CORE OPERATING LIMITS REPORT FOR

PEACH BOTTOM ATOMIC POWER STATION UNIT 3

RELOAD 24, CYCLE 25

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Table of Contents

		Page
	Revision History	3
	List of Tables	4
1.0	Terms and Definitions	6
2.0	General Information	8
3.0	MAPLHGR Limits	9
4.0	MCPR Limits	10
5.0	LHGR Limits	15
6.0	Rod Block Monitor Setpoints	19
7.0	Turbine Bypass Valve Parameters	20
8.0	EOC Recirculation Pump Trip (EOC-RPT) Operability	21
9.0	Stability Protection	22
10.0	Asymmetric Feedwater Temperature Operation (AFTO)	24
11.0	Modes of Operation	31
12.0	Methodology	32
13.0	References	32
	Appendix A: Power/Flow Operating Map for MELLLA+ with TPO	34

Revision History

Revision	Description
Revision 19	Initial issuance for Cycle 25

List of Tables

		Page
Table 3-1	MAPLHGR Versus Average Planar Exposure GNF2 Fuel	9
Table 3-2	MAPLHGR Versus Average Planar Exposure GNF3 Fuel	9
Table 3-3	MAPLHGR Single Loop Operation (SLO) Multiplier	9
Table 4-1	Operating Limit Minimum Critical Power Ratio (Symmetric Feedwater Heating) All Fuel Types	11
Table 4-2	Power Dependent MCPR(P) Limit Adjustments and Multipliers (Symmetric Feedwater Heating) All Fuel Types	12
Table 4-3	Flow Dependent MCPR Limits MCPR(F) (Symmetric Feedwater Heating) GNF2 Fuel	13
Table 4-4	Flow Dependent MCPR Limits MCPR(F) (Symmetric Feedwater Heating) GNF3 Fuel	13
Table 4-5	SLO Flow Dependent MCPR Limits MCPR(F) (Symmetric Feedwater Heating) GNF2 Fuel	13
Table 4-6	SLO Flow Dependent MCPR Limits MCPR(F) (Symmetric Feedwater Heating) GNF3 Fuel	13
Table 4-7	Cycle Specific SLMCPR ($MCPR_{99.9\%}$) All Fuel Types	14
Table 5-1	Linear Heat Generation Rate Limits - UO2 Rods	15
Table 5-2	Linear Heat Generation Rate Limits - Gad Rods	15
Table 5-3	Power Dependent LHGR Multiplier LHGRFAC(P) (Symmetric Feedwater Heating) GNF2 Fuel	16
Table 5-4	Power Dependent LHGR Multiplier LHGRFAC(P) (Symmetric Feedwater Heating) GNF3 Fuel	17
Table 5-5	Power Dependent LHGR Multiplier LHGRFAC(P) Asymmetric Loss of Feedwater Heating GNF3 Fuel	18
Table 5-6	Flow Dependent LHGR Multiplier LHGRFAC(F) (Symmetric Feedwater Heating) GNF2 Fuel	18
Table 5-7	Flow Dependent LHGR Multiplier LHGRFAC(F) (Symmetric Feedwater Heating) GNF3 Fuel	18
Table 6-1	Rod Block Monitor Setpoints All Fuel Types	19
Table 7-1	Turbine Bypass System Response Time	20
Table 7-2	Minimum Required Bypass Valves to Maintain System Operability	20

Table 8-1 Recirculation Pump Trip Response Time 21

Table 9-1 Automated BSP Setpoints for the Scram Region 22

Table 9-2 Manual BSP Endpoints for Normal Feedwater Temperature 23

Table 9-3 Manual BSP Endpoints for Reduced Feedwater Temperature 23

Table 10-1 AFTO MAPLHGR Reduction Factor (Asymmetric Feedwater Heating) All Fuel Types 24

Table 10-2 AFTO Operating Limit Minimum Critical Power Ratio 20°F < FWT DELTA ≤ 55°F (Asymmetric Feedwater Heating) All Fuel Types 25

Table 10-3 AFTO Power Dependent MCPR Limit Adjustments and Multipliers MCPR(P) 20°F < FWT DELTA ≤ 55°F (Asymmetric Feedwater Heating) All Fuel Types 26

