COOPER NUCLEAR STATION

CORE OPERATING LIMITS REPORT

CYCLE 29, REVISION 1

NON-PROPRIETARY

COOPER NUCLEAR STATION

CORE OPERATING LIMITS REPORT

Cycle 29
Revision 1

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Information Notice

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

REVISION HISTORY

Revision	Date	Description
0	9/10/14	Original issue
1	07/29/15	Proprietary information marked, correct date on reference 1

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1. INTRODUCTION

The Core Operating Limits Report (COLR) provides the limits for operation of the Cooper Nuclear Station for Cycle 29 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-19-US, "General Electric Standard Application for Reactor Fuel", May 2012 (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) = $MAPLHGR_{STD}$ * LHGRFACp,

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

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

LHGRFACp = Core power dependent multiplier shown in Table 2-2,

LHGRFACf = Core flow rate dependent multiplier shown in Table 2-3.

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 LHGRFACp and LHGRFACf multipliers presented in Table 2-2 and Table 2-3, respectively, are defined in References 5, 6, and 14.

LHGRFACp and LHGRFACf multipliers are applied to MAPLHGR.

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 (LHGRFACp and LHGRFACf) 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 bundles	0.87

Table 2-1: $MAPLHGR_{STD}$ Values

Average Planar Exposure (GWd/MT)	$MAPLHGR_{STD}$ Values for all GE14C 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-2801	GE14-P10DNAB393-17GZ-100T-150-T6-2801 (GE14C)
EDB-3033	GE14-P10DNAB383-2G6.0/12G5.0-100T-150-T6-3033 (GE14C)
EDB-3187	GE14-P10DNAB381-15GZ-100T-150-T6-3187 (GE14C)

Average Planar Exposure (GWd/MT)	$MAPLHGR_{STD}$ Values for all GNF2 bundles (kW/ft)
0.00	12.45
29.40	12.45
67.00	7.50
70.00	6.69

GNF Bundle #	GNF Fuel Bundle Identification
EDB-4115	GNF2-P10DG2B390-14GZ-100T2-150-T6-4115 (GNF2)
EDB-4116	GNF2-P10DG2B389-12GZ-100T2-150-T6-4116 (GNF2)
EDB-4276	GNF2-P10DG2B391-14GZ-100T2-150-T6-4276 (GNF2)
EDB-4277	GNF2-P10DG2B390-2G7.0/10G6.0-100T2-150-T6-4277 (GNF2)

Table 2-2: Power Dependent LHGRFACp Multiplier*

Equipment In Service and Turbine Bypass Valve Out-of-Service (1 Valve OOS)		
Limits for Power < 30.0%		
Power (%)	Limit for Flow >50.0%	Limit for Flow ≤50.0%
25.0	0.405	0.505
30.0	0.422	0.530
Limits for Power ≥30.0%		
Power (%)		Limit
30.0		0.634
100.0		1.000

* Values are based on Turbine Bypass Value Out-of-Service and are conservative to the Equipment in Service values.

Table 2-3: Flow Dependent LHGRFACf Multiplier

Equipment in Service and Turbine Bypass Valve Out-of-Service (1 Valve OOS)	
Limits for a Maximum Runout Flow of 107.0%	
Flow(%)	Limit
32.5	0.677
90.0	1.000
107.0	1.000
Limits for a Maximum Runout Flow of 102.5%	
Flow(%)	Limit
32.5	0.706
80.0	1.000
102.5	1.000
Limits for a Maximum Runout Flow of 112.0%	
Flow(%)	Limit
32.5	0.642
90.0	1.000
112.0	1.000
Limits for a Maximum Runout Flow of 117.0%	
Flow(%)	Limit
32.5	0.606
90.0	1.000
117.0	1.000

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 = maximum [MCPRp, MCPRf]

where,

MCPRp = Core power dependent MCPR shown in Table 3-2,

MCPRf = Core flow rate dependent MCPR shown in Table 3-3.

The MCPRp and MCPRf values presented in Table 3-2 and Table 3-3, respectively, are defined in References 5, 6, and 14.

As shown in Reference 4, the MCPRp value is calculated as follows:

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

For $P < P(Bypass)$, MCPRp = MCPRp 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 MCPRp 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 $\tau_{ave} \le \tau_B$, $\tau = 0$.

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:

$$\text{OLMCPR(100)} = \text{maximum} \begin{cases} \text{OLMCPR}_S \\ \text{OLMCPR}_B + \tau * (\text{OLMCPR}_A - \text{OLMCPR}_B) \end{cases}$$

Using the following value obtained from Section 15 of Reference 6,

OLMCPR_S = Is the maximum of either the Stability OLMCPR at Rated Power / Rated Flow = 1.41, or the SLO pump Pump Seizure event at rated conditions = 1.43 - 0.02 = 1.41.

and 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) = MCPRp + ΔOLMCPR(SLO),

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

ΔOLMCPR(SLO) = 0.02 from Section 11 of Reference 6, and OLMCPR(100), MCPRp, and MCPRf 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 G of Reference 6.

