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NLS2008062
July 22, 2008

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555-0001

Subject: Core Operating Limits Report, Cycle 25, Revision 1
Cooper Nuclear Station, Docket No. 50-298, DPR-46

Dear Sir or Madam:

The purpose of this letter is to provide to the Nuclear Regulatory Commission (NRC) the enclosed Revision 1 to the Core Operating Limits Report (COLR) for Cooper Nuclear Station (CNS) for Cycle 25. CNS Technical Specification 5.6.5.d requires that the COLR, including any midcycle revisions or supplements, be provided to the NRC upon issuance. The CNS Cycle 25, Revision 1 COLR contains no proprietary information.

Should you have any questions regarding this matter, please contact me at (402) 825-2904.

Sincerely,

David W Van Der Kamp

David W. Van Der Kamp
Licensing Manager

/lb

Enclosure

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ENCLOSURE

CORE OPERATING LIMITS REPORT

CYCLE 25, REVISION 1

COOPER NUCLEAR STATION

DOCKET NO. 50-298, DPR-46

COOPER NUCLEAR STATION

CORE OPERATING LIMITS REPORT

Cycle 25

Revision 1

	Print	Sign	Date
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REVISION HISTORY

Revision	Date	Description
0	Feb 28, 2008	Original issue, Based on rated core power of 2381
1	July 7, 2008	Revised for Appendix K power level of 2419 Mwth, updated Power flow map and RBM setpoint values.

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1. INTRODUCTION

The Core Operating Limits Report (COLR) provides the limits for operation of the Cooper Nuclear Station for Cycle 25 at a rated power of 2419 MwTH. Cooper Nuclear Station Technical Specification 5.6.5(a) requires the COLR to contain the following limits:

- The Average Planar Linear Heat Generation Rate for Specification 3.2.1,
- The Minimum Critical Power Ratio for Specifications 3.2.2 and 3.7.7,
- The three Rod Block Monitor Upscale Allowable Values for Specification 3.3.2.1,
- The power/flow map defining the Stability Exclusion Region for Specification 3.4.1.

In addition, the following information is required to be in the COLR:

- Turbine Bypass System response time for Surveillance Requirement 3.7.7.3,
- Maximum allowable Linear Heat Generation Rate (LHGR) for Technical Requirements Manual Specification T3.2.1.

The analytical methods used to determine the core operating limits are those previously reviewed and approved by the NRC as required by Technical Specification 5.6.5(b). These methods are:

- NEDE-24011-P-A-15, "General Electric Standard Application for Reactor Fuel", September 2005 (Reference 1),
- NEDE-23785-1-P-A, "The GESTR-LOCA and SAFER Models for the Evaluation of the Loss-of-Coolant Accident", Volume III, Revision 1, October 1984 (Reference 2),
- NEDO-31960-A and NEDO-31960-A Supplement 1, "BWR Owner's Group Long-Term Stability Solutions Licensing Methodology", November 1995 (Reference 3).

2. AVERAGE PLANAR LINEAR HEAT GENERATION RATE

2.1 Technical Specification Reference

Technical Specification 3.2.1.

2.2 Two Recirculation Loop Operation

During steady-state power operation, the maximum Average Planar Linear Heat Generation Rate (MAPLHGR), as a function of fuel bundle type, axial location, and average planar exposure, shall not exceed the applicable limiting value.

The maximum allowable Average Planar Linear Heat Generation Rate with two recirculation loops in operation is defined as follows:

MAPLHGR Limit = minimum [MAPLHGR(P), MAPLHGR(F)]

where,

MAPLHGR(P) = $MAPLHGR_{STD}$ * MAPFAC(P),

MAPLHGR(F) = $MAPLHGR_{STD}$ * MAPFAC(F),

$MAPLHGR_{STD}$ = Fuel bundle type and exposure dependent MAPLHGR values for rated core power and flow conditions represented by the values shown in Table 2-1,

MAPFAC(P) = Core power dependent multiplier shown in Figure 2-1,

MAPFAC(F) = Core flow rate dependent multiplier shown in Figure 2-2.

The $MAPLHGR_{STD}$ values presented in Table 2-1 are the most limiting values for each fuel bundle type from the exposure dependent values defined in Section 16 of Reference 6. The core monitoring computer will be used to verify the MAPLHGR limits for each fuel bundle type are not violated.

The MAPFAC(P) and MAPFAC(F) multipliers presented in Figure 2-1 and Figure 2-2, respectively, are defined in Reference 5.

No thermal limits monitoring is required below 25% of rated power. Therefore, the MAPLHGR limit defined above is only applicable for core conditions at or above 25% of rated power.

2.3 Single Recirculation Loop Operation

The maximum allowable Average Planar Linear Heat Generation Rate with one recirculation loop in operation (SLO) is defined as follows:

MAPLHGR Limit = minimum [MAPLHGR(P), MAPLHGR(F), MAPLHGR(SLO)]

where,

MAPLHGR(SLO) = $MAPLHGR_{STD}$ * MAPFAC(SLO),

MAPFAC(SLO) = Single loop operation MAPLHGR multiplier,

and MAPLHGR(P) and MAPLHGR(F) are as defined in Section 2.2 above.

As shown above, it is not necessary to apply both the off-rated (MAPFAC(P) and MAPFAC(F)) and SLO multiplier corrections at the same time.

The single loop operation MAPLHGR multiplier for each fuel bundle type are defined in Section 16 of Reference 6 as shown in the table below.

Fuel Bundle Type	SLO MAPLHGR Multiplier
All GE14B bundles	0.87
All GE14C bundles	0.87

Table 2-1

$MAPLHGR_{STD}$ Values

Average Planar Exposure (GWd/MT)	$MAPLHGR_{STD}$ Values for all bundles (kW/ft)
0.00	12.82
21.10	12.82
63.50	8.00
70.00	5.00

GNF Bundle #	GNF Fuel Bundle Identification
EDB-3881	GE14-P10HNAB385-14GZ-100T-148-T6-3881 (GE14B)
EDB-2476	GE14-P10HNAB379-17GZ-100T-150-T6-2476 (GE14C)
EDB-2611	GE14-P10DNAB393-17GZ-100T-150-T6-2611 (GE14C)
EDB-2569	GE14-P10DNAB398-16GZ-100T-150-T6-2569 (GE14C)
EDB-2800	GE14-P10DNAB395-14GZ-100T-150-T6-2800 (GE14C)
EDB-2801	GE14-P10DNAB393-17GZ-100T-150-T6-2801 (GE14C)
EDB-2901	GE14-P10DNAB385-13GZ-100T-150-T6-2901 (GE14C)
EDB-2902	GE14-P10DNAB386-14GZ-100T-150-T6-2902 (GE14C)
EDB-3032	GE14-P10DNAB383-2G6.0/10G5.0-100T-150-T6-3032 (GE14C)
EDB-3033	GE14-P10DNAB383-2G6.0/12G5.0-100T-150-T6-3033 (GE14C)

