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JAFP-22-0033
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United States Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

James A. FitzPatrick Nuclear Power Plant
Renewed Facility Operating License No. DPR-59
NRC Docket No. 50-333

Subject: Core Operating Limits Report Mid-Cycle 25

Dear Sir or Madam,

Enclosed is the James A. FitzPatrick Nuclear Power Plant (JAF) Core Operating Limits Report (COLR). This revision includes Feedwater Heater Out of Service (FWHOOS) as a mode of operation in Cycle 25. This report is submitted in accordance with JAF Technical Specifications (TS) 5.6.5.

There are no new regulatory commitments contained in this letter. Questions concerning this report may be addressed to Mr. Andrew Ross, (315) 349-2562.

Very truly yours,

Richard M. Sullivan
Regulatory Assurance Manager

RMS/pa

Enclosure: Core Operating Limits Report for James A. FitzPatrick Nuclear Power Plant Unit 1 Reload 24 Cycle 25

cc: (w/ enclosure)

NRC Regional Administrator, NRC Region 1
NRC Project Manager
NRC Resident Inspector
NYSERDA
NYSPSC

JAFP-22-0033

ENCLOSURE

Core Operating Limits Report for James A. FitzPatrick Nuclear Power Plant Unit 1 Reload 24 Cycle 25

(19 Pages)

CORE OPERATING LIMITS REPORT

FOR

JAMES A. FITZPATRICK NUCLEAR POWER PLANT

UNIT 1 RELOAD 24 CYCLE 25

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Revision History

Revision	Description
Revision 2	Revised to include FWHOOS as a Mode of Operation in Cycle 25
Revision 1	First issuance for Cycle 25

List of Tables

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1.0 Terms and Definitions

APLHGR	Average Planar Linear Heat Generation Rate
APRM	Average Power Range Monitor
BASE	This condition is defined by a group of individual operating conditions that are applicable to all Modes of Operation discussed in Section 9. The “BASE” condition includes the EOOS conditions provided in Table 9-2, concurrent with FWHOOS/FFWTR.
DLO	Dual Loop Operation
EOC	End of Cycle
EOOS	Equipment Out of Service
EOR	End of Rated; the cycle exposure at which reactor power is equal to rated thermal power with recirculation system flow equal to 100%, all control rods fully withdrawn, nominal feedwater temperature, and equilibrium xenon.
FFWTR	Final Feedwater Temperature Reduction
FWHOOS	Feedwater Heater(s) Out of Service
FWTR	Feedwater Temperature Reduction
ICF	Increased Core Flow
K_P	Off-rated power dependent OLMCPR multiplier
LHGR	Linear Heat Generation Rate
$LHGRFAC_F$	Off-rated flow dependent LHGR multiplier
$LHGRFAC_P$	Off-rated power dependent LHGR multiplier
$MAPFAC_F$	Off-rated flow dependent MAPLHGR multiplier
$MAPFAC_P$	Off-rated power dependent MAPLHGR multiplier
MAPLHGR	Maximum Average Planar Linear Heat Generation Rate
MCPR	Minimum Critical Power Ratio
MCPR99.9%	Limiting MCPR value such that 99.9 percent of the fuel in the core is not susceptible to boiling transition
$MCPR_F$	Off-rated flow dependent OLMCPR
$MCPR_P$	Off-rated power dependent OLMCPR
MELLL	Maximum Extended Load Line Limit

MOC	Defined in the licensing as the exposure corresponding to EOR – 3997 MWd/ST for Cycle 25 (Reference 2)
MSIVOOS	Main Steam Isolation Valve Out of Service
OLMCPR	Operating Limit Minimum Critical Power Ratio
P-bypass	Reactor power level below which the TSV position and the TCV fast closure scrams are bypassed
PROOS	Pressure Regulator Out of Service
Rated recirculation flow	Required drive flow to achieve rated core flow
RBM	Rod Block Monitor
RTP	Rated Thermal Power
RWE	Rod Withdrawal Error
SLMCPR	Safety Limit Minimum Critical Power Ratio
SLO	Single Loop Operation
SRVOOS	Safety/Relief Valve(s) Out of Service
TBVOOS	Turbine Bypass Valve(s) Out of Service
TRM	Technical Requirements Manual
W	Loop drive flow in percent of rated