Table 10-4 AFTO Flow Dependent MCPR Limits MCPR(F) 20°F < FWT DELTA ≤ 55°F (Asymmetric Feedwater Heating) GNF2 Fuel 27

Table 10-5 AFTO Flow Dependent MCPR Limits MCPR(F) 20°F < FWT DELTA ≤ 55°F (Asymmetric Feedwater Heating) GNF3 Fuel 27

Table 10-6 AFTO Power Dependent LHGR Multiplier LHGRFAC(P) 20°F < FWT DELTA ≤ 55°F (Asymmetric Feedwater Heating) GNF2 Fuel 28

Table 10-7 AFTO Power Dependent LHGR Multiplier LHGRFAC(P) 20°F < FWT DELTA ≤ 55°F (Asymmetric Feedwater Heating) GNF3 Fuel 29

Table 10-8 AFTO Flow Dependent LHGR Multiplier LHGRFAC(F) 20°F < FWT DELTA ≤ 55°F (Asymmetric Feedwater Heating) GNF2 Fuel 30

Table 10-9 AFTO Flow Dependent LHGR Multiplier LHGRFAC(F) 20°F < FWT DELTA ≤ 55°F (Asymmetric Feedwater Heating) GNF3 Fuel 30

Table 11-1 Modes of Operation 31

Table 11-2 EOOS Options Included in 'Base' Conditions 31

Table 11-3 Power Level Restrictions 31

1.0 TERMS AND DEFINITIONS

ABSP	Automated Backup Stability Protection
AFTO	Asymmetric Feedwater Temperature Operation
ALOFH	Asymmetric Loss of Feedwater Heating
APRM	Average Power Range Monitor
ARTS	APRM, Rod Block and Technical Specification Improvement Program
BASE	The “Base” condition is for normal, steady state operation. See Section 11 for more details
BSP	Backup Stability Protection
DLO	Dual Loop Operation
DSS-CD	Detect and Suppress Solution – Confirmation Density
ECCS-LOCA	Emergency Core Cooling System – Loss of Coolant Accident
EOC	End of Cycle
EOC-RPT	End of Cycle Recirculation Pump Trip
EOOS	Equipment Out of Service. An analyzed option that assumes certain equipment to be non-operational
EOR	End of Rated. The cycle exposure at which reactor power is equal to 100% with recirculation system flow equal to 100%, all control rods fully withdrawn, all feedwater heating in service and equilibrium Xenon
FW	Feedwater
FFWTR	Final Feedwater Temperature Reduction
FWHOOS	Feedwater Heaters Out of Service
FWT	Feedwater Temperature
HFCL	High Flow Control Line
HTSP	Rod Block Monitor High Trip Setpoint
INOP	Inoperable
ITSP	Rod Block Monitor Intermediate Trip Setpoint
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
LTSP	Rod Block Monitor Low Trip Setpoint
MAPLHGR	Maximum Average Planar Linear Heat Generation Rate
MCPR	Minimum Critical Power Ratio
$MCPR_{99.9\%}$	Limiting MCPR value such that 99.9% 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
MELLLA	Maximum Extended Load Line Limit Analysis
MELLLA+	Maximum Extended Load Line Limit Analysis Plus
MSIVOOS	Main Steam Isolation Valve Out of Service
NCL	Natural Circulation Line
NRC	Nuclear Regulatory Commission
OLMCPR	Operating Limit Minimum Critical Power Ratio
PLUOOS	Power Load Unbalance Out of Service

PROOS	Pressure Regulator Out of Service
PR/PLUOOS	Pressure Regulator and/or Power Load Unbalance Out of Service
RBM	Rod Block Monitor
RDF	Recirculation Drive Flow
RPT	Recirculation Pump Trip
RPTOOS	Recirculation Pump Trip Out of Service
RTP	Rated Thermal Power
RWE	Rod Withdrawal Error
S_{AD}	Amplitude Discriminator Setpoint
SFTO	Symmetric Feedwater Temperature Operation
SLMCPR	Safety Limit Minimum Critical Power Ratio
SLO	Single Loop Operation
SRVOOS	Safety Relief Valve Out of Service
Tau (τ)	A measure of scram time performance to notch position 36 throughout the cycle
TBSOOS	Turbine Bypass System Out of Service
TBVOOS	Turbine Bypass Valve Out of Service
TCV	Turbine Control Valve
TCVSC	Turbine Control Valve Slow Closure
TCV/TSVOOS	Turbine Control Valve and/or Turbine Stop Valve Out of Service
TPO	Thermal Power Optimization, also known as Measurement Uncertainty Recapture (MUR)
TSV	Turbine Stop Valve

