reference 2 & 3), shall be calculated by the following equation:

$$LHGRFAC(F) = \mathrm{MIN}(C, A_F \times \frac{WT}{100} + B_F)$$

where:

WT = Core flow (Mlbs/hr).
A_F = Given in Table 6.
B_F = Given in Table 6.
C = 1.0 in Dual Loop and 0.80 in Single Loop.

TABLE 6 FLOW-DEPENDENT LHGR LIMIT COEFFICIENTS

Maximum Core Flow* (Mlbs/hr)	A_F	B_F
110	0.6787	0.4358

*As limited by the Recirculation System MG Set mechanical scoop tube stop setting.

6.0 CONTROL ROD BLOCK INSTRUMENTATION

TECH SPEC IDENT	SETPOINT
3.3.2.1	RBM

6.1 Definition

The nominal trip setpoints and allowable values of the control rod withdrawal block instrumentation are shown in Table 7. These values are consistent with the bases of the APRM Rod Block Technical Specification Improvement Program (ARTS) and the MCPR operating limits. (References 2, 5, & 10)

TABLE 7 CONTROL ROD BLOCK INSTRUMENTATION SETPOINTS WITH FILTER

Setpoint	Trip Setpoint	Allowable Value
Low power setpoint	27.0	28.4
Intermediate power setpoint	62.0	63.4
High power setpoint	82.0	83.4
Low trip setpoint	117.0	118.9
Intermediate trip setpoint	112.2	114.1
High trip setpoint	107.2	109.1
Downscale trip setpoint	94.0	92.3

For this cycle, the analyzed high trip setpoint of 111% bounds the setpoints in Table 7. The OLMCPR associated with the RBM setpoint of 111% is 1.26 for dual loop operation.

7.0 BACKUP STABILITY PROTECTION REGIONS

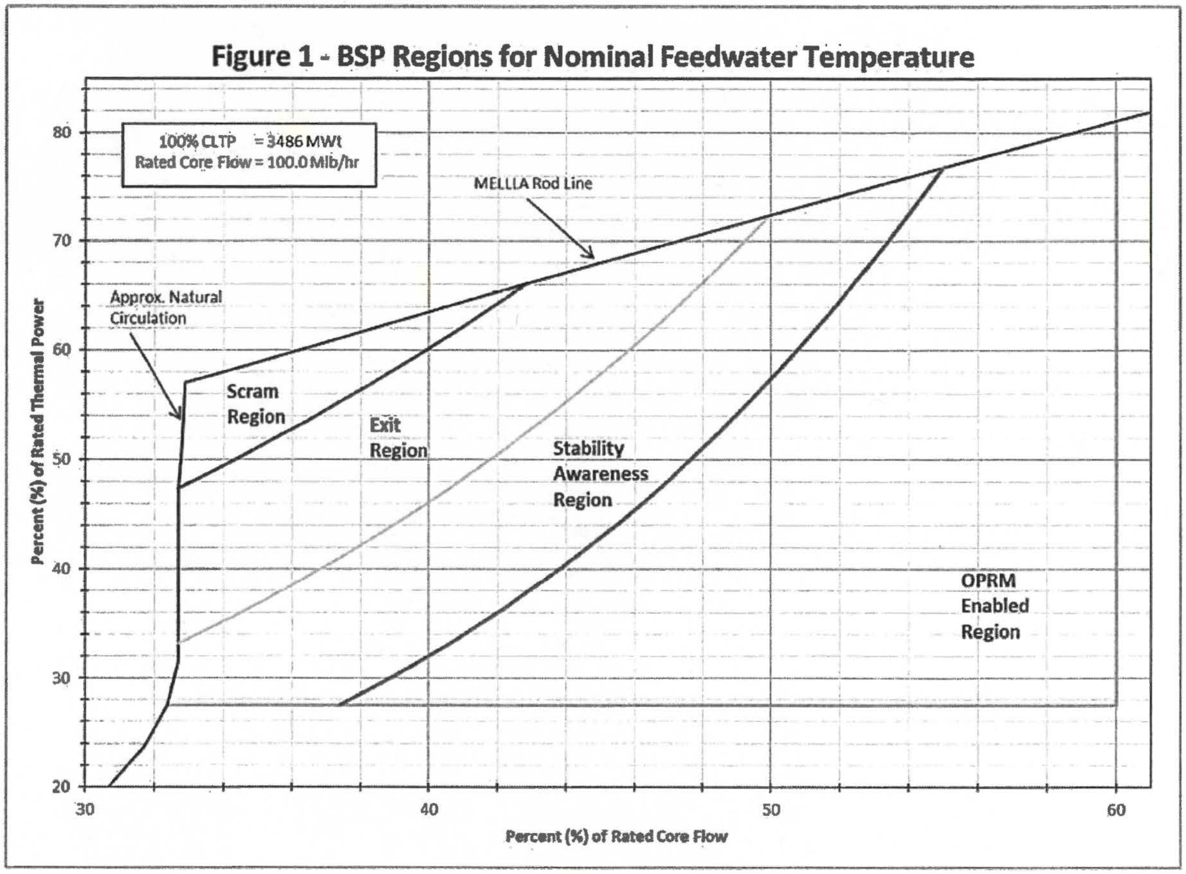
TECH SPEC REFERENCE	OPERATING LIMIT
3.3.1.1 Action Condition J	Alternate method to detect and suppress thermal hydraulic instability oscillations
TRM REFERENCE	**OPERATING LIMIT**
3.4.1.1	Scram, Exit, and Stability Awareness Regions