Table 3-1: OLMCPR Values for OLMCPR(100) Calculation

Equipment Status	Applicable Cycle Exposure Range	$OLMCPR_A$		$OLMCPR_B$	
		GNF2	GE14C	GNF2	GE14C
Equipment In-Service	BOC to EOR-2.504 GWd/MT	1.47	1.48	1.37	1.37
	EOR-2.504 GWd/MT to EOC	1.54	1.60	1.44	1.43
Turbine Bypass Valve Out of Service (TBVOOS)	BOC to EOC	1.56	1.61	1.46	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 1.11.

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 15.113 GWd/MT in Reference 6 Section 3. The EOR exposure will vary based on actual cycle operations.

5. $OLMCPR_B$ for GNF2 for equipment in service from BOC to EOR-2.504 GWd/MT is set by the Inadvertent HPCI /L8 transient..

Table 3-2: Power Dependent Kp and MCPRp*

Equipment in Service and Turbine Bypass Valve Out-of-Service (1 Valve OOS)		
Limits for Power <30.0%		
Power (%)	Limit for Flow >50.0% MCPRp	Limits for Flow ≤50.0% MCPRp
25.0	3.40	2.66
30.0	3.12	2.37
Limits for Power ≥30.0%		
Power (%)	Limit Kp	
30.0	1.481	
45.0	1.280	
60.0	1.151	
85.0	1.082	
100.0	1.000	

* Values are based on Turbine Bypass Value Out-of-Service and are conservative to the Equipment in Service values.

Table 3-3: Flow Dependent MCPRf

Equipment in Service and Turbine Bypass Valve Out-of-Service (1 Valve OOS)	
Limits for a Maximum Runout Flow of 107.0%	
Flow(%)	Limit MCPRf
30.0	1.580
85.7	1.240
107.0	1.240
Limits for a Maximum Runout Flow of 102.5%	
Flow(%)	Limit
30.0	1.539
80.0	1.245
102.5	1.245
Limits for a Maximum Runout Flow of 112.0%	
Flow(%)	Limit
30.0	1.625
90.0	1.250
112.0	1.245
Limits for a Maximum Runout Flow of 117.0%	
Flow(%)	Limit
30.0	1.680
90.0	1.287
117.0	1.245

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	Scaled Generic MCPR Limit [2]	Cycle Specific MCPR Limit[2]	Analytical Limit [3]	Allowable Value [3]
Low Trip Setpoint (LTSP)	LPSP ≤ P < IPSP	1.35	1.32	≤ 123.0 / 125	**≤ 120.0 / 125**
Intermediate Trip Setpoint (ITSP)	IPSP ≤ P < HPSP	1.35	1.32	≤ 118.0 / 125	**≤ 115.0 / 125**
High Trip Setpoint (HTSP)	HPSP ≤ P	1.35	1.32	≤ 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, shown in the cycle specific MCPR limit in the above table, were verified in Section 10 of Reference 6 to bound the cycle specific Rod Withdrawal Error (RWE) analysis for an RBM setpoint of 111% of reference level. The scaled generic 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 1.30 was calculated in Reference 4 for an SLMCPR of 1.07. The scaled generic MCPR limit documented above was calculated by multiplying the generic limit of 1.30 by the ratio of the SLMCPR values (1.11/1.07).
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,

LHGRFACp = Core power dependent multiplier shown in Table 2-2,

LHGRFACf = Core flow rate dependent multiplier shown in Table 2-3.

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. The values in Table 6-1 were obtained from Reference 13. The core monitoring computer will be used to verify the pellet specific LHGR limits for each fuel bundle type are not violated.

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 (LHGRFACp and LHGRFACf) 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 bundles	0.87

Table 6-1: Bounding $LHGR_{STD}$ Values By Fuel Bundle Type

EDB-2801, EDB-3033, and EDB-3187		
Peak Pellet Exposure (GWd/MT)	$LHGR_{STD}$ (kW/ft) UO_2 Only	$LHGR_{STD}$ (kW/ft) bounding gad for all gad conc to 6% max
[[		
		]]

Bundle Types

GNF Bundle #	GNF Fuel Bundle Identification
EDB-2801	GE14-P10DNAB393-17GZ-100T-150-T6-2801 (GE14C)
EDB-3033	GE14-P10DNAB383-2G6.0/12G5.0-100T-150-T6-3033 (GE14C)
EDB-3187	GE14-P10DNAB381-15GZ-100T-150-T6-3187 (GE14C)

EDB-4115, EDB-4116, EDB-4276, and EDB-4277		
Peak Pellet Exposure (GWd/MT)	$LHGR_{STD}$ (kW/ft) UO_2 Only	$LHGR_{STD}$ (kW/ft) bounding gad for all gad conc to 7% max
[[		
		]]

Bundle Types

GNF Bundle #	GNF Fuel Bundle Identification
EDB-4115	GNF2-P10DG2B390-14GZ-100T2-150-T6-4115 (GNF2)
EDB-4116	GNF2-P10DG2B389-12GZ-100T2-150-T6-4116 (GNF2)
EDB-4276	GNF2-P10DG2B391-14GZ-100T2-150-T6-4276 (GNF2)
EDB-4277	GNF2-P10DG2B390-2G7.0/10G6.0-100T2-150-T6-4277 (GNF2)

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)
Highest Flow Control Line Endpoint	70.7	44.1
Natural Circulation Line Endpoint	41.1	32.5

The region boundaries are defined using the modified shape function given in Reference 10. The calculation of the region boundaries as a function of core thermal power and core flow rate is summarized below.