Figure 2-1

Power Dependent MAPFAC(P) and LHGRFAC(P) Multiplier

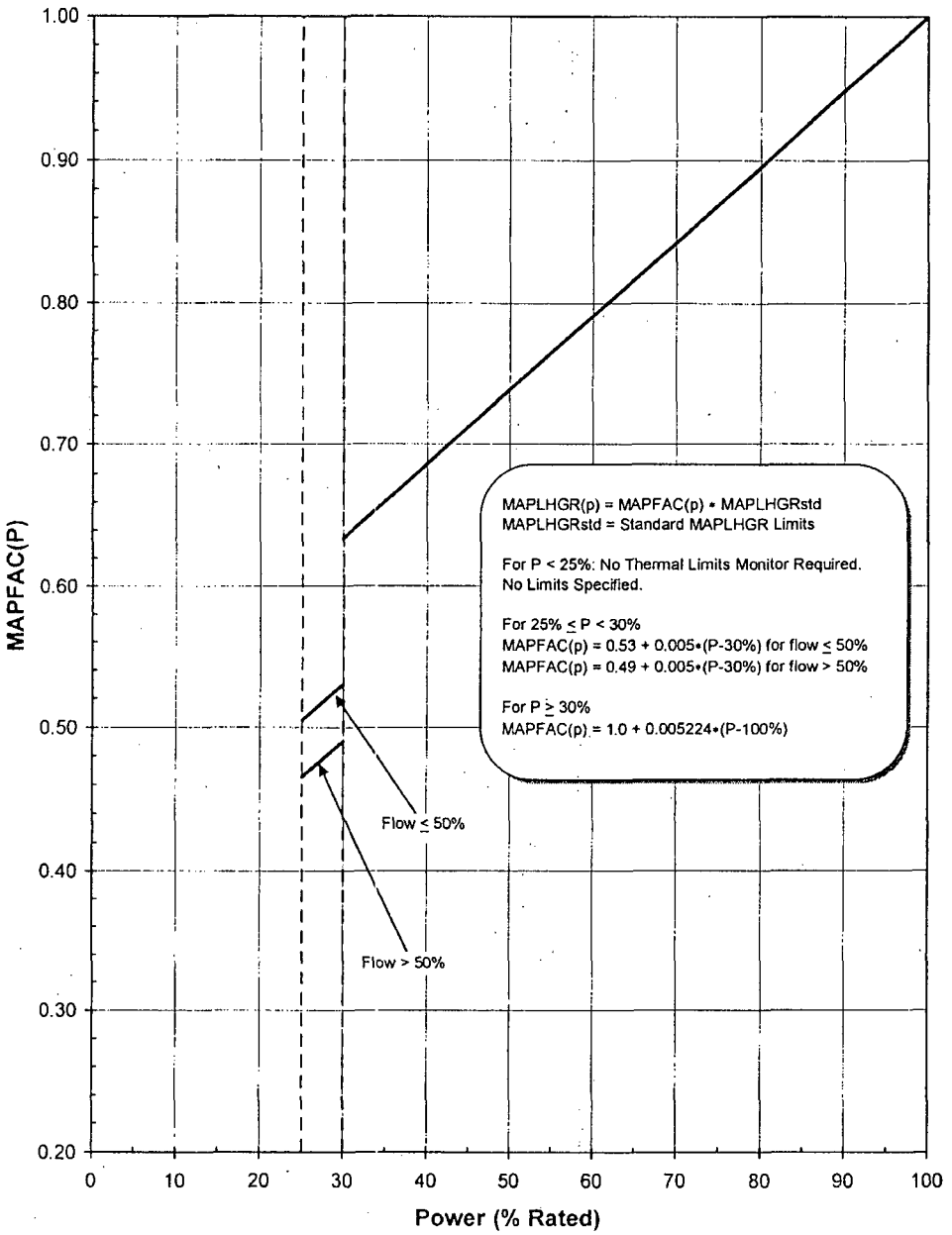
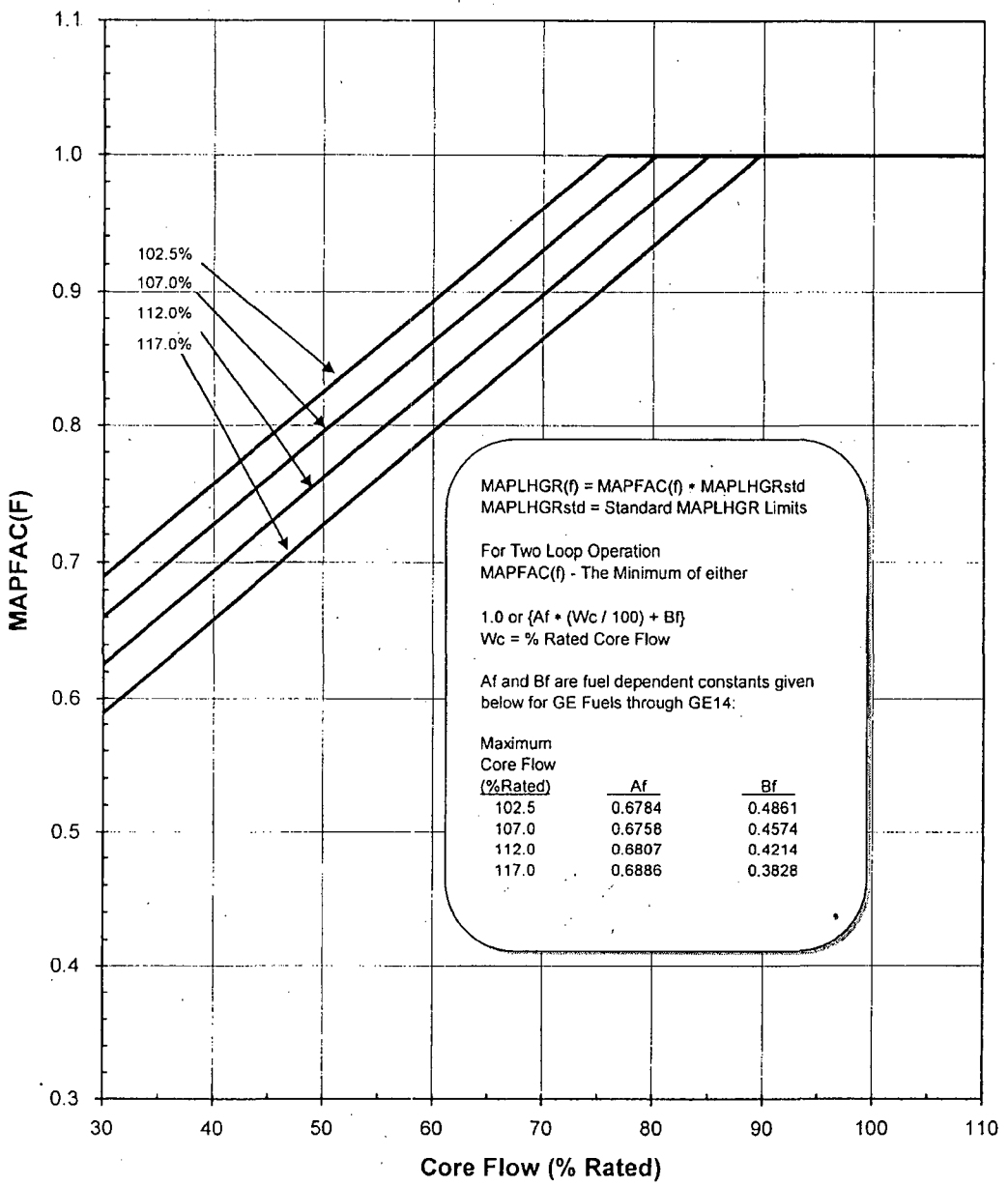