2.0 General Information

This report provides the following cycle-specific parameter limits for James A. FitzPatrick Unit 1 Cycle 25:

- Average Planar Linear Heat Generation Rate (APLHGR)
- Minimum Critical Power Ratio (MCPR) and MCPR(99.9%)
- Linear Heat Generation Rate (LHGR)
- Flow-Biased Average Power Range Monitor (APRM) Allowable Values
- Rod Block Monitor (RBM) Upscale Function Allowable Values
- Power/Flow Exclusion Region

This report is prepared in accordance with Technical Specification 5.6.5 of Reference 1. Preparation of this report was performed in accordance with Constellation Energy Generation, Nuclear Fuels T&RM NF-AB-120-3600.

The data presented in this report is valid for all licensed operating domains on the operating map, including (Reference 2):

- Maximum Extended Load Line Limit down to the minimum licensed core flow (i.e., 79.8% of rated) during full power operation (2536 MWth)
- Rated core flow of 77.0 Mlb/hr
- Increased Core Flow (ICF) up to 105% of rated core flow
- Final Feedwater Temperature Reduction (FFWTR) up to 80°F limited to the load line corresponding to 95% rated core flow at rated power during cycle extension operation
- Feedwater Heater Out of Service (FWHOOS) feedwater temperature reduction up to 80°F limited to the load line corresponding to 95% rated core flow at rated power and at exposures MOC to EOC during normal operation (Reference 8)
- End-of-Cycle coastdown to minimum power level of 40%

Further information on the cycle-specific analyses for FitzPatrick Unit 1 Cycle 25 and the associated operating domains discussed above is available in References 2 and 8.

Per Technical Specification 5.6.5, these values have been determined using NRC-approved methodology and are established such that all applicable limits of the plant safety analysis are met.

A variation of 2% in core flow or 10 psi in dome pressure or 10°F in feedwater temperature has a negligible effect on the calculated ΔCPR or peak vessel pressure (Reference 2).

3.0 MAPLHGR Limits

3.1 Technical Specification

Sections 3.2.1 and 3.4.1

3.2 Description

The MAPLHGR limits for the most limiting lattice for GNF2 fuel, as a function of average planar exposure, is given in Table 3-1. For single loop operation, a multiplier is used, which is shown in Table 3-2. The power and flow dependent multipliers for MAPLHGR have been removed and replaced with $LHGRFAC_P$ and $LHGRFAC_F$; therefore, $MAPFAC_P$ and $MAPFAC_F$ are equal to 1.0 for all power and flow conditions (Reference 2). $LHGRFAC_P$ and $LHGRFAC_F$ are addressed in Section 5.0.

Table 3-1
MAPLHGR Versus Average Planar Exposure
(Reference 2)

Average Planar Exposure (GWd/ST)	MAPLHGR Limit (kW/ft)
0.00	13.78
17.52	13.78
60.78	7.50
63.50	6.69

Table 3-2
MAPLHGR Single Loop Operation (SLO) Multiplier
(Reference 2)

SLO Multiplier	0.85

4.0 MCPR Limits

4.1 Technical Specification

Sections 3.2.2, 3.4.1, and 3.7.6

4.2 Description

The Operating Limit MCPR (OLMCPR) for GNF2 fuel is provided in Table 4-1. These values are determined by the cycle-specific reload analyses in Reference 2 and are valid for all Cycle 25 operating domains. Table 4-1 includes OLMCPR values for all conditions listed in Section 9.0, Modes of Operation. For single loop operation, the MCPR operating limit is 0.03 greater than the analyzed dual loop value. A minimum value of 1.44 is required to obtain an OLMCPR set by the Single Loop Operation Recirculation Pump Seizure Event.