2.0 GENERAL INFORMATION

This report provides the following cycle-specific parameter limits for Peach Bottom Atomic Power Station Unit 3 Cycle 25 (Reload 24):

- Maximum Average Planar Linear Heat Generation Rate (MAPLHGR)
- Single Loop Operation (SLO) MAPLHGR multipliers
- Operating Limit Minimum Critical Power Ratio (OLMCPR)
- ARTS MCPR thermal limits and multipliers
- SLO MCPR limits
- Cycle specific SLMCPR ($MCPR_{99.9\%}$)
- Linear Heat Generation Rate (LHGR)
- ARTS LHGR thermal limit multipliers
- SLO LHGR multipliers
- Rod Block Monitor (RBM) Allowable Values and MCPR Limits
- Turbine Bypass Valve Parameters
- EOC Recirculation Pump Trip (EOC-RPT) Parameters
- Stability Protection Setpoints
- Asymmetric Feedwater Temperature Operation (AFTO) thermal limit penalties
- Power Level Restrictions

These values have been determined using NRC-approved methodology and are established such that all applicable limits of the plant safety analysis are met. SLO, FWHOOS operation, and FFWTR operation are not permitted in the MELLLA+ Region as controlled by station procedures. For the MELLLA+ Region, a specific definition of FWHOOS is provided in Facility Operating License Section 2.C(16). Operation in the MELLLA+ Region with up to a 10°F reduction in feedwater temperature below the design feedwater temperature is permitted.

This report provides cycle-specific OLMCPR, LHGR, and MAPLHGR thermal limits and related information for the following conditions:

- All points in the operating region of the power/flow map including the MELLLA+ Region down to 85.2% of rated core flow during full power (4016 MWt) operation (Appendix A)
- Increased Core Flow, up to 110% of rated core flow
- End-of-Cycle Power Coastdown to a minimum power level of 40%
- Feedwater Heaters Out of Service (FWHOOS) up to 55° F temperature reduction
- Final Feedwater Temperature Reduction (FFWTR) between End-of-Rated (EOR) and End-of-Cycle (EOC) up to 90° F temperature reduction (4^{th} and 5^{th} stage FWHOOS)
- Asymmetric Feedwater Temperature Operation
- Equipment Out of Service Conditions per Section 11

ARTS provides for power- and flow-dependent thermal limit adjustments and multipliers that allow for a more reliable administration of the MCPR and LHGR thermal limits. The off-rated limits assumed in the ECCS-LOCA analyses bound the cycle-specific off-rated limits calculated for MELLLA+ operation. Linear interpolation is to be used to find intermediate values unless otherwise indicated. The Allowable Values documented in Reference 5 for feedwater temperature as a function of thermal power for both FWHOOS and FFWTR are specified in the appropriate Peach Bottom procedures. The Peach Bottom Unit 3 Cycle 25 core is comprised of GNF2 and GNF3 fuel.

3.0 MAPLHGR LIMITS

3.1 Technical Specification

Section 3.2.1, 3.3.4.2, 3.4.1 and 3.7.6

3.2 Description

The limiting MAPLHGR value for the most limiting lattice as a function of average planar exposure is given in Table 3-1 for GNF2 fuel and in Table 3-2 for GNF3 fuel. For SLO, a multiplier is used, which is shown in Table 3-3 for both GNF2 and GNF3 fuel. The impact of AFTO on MAPLHGR is addressed in Section 10.0. The power and flow dependent LHGR multipliers are sufficient to provide adequate protection for the off-rated conditions from an ECCS-LOCA analysis perspective. The MAPLHGR multipliers can either be set to one or set equal to the LHGR multipliers, which remain compliant with the basis of the ECCS-LOCA analysis with no loss of ECCS-LOCA margin.