Figure 2-2

Flow Dependent MAPFAC(F) and LHGRFAC(F) Multiplier



3. MINIMUM CRITICAL POWER RATIO

3.1 Technical Specification Reference

Technical Specifications 3.2.2 and 3.7.7.

3.2 Two Recirculation Loop Operation

During steady-state power operation, the minimum Critical Power Ratio (MCPR) shall be greater than or equal to the Operating Limit MCPR (OLMCPR) defined as a function of cycle exposure and plant conditions.

The Operating Limit MCPR with two recirculation loops in operation is defined as follows:

$$OLMCPR = \text{maximum } [MCPR(P), MCPR(F)]$$

where,

MCPR(P) = Core power dependent MCPR shown in Figure 3-1,

MCPR(F) = Core flow rate dependent MCPR shown in Figure 3-2.

The MCPR(P) and MCPR(F) graphs presented in Figure 3-1 and Figure 3-2, respectively, are defined in Appendix D of Reference 6.

As shown in Figure 3-1, the MCPR(P) value is calculated as follows:

For $P \geq P(Bypass)$, $MCPR(P) = OLMCPR(100) * K_P$

For $P < P(Bypass)$, $MCPR(P) = MCPR(P)$ as a function of core flow

where,

P(Bypass) = P(Bypass) is the core power level below which the Turbine Stop Valve closure and Turbine Control Valve fast closure scrams are assumed to be bypassed. P(Bypass) is currently set at 30% of rated power.

OLMCPR(100) = OLMCPR for rated core power and flow conditions. OLMCPR(100) is defined as a function of scram time surveillance data as defined in Section 3.3.

K_P = Core power dependent OLMCPR multiplier.

No thermal limits monitoring is required below 25% of rated power. Therefore, the OLMCPR limit defined above is only applicable for core conditions at or above 25% of rated power.

3.3 Application of Scram Time Surveillance Data to OLMCPR(100)

The OLMCPR(100) value applicable to the MCPR(P) calculation presented in Section 3.2 is determined based on scram time surveillance data recorded for the current operating cycle and the following methodology defined in Reference 7, Reference 11, and Reference 12.

3.3.1 Mean Scram Time (τ_{ave})

The mean scram time for control rod insertion to notch 36 is calculated as follows:

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

where,

i = Scram time test sequential identification number,

n = Number of scram time tests performed to date in the cycle (including beginning of cycle),

N_i = Number of control rods measured in test i,

τ_i = Average insertion time to notch 36 measured in test i.

3.3.2 20% Insertion Conformance Limit Scram Time (τ_B)

The 20% insertion conformance limit scram time is calculated as follows:

$$\tau_B = \mu + 1.65\sigma \sqrt{\frac{N_1}{\sum_{i=1}^{n} N_i}}$$

where,

μ = Mean of the distribution for average scram time insertion to position 36 used in the ODYN Option B analysis,

σ = Standard deviation of the distribution for average scram time insertion to position 36 used in the ODYN Option B analysis,

N_1 = Total number of control rods measured during the first surveillance test performed at beginning of cycle.

The values for μ, σ and N_1 are given below.

μ = 0.830

σ = 0.019

N_1 = 137

Using the values given above, Reference 7 defines the 20% insertion conformance limit scram time as,

$$\tau_B = 0.830 + 0.367\sqrt{\frac{1}{\sum_{i=1}^{n} N_i}}$$

3.3.3 Scram Time Quality Factor (τ)

The scram time quality factor is calculated as follows:

If $\tau_{ave} \leq \tau_B$, $\tau = 0$.

If $\tau_{ave} > \tau_B$, $\tau = \frac{\tau_{ave} - \tau_B}{\tau_A - \tau_B}$

where,

τ_A = Technical Specification limit for 20% insertion (notch 36)
= 1.08 seconds (Technical Specification Table 3.1.4-1).

3.3.4 Calculation of OLMCPR(100)

The OLMCPR for rated power and core flow conditions is calculated as follows based on the calculated values for τ_{ave}, τ_B, and τ:

$$OLMCPR(100) = OLMCPR_B + \tau * (OLMCPR_A - OLMCPR_B)$$

Using the following values obtained from Section 11 of Reference 6 ,

$OLMCPR_A$ = Option A OLMCPR value given in Table 3-1,

$OLMCPR_B$ = Option B OLMCPR value given in Table 3-1.

3.4 Single Recirculation Loop Operation

The Operating Limit MCPR with a single recirculation loop in operation is defined as follows:

OLMCPR = maximum [MCPR(SL-P), MCPR(SL-F)]

where,

For P ≥ P(Bypass), MCPR(SL-P) = [OLMCPR(100)+ΔOLMCPR(SLO)] * K_P

For P < P(Bypass), MCPR(SL-P) = MCPR(P) + ΔOLMCPR(SLO),

For all core flows, MCPR(SL-F) = MCPR(F) + ΔOLMCPR(SLO),

ΔOLMCPR(SLO) = 0.02 from Section 11 of Reference 6, and OLMCPR(100), MCPR(P), and MCPR(F) are as defined in Section 3.2.

The increase in the OLMCPR for single loop operation corresponds to an increase in the safety limit MCPR (SLMCPR) for single loop operation as described in Reference 6.