Control rod scram time verification is required per Technical Specification 3.1.4, “Control Rod Scram Times”. Tau (τ), a measure of scram time performance to notch position 36 throughout the cycle, is determined based on cumulative scram time test results (Reference 7). The calculation of Tau shall be performed in accordance with site procedures. Linear interpolation shall be used to calculate the OLMCPR value if Tau is between 0.0 (Tau Option B) and 1.0 (Tau Option A).

The power dependent MCPR limits for GNF2 fuel are presented in Table 4-2. Below P-bypass, the $MCPR_P$ limits in Table 4-2 are applied directly; at or above P-bypass, the K_P multiplier is applied to the OLMCPR from Table 4-1. The appropriate $MCPR_P$ or K_P value may be determined by linear interpolation for points not explicitly listed. The flow dependent MCPR limits are provided in Tables 4-3 and 4-4.

The cycle-specific SLMCPR, known as MCPR99.9%, can be found in Table 4-5 for dual loop and single loop operating conditions. The values in Table 4-5 or conservative values were used to calculate the rated and off-rated MCPR limits.

The OLMCPR is determined for a given power and flow condition by evaluating the power and flow dependent MCPR values and selecting the greater of the two.

Table 4-1
Operating Limit Minimum Critical Power Ratio (OLMCPR)
(Reference 2)

EOOS Combination	SCRAM Time Option	Cycle Exposure		
		< 3583 MWd/ST	≥ 3583 MWd/ST & < EOR – 3997 MWd/ST	≥ EOR – 3997 MWd/ST
BASE	A	1.45	1.45	1.50
	B	1.39	1.32	1.36
BASE SLO	A	1.48	1.48	1.53
	B	1.44	1.44	1.44
TBVOOS	A	1.54	1.54	1.54
	B	1.40	1.40	1.40
TBVOOS SLO	A	1.57	1.57	1.57
	B	1.44	1.44	1.44
PROOS	A	1.45	1.45	1.50
	B	1.39	1.32	1.36
PROOS SLO	A	1.48	1.48	1.53
	B	1.44	1.44	1.44

Table 4-2
Power Dependent MCPR Limits and Multipliers, $MCPR_P$ and K_P
(Reference 2)

EOOS Combination	Core Flow (% of rated)	Core Thermal Power (% of Rated)							
		0	25	≤ 29	> 29	40	60	85	100
		Operating Limit MCPR, $MCPR_P$			Operating Limit MCPR Multiplier, K_P				
BASE	< 60	2.41	2.41	2.35	1.520	1.390	1.150	1.056	1.000
	≥ 60	2.74	2.74	2.63					
BASE SLO	< 60	2.44	2.44	2.38	1.520	1.390	1.150	1.056	1.000
	≥ 60	2.77	2.77	2.66					
TBVOOS	< 60	2.53	2.53	2.35	1.520	1.390	1.150	1.056	1.000
	≥ 60	2.74	2.74	2.63					
TBVOOS SLO	< 60	2.56	2.56	2.38	1.520	1.390	1.150	1.056	1.000
	≥ 60	2.77	2.77	2.66					
PROOS	< 60	2.41	2.41	2.35	1.520	1.390	1.177	1.164	1.000
	≥ 60	2.74	2.74	2.63					
PROOS SLO	< 60	2.44	2.44	2.38	1.520	1.390	1.177	1.164	1.000
	≥ 60	2.77	2.77	2.66					

Table 4-3
Flow Dependent MCPR Limits, $MCPR_F$
(Reference 2)

Flow (% rated)	$MCPR_F$[1]
0.0	1.76
30.0	1.58
89.4	1.22
117.0	1.22

Table 4-4
Single Loop Operation (SLO) Flow Dependent MCPR Limits, $MCPR_F$
(Reference 2)

Flow (% rated)	$MCPR_F$
0.0	1.79
30.0	1.61
89.4	1.25
117.0	1.25

Table 4-5
Cycle-Specific SLMCPR (MCPR99.9%)
(Reference 2)

Loop Operation	MCPR99.9% Limit
DLO	1.08
SLO	1.10

[1] Values are applicable up to a Maximum Runout Flow of 112% of rated.