TABLE 3-1
MAPLHGR Versus Average Planar Exposure
GNF2 Fuel
(Reference 2)

Average Planar Exposure (GWD/ST)	MAPLHGR Limit (kW/ft)
0.0	13.78
17.52	13.78
60.78	7.50
63.50	6.69

TABLE 3-2
MAPLHGR Versus Average Planar Exposure
GNF3 Fuel
(Reference 2)

Average Planar Exposure (GWD/ST)	MAPLHGR Limit (kW/ft)
0.0	14.36
21.22	13.01
40.82	10.75
57.60	8.00
63.50	6.00

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

GNF2 SLO Multiplier	0.73
GNF3 SLO Multiplier	0.90

4.0 MCPR LIMITS

4.1 Technical Specification

Section 2.1.1.2, 3.2.2, 3.3.4.2, 3.4.1 and 3.7.6

4.2 Description

The OLMCPR is provided in Table 4-1 for all fuel types. These values are determined by the cycle-specific fuel reload analyses in Reference 2. 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 the cumulative scram time test results. 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). Table 4-1 is valid for the entire range of licensed flow and feedwater temperature (Reference 2).

The ARTS-based power-dependent MCPR limits (MCPR(P)) and multipliers (K_p) are provided in Table 4-2 for all fuel types. Table 4-2 is valid for a maximum temperature reduction of 90°F for FFWTR operation (bounding for FWHOOS operation) (Reference 2). The flow-dependent MCPR limits (MCPR(F)) are provided in Tables 4-3 through 4-6. Table 4-3 for GNF2 fuel and Table 4-4 for GNF3 fuel are valid for DLO conditions with SFTO, and Table 4-5 for GNF2 fuel and Table 4-6 for GNF3 fuel are valid for SLO conditions with SFTO.

The impact of AFTO on MCPR is addressed in Section 10. PR/PLUOOS + TBSOOS values were obtained by taking the most limiting values of the two EOOS conditions (Reference 11). For PR/PLUOOS + RPTOOS condition, the limits are listed in Section 10; these values are bounding for non-AFTO conditions.

The cycle-specific exposure-dependent SLMCPRs, known as $MCPR_{99.9\%}$, can be found in Table 4-7 for dual loop and single loop operating conditions for all fuel types. The values in Table 4-7 or more conservative values were used to calculate the MCPR limits and off-rated limits in this section and Section 10.

TABLE 4-1
Operating Limit Minimum Critical Power Ratio
(Symmetric Feedwater Heating)
All Fuel Types
(References 2 and 11)

EOOS Combination	SCRAM Time Option(1)	Cycle Exposure	
		< 3277 MWd/ST	≥ 3277 MWd/ST
Base	B	1.37	1.34
	A	1.42	1.42
Base SLO	B	1.42	1.42
	A	1.45	1.45
TBSOOS	B	1.45	1.37
	A	1.45	1.45
TBSOOS SLO	B	1.48	1.42
	A	1.48	1.48
RPTOOS	B	1.37	1.37
	A	1.44	1.44
RPTOOS SLO	B	1.42	1.42
	A	1.47	1.47
PR/PLUOOS	B	1.37	1.34
	A	1.42	1.42
PR/PLUOOS SLO	B	1.42	1.42
	A	1.45	1.45
PR/PLUOOS + TBSOOS	B	1.45	1.37
	A	N/A	N/A

(1) When Tau does not equal 0 or 1, use linear interpolation.

TABLE 4-2
Power Dependent MCPR(P) Limit Adjustments and Multipliers
(Symmetric Feedwater Heating)
All Fuel Types
(References 2 and 11)

EOOS Combination	Core Flow (% of rated)	Core Thermal Power (% of rated)									
		0	22.6	≤26.3	>26.3	40	55	65	≤ 85	> 85	100
		OLMCPR			OLMCPR Multiplier, Kp						
Base	< 60	2.47	2.47	2.31	1.405	1.285	1.210	1.130	1.056	1.056	1.000
	≥ 60	2.47	2.47	2.37							
Base SLO	< 60	2.50	2.50	2.34	1.405	1.285	1.210	1.130	1.056	1.056	1.000
	≥ 60	2.50	2.50	2.40							
TBSOOS	< 60	2.90	2.90	2.63	1.405	1.285	1.210	1.130	1.061	1.061	1.000
	≥ 60	2.90	2.90	2.85							
TBSOOS SLO	< 60	2.93	2.93	2.66	1.405	1.285	1.210	1.130	1.061	1.061	1.000
	≥ 60	2.93	2.93	2.88							
RPTOOS	< 60	2.47	2.47	2.31	1.405	1.285	1.210	1.130	1.056	1.056	1.000
	≥ 60	2.47	2.47	2.37							
RPTOOS SLO	< 60	2.50	2.50	2.34	1.405	1.285	1.210	1.130	1.056	1.056	1.000
	≥ 60	2.50	2.50	2.40							
PR/PLUOOS	< 60	2.47	2.47	2.31	1.405	1.285	1.210	1.170	1.119	1.066	1.000
	≥ 60	2.47	2.47	2.37							
PR/PLUOOS SLO	< 60	2.50	2.50	2.34	1.405	1.285	1.210	1.170	1.119	1.066	1.000
	≥ 60	2.50	2.50	2.40							
PR/PLUOOS + TBSOOS	< 60	2.90	2.90	2.63	1.405	1.285	1.210	1.170	1.119	1.066	1.000
	≥ 60	2.90	2.90	2.85							