3.5 Use of Full Arc Turbine Control Valve

The Operating Limit MCPR when using full arc turbine control valve mode (CNS operating procedures refer to this as single valve mode) is defined as follows:

OLMCPR (single valve mode) = OLMCPR + ΔOLMCPR (single valve mode)

where,

OLMCPR = OLMCPR as calculated in Section 3.2 for two recirculation loop operation or in Section 3.4 for single loop operation.

ΔOLMCPR (single valve mode) = 0.01 from Appendix F of Reference 6.

Table 3-1

OLMCPR Values for OLMCPR(100) Calculation

Equipment Status	Applicable Cycle Exposure Range	$OLMCPR_A$	$OLMCPR_B$
Equipment In-Service	BOC to EOR-2.370 GWd/MT	1.47	1.36
	EOR-2.370 GWd/MT to EOC	1.60	1.43
Turbine Bypass Valve Out of Service (TBVOOS)	BOC to EOC	1.61	1.44

NOTES:

1. The range of OLMCPR values are defined as follows:

   $OLMCPR_A$ = Option A OLMCPR from Reference 6 based on Option A analysis using full core scram times defined in Technical Specification Table 3.1.4-1.

   $OLMCPR_B$ = Option B OLMCPR from Reference 6 based on Option B analysis described in Reference 1.

2. The OLMCPR values presented above apply to rated power operation based on a two loop operation Safety Limit MCPR (SLMCPR) of 1.10.

3. The OLMCPR values presented above bound Increased Core Flow (ICF) operation to 105% of rated flow throughout the cycle.

4. Exposure ranges are defined as follows:

   BOC = Beginning of cycle,

   EOC = End of cycle,

   EOR = End of rated power operation at rated core flow and all rods withdrawn. EOR is projected to be 11.795 GWd/MT in Reference 6 Section 3. The EOR exposure will vary based on actual cycle operations.

Figure 3-1

Power Dependent K(P) and MCPR(P) for GE14 Fuel with Safety Limit = 1.10

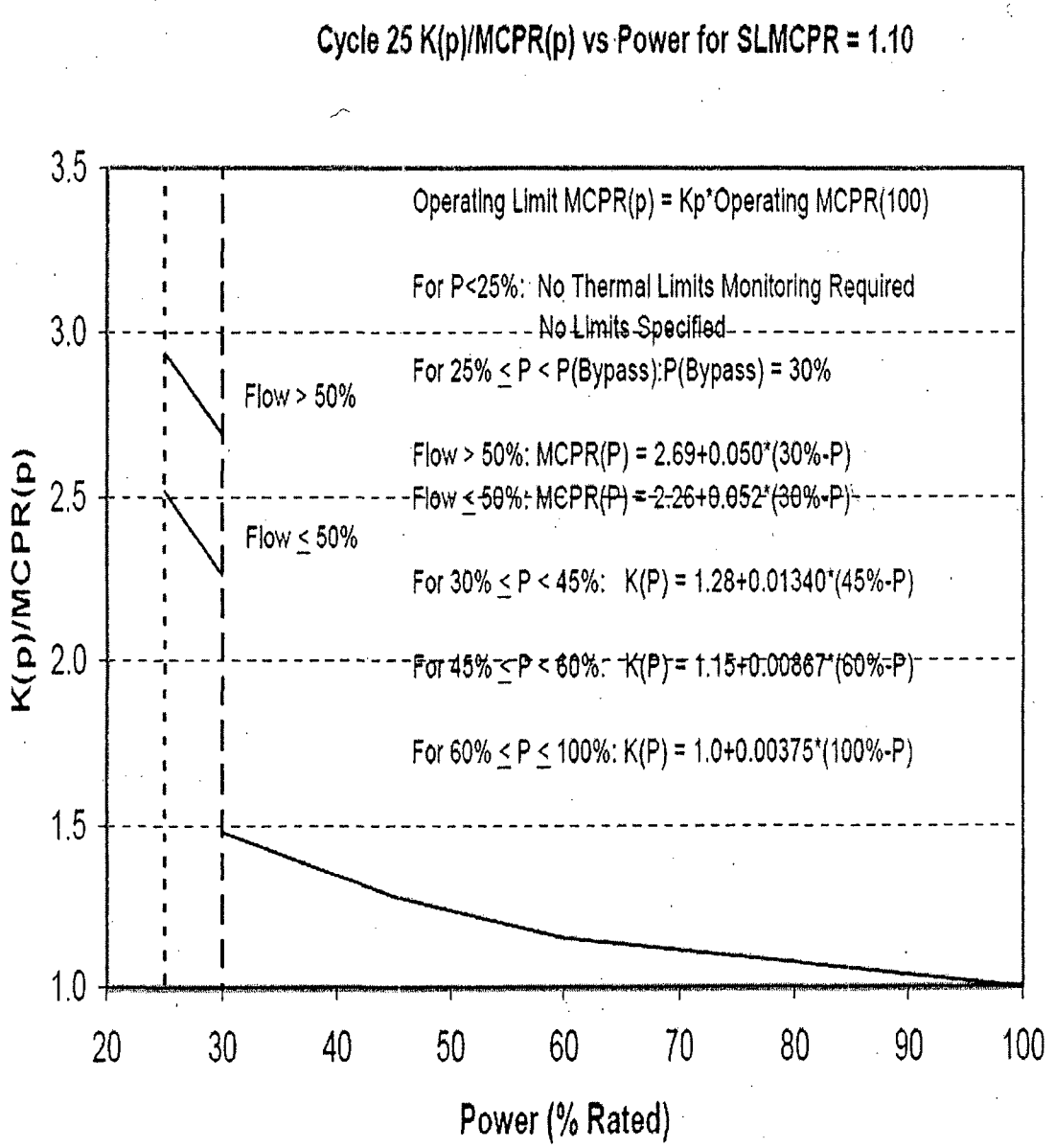
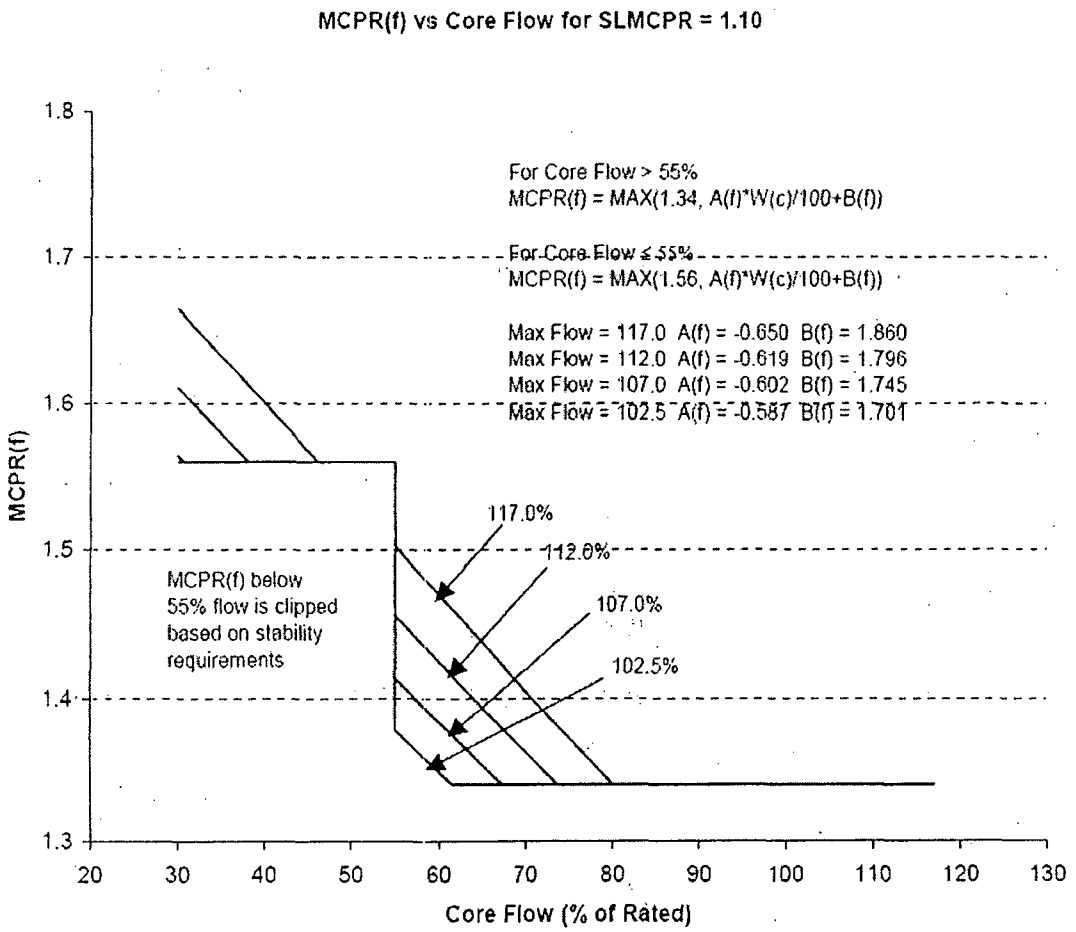