7.1 Definition

The Backup Stability Protection (BSP) Regions are an integral part of the Tech Spec required alternative method to detect and suppress thermal hydraulic instability oscillations in that they identify areas of the power/flow map where there is an increased probability that the reactor core could experience a thermal hydraulic instability. The BSP Regions are required if the Oscillation Power Range Monitors are inoperable. Regions are identified (refer to Figures 1 and 2) that are either excluded from planned entry (Scram Region), or where specific actions are required to be taken to immediately leave the region (Exit Region). A region is also identified where operation is allowed provided that additional monitoring is performed to verify that the reactor core is not exhibiting signs of core thermal hydraulic instability (Stability Awareness Region). (Reference 2)

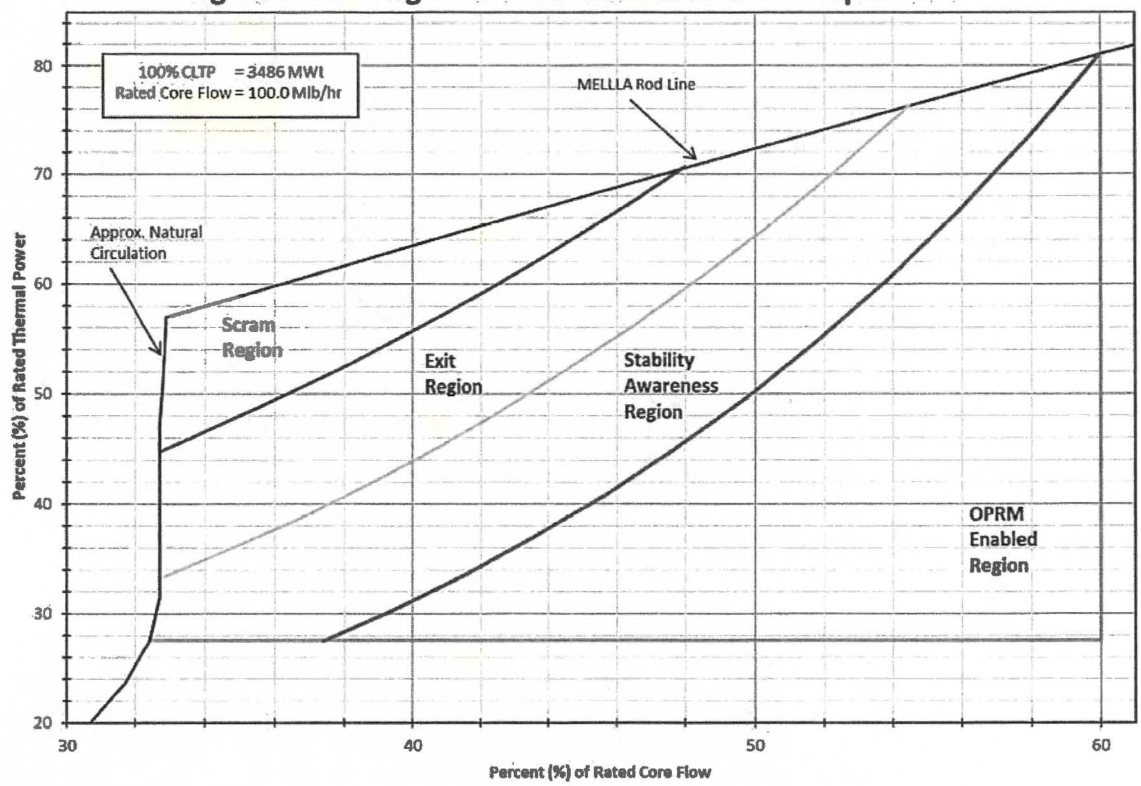
The boundaries of the Scram and Exit regions are established on a cycle specific basis based upon core decay ratio calculations performed using NRC approved methodology.