TABLE 4-3
Flow Dependent MCPR Limits MCPR(F)
(Symmetric Feedwater Heating)
GNF2 Fuel
(Reference 2)

Core Flow (% rated)	MCPR(F) Limit
0.0	1.70
30.0	1.53
79.0	1.25
110.0	1.25

TABLE 4-4
Flow Dependent MCPR Limits MCPR(F)
(Symmetric Feedwater Heating)
GNF3 Fuel
(Reference 2)

Core Flow (% rated)	MCPR(F) Limit
0.0	1.74
30.0	1.56
90.4	1.20
110.0	1.20

TABLE 4-5
SLO Flow Dependent MCPR Limits MCPR(F)
(Symmetric Feedwater Heating)
GNF2 Fuel
(Reference 2)

Core Flow (% rated)	MCPR(F) Limit
0.0	1.73
30.0	1.56
79.0	1.28
110.0	1.28

TABLE 4-6
SLO Flow Dependent MCPR Limits MCPR(F)
(Symmetric Feedwater Heating)
GNF3 Fuel
(Reference 2)

Core Flow (% rated)	MCPR(F) Limit
0.0	1.77
30.0	1.59
90.4	1.23
110.0	1.23

TABLE 4-7
Cycle Specific SLMCPR ($MCPR_{99.9\%}$)
All Fuel Types
(Reference 2)

Loop Operation	$MCPR_{99.9\%}$
DLO	1.10
SLO	1.11

5.0 LHGR LIMITS

5.1 Technical Specification

Section 3.2.3, 3.3.4.2, 3.4.1 and 3.7.6

5.2 Description

The LHGR values for all fuel types are provided in Tables 5-1 and 5-2. The ARTS-based LHGR power-dependent multipliers (LHGRFAC(P)) are provided in Table 5-3 for GNF2 fuel and Table 5-4 for GNF3 fuel. Table 5-3 and Table 5-4 are valid for a maximum temperature reduction of 90º F for FFWTR operation (bounding for FWHOOS operation) (Reference 2). In certain configurations when the unit is operating with two FW pumps and two FW heater strings in service, there is the potential that there could be an asymmetric loss of feedwater heating (ALOFH) event of more than 100°F. Per Reference 8, operation in that configuration requires LHGRFAC(P) restriction provided in Table 5-5 for operation at or below 60% of rated power. The penalty provided in Table 5-5 is GNF3 specific per Reference 8. The corresponding penalty for GNF2 fuel is bounded by the LHGRFAC(P) limits in Table 5-3. Linear interpolation should be used for Tables 5-1 and 5-2 as directed in References 13 and 15.

The LHGR flow-dependent multipliers (LHGRFAC(F)) are provided in Table 5-6 for GNF2 and Table 5-7 for GNF3 fuel as a function of the number of recirculation loops in operation. The SLO LHGR multiplier is provided and accounted for in these tables. The impact of AFTO on LHGR is addressed in Section 10.0. PR/PLUOOS + TBSOOS values were obtained by taking the most limiting values of the two EOOS conditions (Reference 11). For the PR/PLUOOS + RPTOOS condition, the limits are listed in Section 10; these values are bounding for non-AFTO conditions. The power and flow dependent LHGR multipliers are sufficient to provide adequate protection for the off-rated conditions from an ECCS-LOCA analysis perspective.