5.0 LHGR Limits

5.1 Technical Specification

Sections 3.2.3 and 3.7.6

5.2 Description

The LHGR limit for the GNF2 fuel type is the product of the exposure dependent LHGR limit (from Table 5-1 for UO_2 fuel rods and Table 5-2 for Gadolinia fuel rods) and the minimum of the power dependent LHGR factor, $LHGRFAC_P$, and the flow dependent LHGR factor, $LHGRFAC_F$. The $LHGRFAC_P$ multiplier is determined from Table 5-4. The $LHGRFAC_F$ multiplier is determined from Table 5-5.

The single loop operation multiplier is shown in Table 5-3 and applied in Table 5-5.

Linear interpolation should be used for points not explicitly listed, or as directed in Reference 6 for Tables 5-1 and 5-2.

Table 5-1
Linear Heat Generation Rate Limits – UO_2 Rods
(References 4 and 6)

Fuel Type	LHGR
GNF2	See Table B-1 of Reference 6

Table 5-2
Linear Heat Generation Rate Limits – Gadolinia Rods
(References 4 and 6)

Fuel Type	LHGR
GNF2	See Table B-2 of Reference 6

Table 5-3
LHGR Single Loop Operation (SLO) Multiplier
(Reference 2)

SLO Multiplier	0.85

Table 5-4
Power Dependent LHGR Multiplier, $LHGRFAC_P$
(Reference 2)

EOOS Combination	Core Flow (% of rated)	Core Thermal Power (% of Rated)							
		0	25	≤ 29	> 29	40	60	85	100
		$LHGRFAC_P$ Multiplier							
BASE	< 60	0.513	0.513	0.524	0.625	0.683	0.789	0.921	1.000
	≥ 60	0.513	0.513	0.524					
BASE SLO	< 60	0.513	0.513	0.524	0.625	0.683	0.789	0.921	1.000
	≥ 60	0.513	0.513	0.524					
TBVOOS	< 60	0.415	0.415	0.470	0.625	0.683	0.789	0.921	1.000
	≥ 60	0.408	0.408	0.410					
TBVOOS SLO	< 60	0.415	0.415	0.470	0.625	0.683	0.789	0.921	1.000
	≥ 60	0.408	0.408	0.410					
PROOS	< 60	0.513	0.513	0.524	0.625	0.683	0.789	0.921	1.000
	≥ 60	0.513	0.513	0.524					
PROOS SLO	< 60	0.513	0.513	0.524	0.625	0.683	0.789	0.921	1.000
	≥ 60	0.513	0.513	0.524					

Table 5-5
Flow Dependent LHGR Multiplier, $LHGRFAC_F$
(Reference 2)

EOOS Combination	Core Flow (% of rated)				
	0	30	62.94	85	110
	$LHGRFAC_F$ Multiplier				
Dual Loop Operation	0.422	0.626		1.000	1.000
Single Loop Operation	0.422	0.626	0.850		0.850

6.0 APRM Allowable Values

6.1 Technical Specification

Sections 3.3.1.1 and 3.4.1

6.2 Description

When operating in MODE 1, the APRM Neutron Flux-High (Flow Biased) Allowable Values shall be set as provided in Table 6-1. APRM Neutron Flux-High (Flow Biased) Rod Block Allowable Values are found in TRM 3.3.B, Control Rod Block Instrumentation.

Table 6-1
APRM Allowable Values
(Reference 3)

APRM Neutron Flux-High (Flow Biased) Function	Allowable Value (% RTP)	Applicable Drive Flow Range
Dual Loop Operation	0.38W + 61.0%	0 < W ≤ 24.7%
	1.15W + 42.0%	24.7 < W ≤ 47.0%
	0.63W + 73.7%	47.0 < W ≤ 68.7%
	117.0% (clamp)	W > 68.7%
Single Loop Operation	0.38W + 57.9%	0 < W ≤ 32.7%
	1.15W + 32.8%	32.7 < W ≤ 50.1%
	0.58W + 61.3%	50.1 < W ≤ 95.9%
	117.0% (clamp)	W > 95.9%

7.0 RBM Allowable Values

7.1 Technical Specification

Sections 3.3.2.1 and 3.4.1

7.2 Description

The Rod Block Monitor Upscale Allowable Values are determined from the relationships shown in Table 7-1. The setpoint is set at maximum equipment adjustability limits and still complies with the RWE analysis because RWE is analyzed unblocked (Reference 2). The allowable value is clamped with a maximum value not to exceed 120.9%, the allowable value for recirculation loop drive flow (W) of 100% per Reference 5.