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

where,

P = a core thermal power value on the region boundary (% of rated),

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

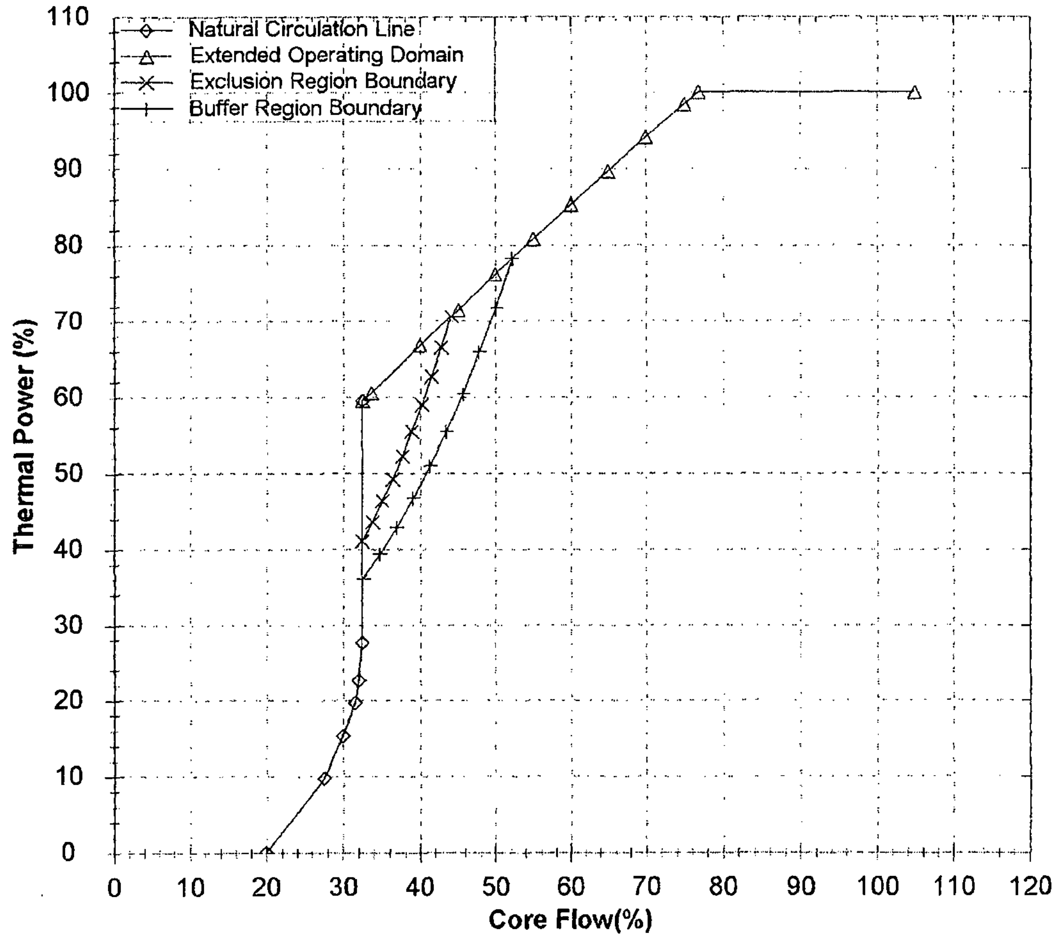
P_A = core thermal power at the highest flow control line endpoint (% of rated on the highest flow control line),

P_B = core thermal power at the natural circulation line endpoint (% of rated on the natural circulation line),

W_A = core flow rate at the highest flow control line endpoint (% of rated on the highest flow control line),

W_B = core flow rate at the natural circulation line endpoint (% of rated on the natural circulation line).

Figure 7-1: Stability Exclusion Region Map



8. REFERENCES

The following references are identified in this report:

1. NEDE-24011-P-A-19, "General Electric Standard Application for Reactor Fuel", May 2012.

2. 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.

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. NEDC-33270P, "GNF2 Advantage Generic Compliance with NEDE-24011-P-A (GESTAR II)", Revision 4, October 2011.

6. 001N0731-R1, "Supplemental Reload Licensing Report for Cooper Nuclear Station Reload 28 Cycle 29", Revision 0, July 2014.

7. CNS Procedure 10.9, "Control Rod Scram Time Evaluation", current revision.

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

11. GE Letter DTI:NPPD 81-029, "ODYN Option B Scram Time Surveillance Procedures," March 29, 1981.

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