TABLE 5-1
Linear Heat Generation Rate Limits – UO2 Rods
(References 10, 13, and 15)

Fuel Type	LHGR Limit
GNF2	See Table 1 of Reference 13
GNF3	See Table A-1 of Reference 15

TABLE 5-2
Linear Heat Generation Rate Limits – Gad Rods
(References 10, 13, and 15)

Fuel Type	LHGR Limit
GNF2	See Table 2 of Reference 13
GNF3	See Table A-2 of Reference 15

TABLE 5-3
Power Dependent LHGR Multiplier LHGRFAC(P)
(Symmetric Feedwater Heating)
GNF2 Fuel
(References 2 and 11)

EOOS Combination	Core Flow (% of rated)	Core Thermal Power (% of rated)								
		0	22.6	≤26.3	>26.3	40	55	65	85	100
Base	< 60	0.508	0.508	0.522	0.620	0.696	0.751	0.817	0.930	1.000
	≥ 60	0.508	0.508	0.522						
Base SLO	< 60	0.508	0.508	0.522	0.620	0.696	0.751	0.817	0.930	1.000
	≥ 60	0.508	0.508	0.522						
TBSOOS	< 60	0.397	0.397	0.442	0.620	0.655	0.714	0.817	0.930	1.000
	≥ 60	0.397	0.397	0.417						
TBSOOS SLO	< 60	0.397	0.397	0.442	0.620	0.655	0.714	0.817	0.930	1.000
	≥ 60	0.397	0.397	0.417						
RPTOOS	< 60	0.508	0.508	0.522	0.620	0.696	0.751	0.817	0.930	1.000
	≥ 60	0.508	0.508	0.522						
RPTOOS SLO	< 60	0.508	0.508	0.522	0.620	0.696	0.751	0.817	0.930	1.000
	≥ 60	0.508	0.508	0.522						
PR/PLUOOS	< 60	0.508	0.508	0.522	0.620	0.696	0.751	0.817	0.930	1.000
	≥ 60	0.508	0.508	0.522						
PR/PLUOOS SLO	< 60	0.508	0.508	0.522	0.620	0.696	0.751	0.817	0.930	1.000
	≥ 60	0.508	0.508	0.522						
PR/PLUOOS + TBSOOS	< 60	0.397	0.397	0.442	0.620	0.655	0.714	0.817	0.930	1.000
	≥ 60	0.397	0.397	0.417						

TABLE 5-4
Power Dependent LHGR Multiplier LHGRFAC(P)
(Symmetric Feedwater Heating)
GNF3 Fuel
(References 2 and 11)

EOOS Combination	Core Flow (% of rated)	Core Thermal Power (% of rated)								
		0	22.6	≤26.3	>26.3	40	55	65	85	100
Base	< 60	0.440	0.440	0.460	0.640	0.790	0.950	1.000	1.000	1.000
	≥ 60	0.440	0.440	0.460						
Base SLO	< 60	0.440	0.440	0.460	0.640	0.790	0.950	1.000	1.000	1.000
	≥ 60	0.440	0.440	0.460						
TBSOOS	< 60	0.410	0.410	0.460	0.640	0.790	0.950	1.000	1.000	1.000
	≥ 60	0.410	0.410	0.430						
TBSOOS SLO	< 60	0.410	0.410	0.460	0.640	0.790	0.950	1.000	1.000	1.000
	≥ 60	0.410	0.410	0.430						
RPTOOS	< 60	0.440	0.440	0.460	0.640	0.790	0.950	1.000	1.000	1.000
	≥ 60	0.440	0.440	0.460						
RPTOOS SLO	< 60	0.440	0.440	0.460	0.640	0.790	0.950	1.000	1.000	1.000
	≥ 60	0.440	0.440	0.460						
PR/PLUOOS	< 60	0.440	0.440	0.460	0.640	0.790	0.950	0.990	1.000	1.000
	≥ 60	0.440	0.440	0.460						
PR/PLUOOS SLO	< 60	0.440	0.440	0.460	0.640	0.790	0.950	0.990	1.000	1.000
	≥ 60	0.440	0.440	0.460						
PR/PLUOOS + TBSOOS	< 60	0.410	0.410	0.460	0.640	0.790	0.950	0.990	1.000	1.000
	≥ 60	0.410	0.410	0.430						