Table 7-1
Rod Block Monitor Setpoints
(Reference 5)

Rod Block Monitor Upscale Trip Function	Allowable Value (%RTP)
Dual Loop and Single Loop Operation	≤ 0.66W + 54.9%

8.0 Power/Flow Exclusion Region and Buffer Zone

8.1 Technical Specification

Section 3.4.1

8.2 Description

The FitzPatrick Unit 1 Cycle 25 power/flow relationship for the Stability Option I-D Exclusion and Buffer Region is shown in Figure 8-1 for Normal Feedwater Temperature Operation and in Figure 8-2 for Reduced Feedwater Temperature Operation.

Figure 8-1
Exclusion and Buffer Region Illustration – Normal Feedwater Temperature Operation
(Reference 2)

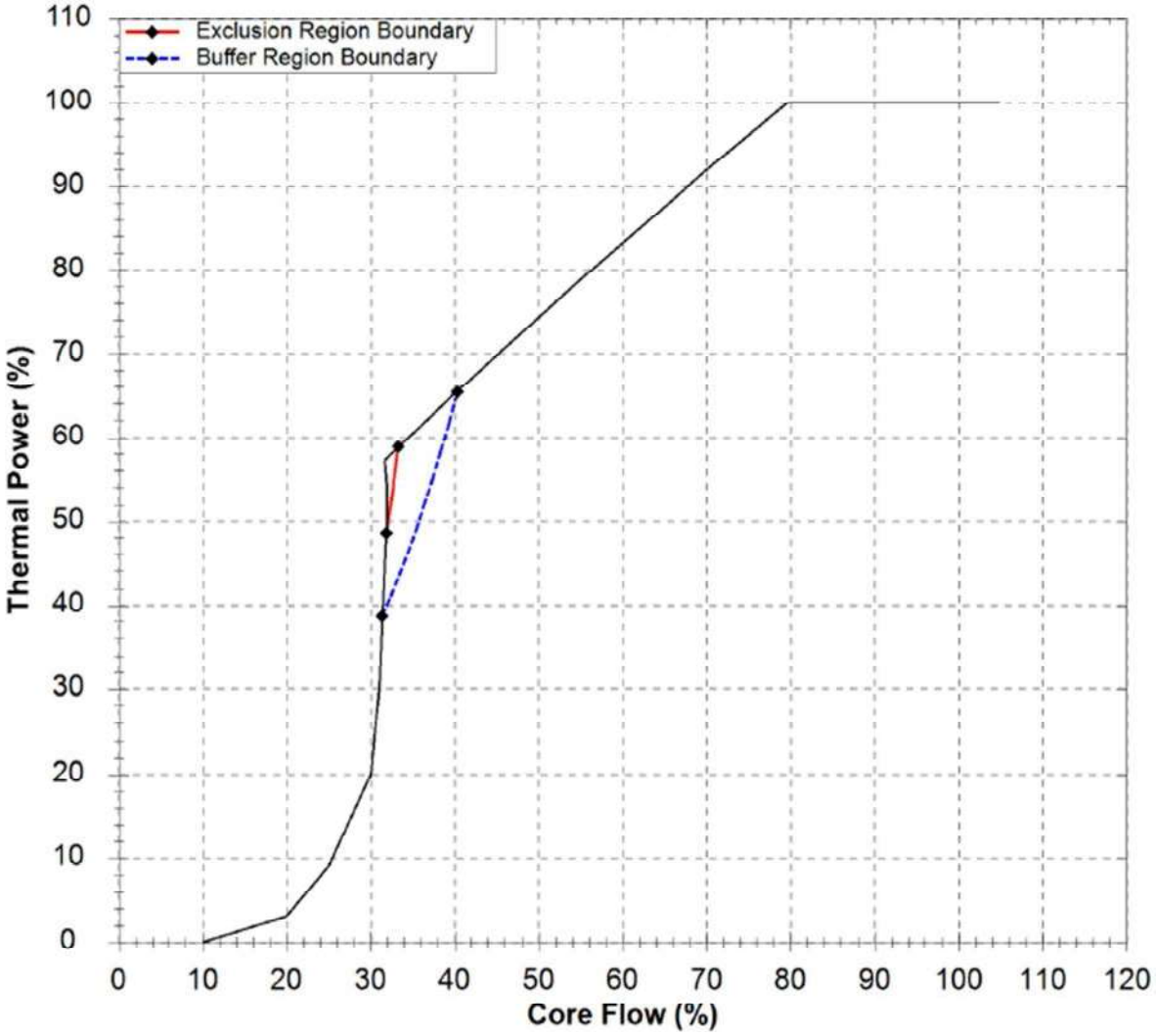
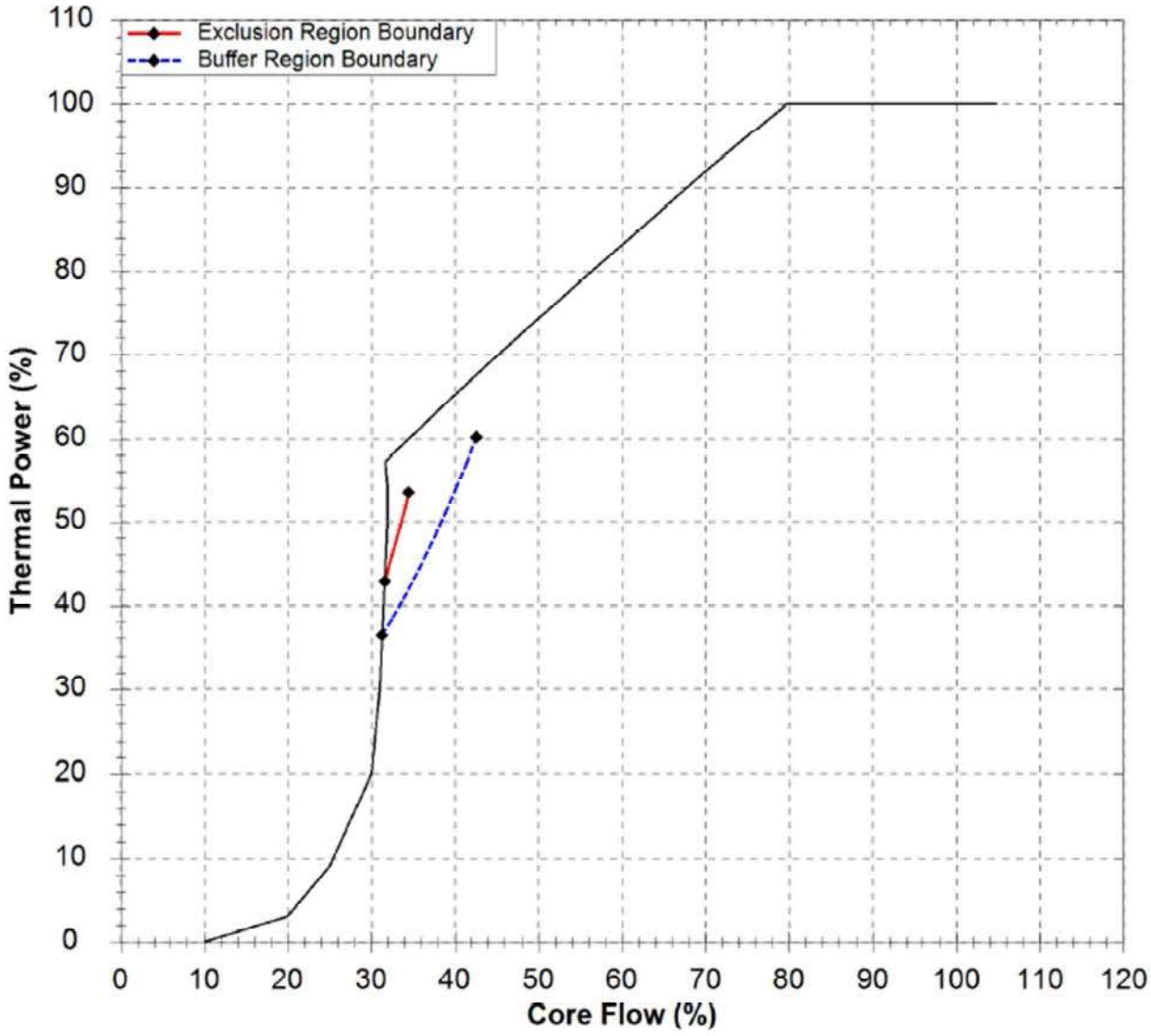