Figure 3-2

Flow Dependent MCPR(F) for GE14 Fuel with Safety Limit = 1.10



4. TURBINE BYPASS SYSTEM RESPONSE TIME

4.1 Technical Specification Reference

Technical Specification 3.7.7.3.

4.2 System Response Time

The system response time for the Turbine Bypass System to be at 80% of rated bypass flow is 0.3 seconds. This was obtained from Reference 8.

5. ROD BLOCK MONITOR TRIP SETPOINTS

5.1 Technical Specification Reference

Technical Specification 3.3.2.1.

5.2 Trip Setpoints

The allowable values for the power dependent Rod Block Monitor (RBM) upscale trip setpoints are defined in Table 5-1, along with the applicable reactor power ranges associated with each trip setpoint. The Analytical Limit (AL) and Technical Specification Allowable Value (AV) presented in Table 5-1 were determined in Reference 9 and Reference 4.

Table 5-1

Rod Block Monitor Channel Settings

Trip Function	Analytical Limit [1]	Allowable Value [1]
Low Power Setpoint (LPSP)	30.0%	**27.5%**
Intermediate Power Setpoint (IPSP)	65.0%	**62.5%**
High Power Setpoint (HPSP)	85.0%	**82.5%**
Downscale Trip Setpoint (DTSP)	89.0%	**92.0%**

Trip Function	Applicable Core Power Range	MCPR Limit [2]	Analytical Limit [3]	Allowable Value [3]
Low Trip Setpoint (LTSP)	LPSP ≤ P ≤ IPSP	1.29	≤ 123.0 / 125	**≤ 120.0 / 125**
Intermediate Trip Setpoint (ITSP)	IPSP < P ≤ HPSP	1.29	≤ 118.0 / 125	**≤ 115.0 / 125**
High Trip Setpoint (HTSP)	HPSP < P	1.29	≤ 113.2 / 125	**≤ 110.5 / 125**

NOTES:

1. Setpoints are given in units of percent of rated power.
2. The RBM trip level settings associated with the MCPR limit were verified in Appendix D of Reference 6 to bound the cycle specific Rod Withdrawal Error (RWE) analysis for an RBM setpoint of 114% of reference level. The MCPR limit is based on an adjusted MCPR limit from the generic analysis documented in Reference 4 performed for an Analyzed Trip Level Setting (without RBM filter) of 114.0% of the reference level or an Analyzed Trip Level Setting (with RBM filter) of 113.2% of the reference level. The generic MCPR limit of 1.25 was calculated in Reference 4 for an SLMCPR of 1.07. The MCPR limit documented above was calculated by multiplying the generic limit of 1.25 by the ratio of the SLMCPR values (1.10/1.07).
3. RBM trip setpoints are given in units of divisions of full scale.

6. MAXIMUM LINEAR HEAT GENERATION RATE

6.1 Technical Requirements Manual Reference

Technical Requirements Manual Specification T3.2.1.

6.2 Two Recirculation Loop Operation

During steady-state power operation, the maximum Linear Heat Generation Rate (LHGR) in any fuel rod in any fuel bundle at any axial location shall not exceed the applicable limiting value.

The maximum allowable Linear Heat Generation Rate with two recirculation loops in operation is defined as follows:

LHGR Limit = minimum [LHGR(P), LHGR(F)]

where,

LHGR(P) = $LHGR_{STD}$ * LHGRFAC(P),

LHGR(F) = $LHGR_{STD}$ * LHGRFAC(F),

$LHGR_{STD}$ = Fuel bundle type, fuel rod type, and peak pellet exposure dependent maximum LHGR values for rated core power and flow conditions represented by the values shown in Table 6-1,

LHGRFAC(P) = Core power dependent multiplier shown in Figure 2-1,

LHGRFAC(F) = Core flow rate dependent multiplier shown in Figure 2-2.

The $LHGR_{STD}$ values presented in Table 6-1 represent the maximum allowable peak pellet power (LHGR) as a function of pellet exposure for each pin type in each fuel bundle design. The maximum allowable LHGR limit values have the following pin type dependencies; UO_2 only pins which can either be full and partial length fuel rods, Gadolinia rods based on the local and maximum gadolinia concentration in the rod. Each combination of pin type is determined using the fuel bundle gadolinia distributions from Reference 13. The LHGR limit pellet exposure knee point values were obtained from Reference 14 for GE14B bundles and Reference 15 for GE14C bundles The core monitoring computer will be used to verify the pellet specific LHGR limits for each fuel bundle type are not violated.