BSP boundaries for this cycle defined in Figure 1 are applicable when final feedwater temperature is near the optimum range as illustrated in 20.107.02, Loss of Feedwater Heating Abnormal Operating Instruction. Figure 2 is applicable to operation with Feedwater Heaters Out-Of-Service (FWHOOS) or with Final Feedwater Temperature Reduction (FFWTR) or when final feedwater temperature is below the optimum range.



Nominal feedwater heating exists with all feedwater heaters in service, the moisture separator reheaters in service, and reactor water cleanup in or out of service. Nominal feedwater temperature is determined with the Loss of Feedwater Heating Abnormal Operating Procedure, 20.107.02. If feedwater temperature is less than 15 degrees Fahrenheit below the Optimum Line of the Feedwater Inlet Temperature vs. Reactor Power graph provided in Enclosure A of 20.107.02, then Figure 1 can be used.

Figure 2 - BSP Regions for Reduced Feedwater Temperature



Reduced feedwater temperature is analyzed for a 50 degree Fahrenheit reduction in feedwater temperature. If feedwater temperature is more than 15 degrees Fahrenheit below the Optimum Line of the Feedwater Inlet Temperature vs. Reactor Power graph provided in Enclosure A of 20.107.02, then Figure 2 can be used.

8.0 REFERENCES

Core Operating Limits Report references are cited for two purposes. Many references are used as the basis for information, numbers, and equations found in COLR. These references tend to be fuel type or cycle specific. Other references are listed as basis information for the content and structure of COLR but are not Cycle specific.

1. "Fuel Bundle Information Report for Enrico Fermi 2 Reload 19 Cycle 20," Global Nuclear Fuel, DRF 004N4270, Revision 0, July 2018 (LHGR Limits), DTC: TRVEND, DSN: Cycle 20 FBIR

2. "Supplemental Reload Licensing Report for Enrico Fermi 2 Reload 19 Cycle 20," Global Nuclear Fuel, DRF: 004N4269, Revision 0, July 2018 (MAPLHGR Limits, SLO Multiplier, MCPR Limits, SLMCPR, Off-Rated Limits, Backup Stability Regions, OPRM setpoints, RBM setpoint), DTC: TRVEND, DSN: Cycle 20 SRLR

3. "GE14 Fuel Cycle-Independent Analyses for Fermi Unit 2", GE-NE-0000-0025-3282-00 dated November 2004 (ARTS Limits equations, RR Pump Seizure)

4. Letter from Greg Porter to B. L. Myers, "Scram Times for Improved Tech Specs." GP-99014, October 22, 1999 containing DRF A12-00038-3, Vol. 4 information from G. A. Watford, GE, to Distribution, Subject: Scram Times versus Notch Position (TAU Calculation), Edison File Number: R1-7242