Figure 8-2
Exclusion and Buffer Region Illustration – Reduced Feedwater Temperature Operation (Reference 2)



9.0 Modes of Operation

The following conditions are supported by the FitzPatrick Unit 1 Cycle 25 licensing analysis; operation in a condition (or conditions) is controlled by station procedures. **If a combination of options is not listed, it is not supported.** Table 9-1 provides allowed modes of operation with thermal limit sets in this COLR. Table 9-2 provides allowed modes of operation that do not contain explicit thermal limit sets in this COLR. Table 9-3 provides power level restrictions that support specific operating conditions.

Table 9-1
Modes of Operation
(References 2 and 8)

EOOS Options	Supported Scram Speed Option	Supported Recirculation Loops
BASE[1]	A or B	DLO or SLO
TBVOOS	A or B	DLO or SLO
PROOS	A or B	DLO or SLO

Table 9-2
"BASE" EOOS Option – Included Conditions
(Reference 2)

Condition
SRVOOS[2]
MSIVOOS[3]

Table 9-3
Power Level Restrictions
(Reference 2)

Condition	Power Level Restrictions (% rated)
1 MSIVOOS	≤ 75

[1] The "BASE" condition includes operation with or without FWHOOS/FFWTR.
[2] Includes up to 2 SRVOOS.
[3] Includes up to 1 MSIVOOS.

10.0 Methodology

The analytical methods used to determine the core operating limits shall be those previously reviewed and approved by the NRC, specifically those described in the following document:

1. "General Electric Standard Application for Reactor Fuel," NEDE-24011-P-A-29, October 2019 and U.S. Supplement NEDE-24011-P-A-29-US, October 2019.

11.0 References

1. "James A. FitzPatrick Nuclear Power Plant Renewed Facility Operating License", Docket No. 50-333, Renewed License No. DPR-59.

2. "Supplemental Reload Licensing Report for FitzPatrick Reload 24 Cycle 25", Global Nuclear Fuel Document No. 006N1761, Revision 0, July 2020.

3. "Setpoint Calculation for APRM A through F", FitzPatrick Calculation Doc No. JAF-CALC-NMS-00758 Revision 12, March 2019.

4. "Fuel Bundle Information Report for FitzPatrick Reload 24 Cycle 25", Global Nuclear Fuel Document No. 005N1960, Revision 0, July 2020.

5. "Setpoint Calculation for the Rod Block Monitor (07RBM-82A, B)", FitzPatrick Calculation Doc. No. JAF-CALC-NMS-00759, Revision 8D, October 2018.

6. "GNF2 Advantage Generic Compliance with NEDE-24011-P-A (GESTAR II)," Global Nuclear Fuel Document No. NEDC-33270P, Revision 10, March 2020.

7. "Scram Times Versus Notch Positions for Option B", GNF Letter REK-E:02-009, May 28, 2002.

8. "Feedwater Heater Out-of-Service Evaluation for Cycle 25 from MOC to EOC for Constellation Energy Generation, LLC James A. FitzPatrick Nuclear Power Plant," GE Hitachi Nuclear Energy Document No. 007N1164, Revision 0, June 2022.