Reference 6 Appendix D defines the LHGRFAC(P) and LHGRFAC(F) multipliers to be identical to the MAPFAC(P) and MAPFAC(F) multipliers presented in Figure 2-1 and Figure 2-2, respectively.

No thermal limits monitoring is required below 25% of rated power. Therefore, the LHGR limit defined above is only applicable for core conditions at or above 25% of rated power.

6.3 Single Recirculation Loop Operation

The maximum allowable Linear Heat Generation Rate with one recirculation loop in operation (SLO) is defined as follows:

LHGR Limit = minimum [LHGR(P), LHGR(F), LHGR(SLO)]

where,

LHGR(SLO) = $LHGR_{STD}$ * LHGRFAC(SLO),

LHGRFAC(SLO) = Single loop operation PLHGR multiplier,

and LHGR(P) and LHGR(F) are as defined in Section 6.2 above.

As shown above, it is not necessary to apply both the off-rated (LHGRFAC(P) and LHGRFAC(F)) and SLO multiplier corrections at the same time.

The single loop operation peak LHGR (PLHGR) multipliers for each fuel bundle type are defined in Section 16 of Reference 6 as shown in the table below.

Fuel Bundle Type	SLO PLHGR Multiplier
All GE14B bundles	0.87
All GE14C bundles	0.87

Table 6-1

Bounding $LHGR_{STD}$ Values By Fuel Bundle Type

EDB-3881				
Peak Pellet Exposure (GWd/MT)	$LHGR_{STD}$ (kW/ft) UO_2 Only	$LHGR_{STD}$ (kW/ft) 6% gad	$LHGR_{STD}$ (kW/ft) 3% gad	$LHGR_{STD}$ (kW/ft) 0% gad 3-6% max
0.0000	13.400	11.346	11.800	13.100
12.888	--	11.346	--	--
13.069	--	--	11.800	--
15.642	--	--	--	13.100
16.000	13.400	--	--	--
68.433	--	--	--	6.648
70.000	6.800	6.203	6.531	xx

EDB-2476							
Peak Pellet Exposure (GWd/MT)	$LHGR_{STD}$ (kW/ft) UO_2 Only	$LHGR_{STD}$ (kW/ft) 5% gad 5% max gad	$LHGR_{STD}$ (kW/ft) 4% gad 5% max gad	$LHGR_{STD}$ (kW/ft) 4% gad 4% max gad	$LHGR_{STD}$ (kW/ft) 3% gad	$LHGR_{STD}$ (kW/ft) 0% gad 3% max gad	$LHGR_{STD}$ (kW/ft) 0% gad 4-5% max gad
0.0000	13.400	12.521	12.700	12.800	12.945	13.000	13.100
12.888	--	--	--	--	--	--	--
13.664	--	--	12.700	--	--	--	--
13.656	--	12.521	--	--	--	--	--
13.754	--	--	--	--	12.945	--	--
13.790	--	--	--	12.800	--	--	--
15.522	--	--	--	--	--	13.000	--
15.642	--	--	--	--	--	--	13.100
16.000	13.400	--	--	--	--	--	--
61.115	--	7.475	--	--	--	--	--
61.149	--	--	7.582	--	--	--	--
61.505	--	--	--	--	7.728	--	--
61.604	--	--	--	--	--	7.761	--
61.649	--	--	--	7.642	--	--	--
62.078	--	--	--	--	--	--	7.821
63.500	8.00	--	--	--	--	--	--
67.610	--	4.672	--	--	--	--	--
67.646	--	xx	4.739	--	--	--	--
67.910	--	xx	xx	--	--	4.850	--
68.039	--	xx	xx	--	4.830	xx	--
68.198	--	xx	xx	4.776	xx	xx	--
68.433	--	xx	xx	xx	xx	xx	4.888
70.000	5.000	xx	xx	xx	xx	xx	xx

EDB-2611					
Peak Pellet Exposure (GWd/MT)	$LHGR_{STD}$ (kW/ft) UO_2 Only	$LHGR_{STD}$ (kW/ft) 5% gad 5% max gad	$LHGR_{STD}$ (kW/ft) 3% gad	$LHGR_{STD}$ (kW/ft) 0% gad 3% max gad	$LHGR_{STD}$ (kW/ft) 0% gad 5% max gad
0.000	13.400	12.521	12.945	13.000	13.100
13.656	--	12.521	--	--	--
13.754	--	--	12.945	--	--
15.522	--	--	--	13.000	--
15.642	--	--	--	--	13.100
16.000	13.400	--	--	--	--
61.115	--	7.475	--	--	--
61.505	--	--	7.728	--	--
61.604	--	--	--	7.761	--
62.078	--	--	--	--	7.821
63.500	8.000	--	--	--	--
67.610	--	4.672	--	--	--
67.910	--	xx	--	4.850	--
68.039	--	xx	4.830	xx	--
68.433	--	xx	xx	xx	4.888
70.000	5.000	xx	xx	xx	xx

EDB-2569					
Peak Pellet Exposure (GWd/MT)	$LHGR_{STD}$ (kW/ft) UO_2 Only	$LHGR_{STD}$ (kW/ft) 4% gad 4% max gad	$LHGR_{STD}$ (kW/ft) 3% gad	$LHGR_{STD}$ (kW/ft) 0% gad 3% max gad	$LHGR_{STD}$ (kW/ft) 0% gad 4% max gad
0.0000	13.400	12.800	12.945	13.000	13.100
13.7540	--	--	12.945	--	--
13.7900	--	12.800	--	--	--
15.5220	--	--	--	13.000	--
15.6420	--	--	--	--	13.100
16.0000	13.400	--	--	--	--
61.505	--	--	7.728	--	--
61.604	--	--	--	7.761	--
61.649	--	7.642	--	--	--
62.078	--	--	--	--	7.821
63.500	8.000	--	--	--	--
67.9100	--	--	--	4.850	--
68.0390	--	--	4.830	xx	--
68.1980	--	4.776	xx	xx	--
68.4330	--	xx	xx	xx	4.888
70.0000	5.000	xx	xx	xx	xx