5. NUMAC Power Range Neutron Monitoring System (PRNM) Surveillance Validation, Design Calculation DC-4608 Volume 1, Revision G (RBM A and B Setpoints), DTC: TDPINC, DSN: DC-4608 VOL I

6. Detroit Edison Fermi-2 Thermal Power Optimization Task T0201: Operating Power/Flow Map, Edison File Number: T13-050 (P-F Map for BSP figures)

7. "General Electric Standard Application for Reactor Fuel (GESTAR II)," NEDE-24011-P-A, Revision 27 with amendments

8. "The GESTR-LOCA and SAFER Models for the Evaluation of the Loss-of-Coolant Accident - SAFER/GESTR Application Methodology," NEDE 23785-1-PA, Revision 1, October 1984

9. "Fermi-2 SAFER/GESTR-LOCA, Loss-of-Coolant Accident Analysis," NEDC-31982P, July 1991, and Errata and Addenda No. 1, April 1992

10. "Maximum Extended Operating Domain Analysis for Detroit Edison Company Enrico Fermi Energy Center Unit 2," GE Nuclear Energy, NEDC-31843P, July 1990

11. Fermi 2 Pressure Regulator Out of Service Evaluation – Verified Final Report, Letter 1-2LHRMS-4 dated February 10, 2011. DTC: TRVEND, DSN: 1-2LHRMS-4 Edison File Number: R1-8100 (PROOS Limits)

12. "DTE Energy Enrico Fermi 2 SAFER/PRIME-LOCA Loss of Coolant Accident Analysis" DRF: 000N1319-R0 dated March 2015

13. Letter from T. G. Colburn to W. S. Orser, "Fermi-2 - Amendment No. 87 to Facility Operating License No. NPF-43 (TAC NO. M82102)," September 9, 1992

14. Letter from J. F. Stang to W. S. Orser, "Amendment No. 53 to Facility Operating License No. NPF-43: (TAC No. 69074)," July 27, 1990

15. "Fermi 2 TRACG Implementation for Reload Licensing Transient Analysis", Revision 1, 0000-0128-8831-R1, June 2014, Edison File Number: R1-8124

16. Methodology and Uncertainties for Safety Limit MCPR Evaluations, NEDC-32601P-A, August 1999

17. Power Distribution Uncertainties for Safety Limit MCPR Evaluation, NEDC-32694P-A, August 1999

18. R-Factor Calculation Method for GE11, GE12, and GE13 Fuel, NEDC-32505P-A, Revision 1, July 1999

19. "Turbine Control Valve Out-Of-Service for Enrico Fermi Unit-2," GE – Nuclear Energy, GE-NE-J11-03920-07-01, October 2001

20. "Fermi 2 - Issuance of Amendment No. 214 Re: Technical Specifications Task Force (TSTF) TSTF-564, "Safety Limit Minimum Critical Power Ratio" (EPID L-2019-LLA-0028)" Letter from Sujata Goetz, NRC, to Peter Dietrich, DTE Electric dated November 5, 2019 (SLMCPR)

21. "GE14 Compliance with Amendment 22 of NEDE-24011-P-A (GESTAR II)", NEDC-32868P, Revision 6, March 2016 (LHGR Limits), Edison File Number: R1-7307

22. "Fermi 2 – Issuance of Amendment Re: Measurment Uncertainty Recapture Power Uprate (TAC No. MF0650)" Letter from Thomas Wengert, NRC, to Joseph Plona, DTE Electric dated February 10, 2014

23. Qualification of the One-Dimensional Core Transient Model for Boiling Water Reactors – Volume 1, NEDO-24154-A, August 1986, Edison File Number: R1-7389.

24. Letter from G. G. Jones to A. D. Smart, "Fermi 2 Technical Specification Changes," February 17, 1989

25. "Cycle Management Report for Fermi-2 Cycle 20," 004N4278 Revision 0, October 2018 Edison File Number: R1-8497 (Fuel Type Table)