TABLE 5-5
Power Dependent LHGR Multiplier LHGRFAC(P)
Asymmetric Loss of Feedwater Heating
GNF3 Fuel
(Reference 8)

Reactor Power	LHGR Restriction
P ≤ 60%	0.902

TABLE 5-6
Flow Dependent LHGR Multiplier LHGRFAC(F)
(Symmetric Feedwater Heating)
GNF2 Fuel
(Reference 2)

EOOS Combination	Core Flow (% of rated)					
	0	30	33.6	70	80	110
	LHGRFAC(F) Multiplier					
Dual Loop	0.506	0.706	0.730	0.973	1.000	1.000
Single Loop	0.506	0.706	0.730	0.730	0.730	0.730

TABLE 5-7
Flow Dependent LHGR Multiplier LHGRFAC(F)
(Symmetric Feedwater Heating)
GNF3 Fuel
(Reference 2)

EOOS Combination	Core Flow (% of rated)				
	0	30	65.5	80.3	110
	LHGRFAC(F) Multiplier				
Dual Loop	0.457	0.660	0.900	1.000	1.000
Single Loop	0.457	0.660	0.900	0.900	0.900

6.0 ROD BLOCK MONITOR SETPOINTS

6.1 Technical Specification

Section 3.3.2.1

6.2 Description

The RBM power-biased Allowable Values and MCPR Limits for all fuel types are provided in Table 6-1 with supporting documentation in References 2, 3, 8 and 9. Per Reference 8, the more limiting GNF2 penalties are no longer required since GNF2 fuel is only loaded in non-limiting locations in the core. GNF3 AFTO penalties will be applied to all fuel types in the core. The SFTO MCPR Limits apply when FWT difference is below 20°F. The AFTO MCPR Limits apply with FWT difference between 20 and 55°F. AFTO conditions are discussed further in Section 10.

TABLE 6-1
Rod Block Monitor Setpoints
All Fuel Types
(References 2, 3, 8 and 9)

Power Level	Allowable Value(1)	SFTO MCPR Limit	AFTO MCPR Limit
Low Trip Setpoint (LTSP)	124.0%	< 1.75 (2) < 1.45 (3)	< 1.79 (4) < 1.48 (5)
Intermediate Trip Setpoint (ITSP)	119.2%	< 1.75 (2) < 1.45 (3)	< 1.79 (4) < 1.48 (5)
High Trip Setpoint (HTSP)	114.2%	< 1.75 (2) < 1.45 (3)	< 1.79 (4) < 1.48 (5)
Inoperable (INOP)	N/A	< 1.75 (2) < 1.45 (3)	< 1.79 (4) < 1.48 (5)

(1) These setpoints (with RBM filter time constant between 0.1 seconds and 0.55 seconds) are based on cycle-specific rated RWE MCPR limits which are bounded by the OLMCPRs listed in Table 4-1.
(2) This is the MCPR limit for SFTO (given THERMAL POWER is ≥28.4% and < 90%) below which the RBM is required to be OPERABLE (see COLR Reference 2 and TS Table 3.3.2.1-1).
(3) This is the MCPR limit for SFTO (given THERMAL POWER is ≥ 90%) below which the RBM is required to be OPERABLE (see COLR Reference 2 and TS Table 3.3.2.1-1).
(4) This is the MCPR limit for AFTO (given THERMAL POWER is ≥ 28.4% and < 90%) below which the RBM is required to be OPERABLE (see COLR References 2 and 8 and TS Table 3.3.2.1-1).
(5) This is the MCPR limit for AFTO (given THERMAL POWER is ≥ 90%) below which the RBM is required to be OPERABLE (see COLR References 2 and 8 and TS Table 3.3.2.1-1).

7.0 TURBINE BYPASS VALVE PARAMETERS

7.1 Technical Specification

Section 3.7.6

7.2 Description

The operability requirements for the steam bypass system are governed by Technical Specification 3.7.6. If the requirements cannot be met, the appropriate power and flow dependent limits for Turbine Bypass System Out-of-Service (TBSOOS) must be used. Table 7-1 includes the Turbine Bypass Valve response time parameters. The minimum number of bypass valves to maintain system operability is provided in Table 7-2 per Reference 12 and Technical Specification 3.7.6.