EDB-2800						
Peak Pellet Exposure (GWd/MT)	$LHGR_{STD}$ (kW/ft) UO_2 Only	$LHGR_{STD}$ (kW/ft) 6% gad 6% max gad	$LHGR_{STD}$ (kW/ft) 5% gad 6% max gad	$LHGR_{STD}$ (kW/ft) 5% gad 5% max gad	$LHGR_{STD}$ (kW/ft) 4% gad 4% max gad	$LHGR_{STD}$ (kW/ft) 0% gad 4-6% max gad
0.0000	13.400	12.255	12.400	12.521	12.800	13.100
13.500	--	--	12.400	--	--	--
13.532	--	12.255	--	--	--	--
13.656	--	--	--	12.521	--	--
13.790	--	--	--	--	12.800	--
15.642	--	--	--	--	--	13.100
16.000	13.400	--	--	--	--	--
60.499	--	--	7.403	--	--	--
60.625	--	7.316	--	--	--	--
61.115	--	--	--	7.475	--	--
61.649	--	--	--	--	7.642	--
62.078	--	--	--	--	--	7.821
63.500	8.000	--	--	--	--	--
66.930	--	--	4.627	--	--	--
67.069	--	4.572	xx	--	--	--
67.610	--	xx	xx	4.672	--	--
68.198	--	xx	xx	xx	4.776	--
68.433	--	xx	xx	xx	xx	4.888
70.000	5.000	xx	xx	xx	xx	xx

EDB-2801					
Peak Pellet Exposure (GWd/MT)	$LHGR_{STD}$ (kW/ft) UO_2 Only	$LHGR_{STD}$ (kW/ft) 6% gad 6% max gad	$LHGR_{STD}$ (kW/ft) 5% gad 6% max gad	$LHGR_{STD}$ (kW/ft) 4% gad 4% max gad	$LHGR_{STD}$ (kW/ft) 0% gad 4-6% max gad
0.0000	13.400	12.255	12.400	12.800	13.100
13.500	--	--	12.400	--	--
13.532	--	12.255	--	--	--
13.656	--	--	--	--	--
13.790	--	--	--	12.800	--
15.642	--	--	--	--	13.100
16.000	13.400	--	--	--	--
60.499	--	--	7.403	--	--
60.625	--	7.316	--	--	--
61.649	--	--	--	7.642	--
62.078	--	--	--	--	7.821
63.500	8.000	--	--	--	--
66.930	--	--	4.627	--	--
67.069	--	4.572	xx	--	--
68.198	--	xx	xx	4.776	--
68.433	--	xx	xx	xx	4.888
70.000	5.000	xx	xx	xx	xx

EDB-2901						
Peak Pellet Exposure (GWd/MT)	$LHGR_{STD}$ (kW/ft) UO_2 Only	$LHGR_{STD}$ (kW/ft) 6% gad 6% max gad	$LHGR_{STD}$ (kW/ft) 5% gad 5% max gad	$LHGR_{STD}$ (kW/ft) 4% gad 5% max gad	$LHGR_{STD}$ (kW/ft) 4% gad 4% max gad	$LHGR_{STD}$ (kW/ft) 0% gad 4-6% max gad
0.0000	13.400	12.255	12.521	12.700	12.800	13.100
13.500	--	--	--	--	--	--
13.532	--	12.255	--	--	--	--
13.656	--	--	12.521	--	--	--
13.664	--	--	--	12.700	--	--
13.790	--	--	--	--	12.800	--
15.642	--	--	--	--	--	13.100
16.000	13.400	--	--	--	--	--
60.499	--	--	--	--	--	--
60.625	--	7.316	--	--	--	--
61.115	--	--	7.475		--	--
61.149	--	--	--	7.582	--	--
61.649	--	--	--	--	7.642	--
62.078	--	--	--	--	--	7.821
63.500	8.000	--	--	--	--	--
66.930	--	--	--	--	--	--
67.069	--	4.572	--	--	--	--
67.610	--	xx	4.672	--	--	--
67.646	--	xx	xx	4.739	--	--
68.198	--	xx	xx	xx	4.776	--
68.433	--	xx	xx	xx	xx	4.888
70.000	5.000	xx	xx	xx	xx	xx

EDB-2902				
Peak Pellet Exposure (GWd/MT)	$LHGR_{STD}$ (kW/ft) UO_2 Only	$LHGR_{STD}$ (kW/ft) 5% gad 5% max gad	$LHGR_{STD}$ (kW/ft) 4% gad 5% max gad	$LHGR_{STD}$ (kW/ft) 0% gad 4-5% max gad
0.0000	13.400	12.521	12.700	13.100
13.656	--	12.521	--	--
13.664	--	--	12.700	--
15.642	--	--	--	13.100
16.000	13.400	--	--	--
61.115	--	7.475		--
61.149	--	--	7.582	--
62.078	--	--	--	7.821
63.500	8.000	--	--	--
67.610	--	4.672	--	--
67.646	--	xx	4.739	--
68.433	--	xx	xx	4.888
70.000	5.000	xx	xx	xx

EDB-3032 and EDB-3033				
Peak Pellet Exposure (GWd/MT)	$LHGR_{STD}$ (kW/ft) UO_2 Only	$LHGR_{STD}$ (kW/ft) 6% gad 6% max gad	$LHGR_{STD}$ (kW/ft) 5% gad 5% max gad	$LHGR_{STD}$ (kW/ft) 0% gad 4-6% max gad
0.0000	13.400	12.255	12.521	13.100
13.532	--	12.255	--	--
13.656	--	--	12.521	--
15.642	--	--	--	13.100
16.000	13.400	--	--	--
60.625	--	7.316	--	--
61.115	--	--	7.475	--
62.078	--	--	--	7.821
63.500	8.000	--	--	--
67.069	--	4.572	--	--
67.610	--	xx	4.672	--
68.433	--	xx	xx	4.888
70.000	5.000	xx	xx	xx

Bundle Types

GNF Bundle #	GNF Fuel Bundle Identification
EDB-3881	GE14-P10HNAB385-14GZ-100T-148-T6-3881 (GE14B)
EDB-2476	GE14-P10HNAB379-17GZ-100T-150-T6-2476 (GE14C)
EDB-2611	GE14-P10DNAB393-17GZ-100T-150-T6-2611 (GE14C)
EDB-2569	GE14-P10DNAB398-16GZ-100T-150-T6-2569 (GE14C)
EDB-2800	GE14-P10DNAB395-14GZ-100T-150-T6-2800 (GE14C)
EDB-2801	GE14-P10DNAB393-17GZ-100T-150-T6-2801 (GE14C)
EDB-2901	GE14-P10DNAB385-13GZ-100T-150-T6-2901 (GE14C)
EDB-2902	GE14-P10DNAB386-14GZ-100T-150-T6-2902 (GE14C)
EDB-3032	GE14-P10DNAB383-2G6.0/10G5.0-100T-150-T6-3032 (GE14C)
EDB-3033	GE14-P10DNAB383-2G6.0/12G5.0-100T-150-T6-3033 (GE14C)

7. STABILITY POWER/FLOW MAP

7.1 Technical Specification Reference

Technical Specification 3.4.1.

7.2 Stability Exclusion Region

The stability region is represented by the Exclusion Region boundaries defined in Section 15 of Reference 6. A detailed view of the Exclusion Region of the power/flow map is presented in Figure 7-1.

Intentional operation within the Exclusion Region is prohibited. The Exclusion Region is defined in the table below.

Exclusion Region	Power (% of CLTP Rated)	Flow (% of Rated)
A	84.0	58.6
B	35.0	32.50

Point "A" is on the highest flow control line and point "B" is on the natural circulation line (see Figure 7-1).

The region boundaries are defined using the generic shape function given in Reference 6. The calculation of the region boundaries as a function of core thermal power and core flow rate is summarized below.

$$P = P_B \times \left(\frac{P_A}{P_B}\right)^{\frac{1}{2}\left[\frac{W-W_B}{W_A-W_B}+\left(\frac{W-W_B}{W_A-W_B}\right)^2\right]}$$

where,

P = Core thermal power (% of CLTP rated) on the region boundary,

W = Core flow rate (% of rated) corresponding to power, P, on the region boundary,

P_A = Core thermal power (% of CLTP rated) at point A,

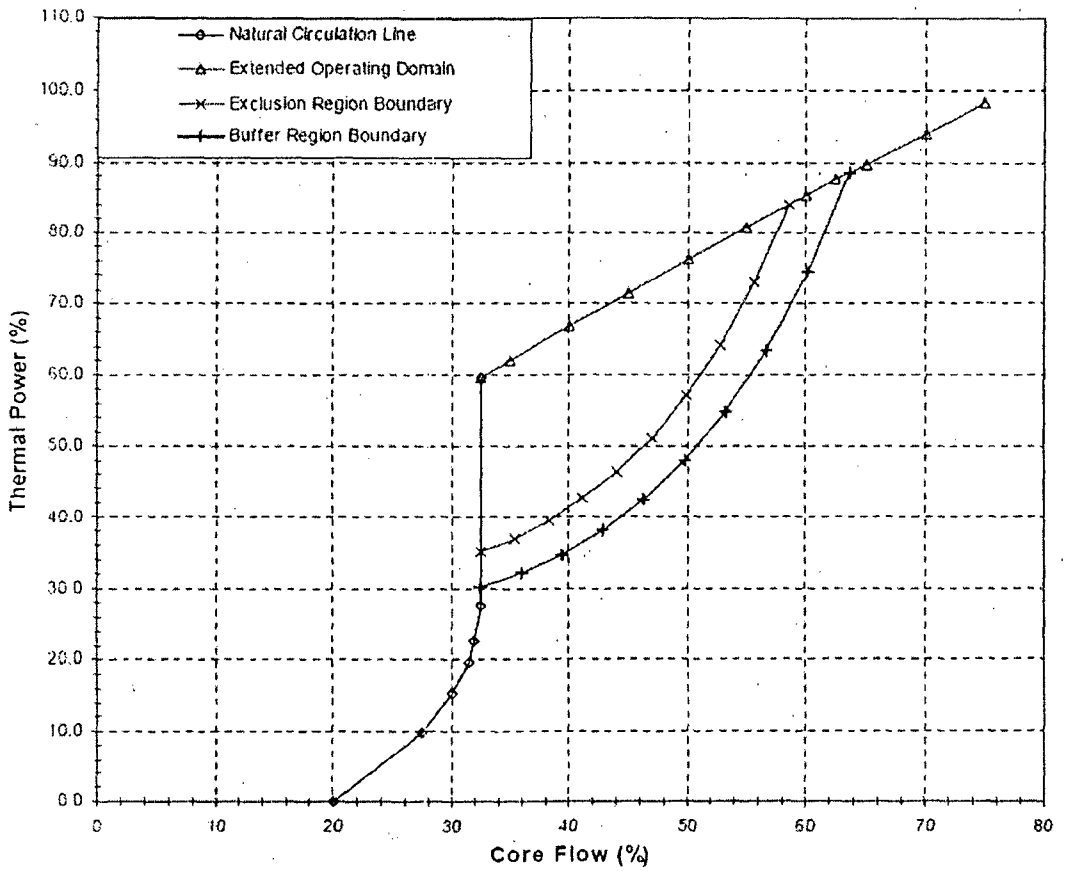
P_B = Core thermal power (% of CLTP rated) at point B,

W_A = Core flow rate (% of rated) at point A,

W_B = Core flow rate (% of rated) at point B.

Figure 7-1

Stability Exclusion Region Map



8. REFERENCES

The following references are identified in this report:

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3. NEDO-31960-A and NEDO-31960-A Supplement 1, "BWR Owner's Group Long-Term Stability Solutions Licensing Methodology", November 1995.
4. NEDC-31892P, "Extended Load Line Limit and ARTS Improvement Program Analyses for Cooper Nuclear Station Cycle 14", Revision 1, May 1991.
5. GE-NE-L12-00867-12, "Project Task Report Cooper Nuclear Station MIG Project Task 900: Transient Analysis", Revision 1, May 2000.
6. 0000-0080-1273-SRLR, "Supplemental Reload Licensing Report for Cooper Nuclear Station Reload 24 Cycle 25", Revision 1, February 2008.
7. CNS Procedure 10.9, "Control Rod Scram Time Evaluation", current rev.
8. GE Design Specification 22A2859, "Turbine-Generator and Steam Bypass System", Paragraph 4.3.8, Revision 3.
9. NEDC 98-024, "APRM - RBM Setpoint Calculation", current revision.
10. deleted
11. GE Letter DTI:NPPD 81-029, "ODYN Option B Scram Time Surveillance Procedures," March 29, 1981.
12. GE Letter DGC:89-190, "Cooper Reload 13 Technical Specification Changes," November 30, 1989.
13. 0000-0080-1273-FBIR, "Fuel Bundle Information Report for Cooper Nuclear Station Reload 24 Cycle 25", Revision 0, February 2008.
14. DB-0012.02, "Fuel-Rod Thermal-Mechanical Performance Limits for GE14", Rev. 0, October 1999
15. DB-0012.03, "Fuel-Rod Thermal-Mechanical Performance Limits for GE14C", Rev. 0, May 2000

ATTACHMENT 3 LIST OF REGULATORY COMMITMENTS©

Correspondence Number: NLS2008062

The following table identifies those actions committed to by Nebraska Public Power District (NPPD) in this document. Any other actions discussed in the submittal represent intended or planned actions by NPPD. They are described for information only and are not regulatory commitments. Please notify the Licensing Manager at Cooper Nuclear Station of any questions regarding this document or any associated regulatory commitments.

COMMITMENT	COMMITMENT NUMBER	COMMITTED DATE OR OUTAGE
None		