TABLE 7-1
Turbine Bypass System Response Time
(Reference 12)

Maximum delay time before start of bypass valve opening following initial turbine inlet valve movement(1)	0.10 sec
Maximum time after initial turbine inlet valve movement(1) for bypass valve position to reach 80% of full flow (includes the above delay time)	0.30 sec

TABLE 7-2
Minimum Required Bypass Valves to Maintain System Operability
(Reference 12)

Reactor Power	No. of Valves in Service
P ≥ 22.6%	8

(1) First movement of any TSV or any TCV (whichever occurs first).

8.0 EOC RECIRCULATION PUMP TRIP (EOC-RPT) OPERABILITY

8.1 Technical Specification

Section 3.3.4.2

8.2 Description

The operability requirements for the EOC-RPT are governed by Technical Specification 3.3.4.2. If the requirements cannot be met, the appropriate power and flow dependent limits for EOC Recirculation Pump Trip Out of Service (RPTOOS) must be used. Table 8-1 includes the total RPT response time parameter.

TABLE 8-1
Recirculation Pump Trip Response Time
(Reference 12)

Total Recirculation Pump Trip Response Time *The time from when the turbine valves (turbine control valve or turbine stop valve) start to close until complete arc suppression of the EOC-RPT circuit breakers as described in Reference 7.*	0.175 sec

9.0 STABILITY PROTECTION

9.1 Technical Specification

Section 3.3.1.1, Table 3.3.1.1-1 Function 2.f

9.2 Description

Per Reference 2, the cycle-specific DSS-CD S_{AD} Setpoint was confirmed to be 1.10 for DLO and SLO. The Automated Backup Stability Protection (BSP) Setpoints are provided in Table 9-1. The Manual BSP Endpoints for Normal FWT and Reduced FWT are provided in Table 9-2 and Table 9-3, respectively. Table 9-3 is intended for feedwater temperatures 10-90°F below nominal (Reference 2).

TABLE 9-1
Automated BSP Setpoints for the Scram Region
(Reference 2)

Parameter	Symbol	Value
Slope of ABSP APRM flow-biased trip linear segment.	m_{Trip}	1.37
ABSP APRM flow-biased trip setpoint power intercept. Constant Power Line for Trip from zero Drive Flow to Flow Breakpoint value.	$P_{BSP\text{-}Trip}$	37.9 %RTP
ABSP APRM flow-biased trip setpoint drive flow intercept. Constant Flow Line for Trip.	$W_{BSP\text{-}Trip}$	55.4 %RDF
Flow Breakpoint value	$W_{BSP\text{-}Break}$	26.0 %RDF

TABLE 9-2[1,2]
Manual BSP Endpoints for Normal Feedwater Temperature
(Reference 2)

Endpoint	Power (%)	Flow (%)	Definition
A1	80.9	59.5	Scram Region Boundary, HFCL
B1	39.3	31.0	Scram Region Boundary, NCL
A2	83.1	62.5	Controlled Entry Region Boundary, HFCL
B2	27.6	30.1	Controlled Entry Region Boundary, NCL

TABLE 9-3[1,2]
Manual BSP Endpoints for Reduced Feedwater Temperature
(Reference 2)

Endpoint	Power (%)	Flow (%)	Definition
A1'	63.8	50.5	Scram Region Boundary, HFCL
B1'	36.2	30.8	Scram Region Boundary, NCL
A2'	68.8	57.0	Controlled Entry Region Boundary, HFCL
B2'	27.6	30.1	Controlled Entry Region Boundary, NCL

(1) Station may elect to place additional administrative margin on the endpoints provided in Table 9-2 and Table 9-3, per Reference 14.
(2) The BSP Boundary for Normal and Reduced Feedwater Temperature is defined by the MELLLA boundary line, per Reference 2.

10.0 ASYMMETRIC FEEDWATER TEMPERATURE OPERATION (AFTO)

AFTO is the result of the specific configuration of the feedwater lines at Peach Bottom. A reduction in heating in either the 'A' or the 'C' heater strings will result in a temperature mismatch between the feedwater flows entering the opposite sides of the reactor vessel. This temperature mismatch may result in errors in the thermal limit values calculated by the core monitoring system. Thermal limit values for all conditions and events are impacted by these errors, excluding SLO conditions.

AFTO is defined as operation in a feedwater heater/string configuration that results in a specified threshold difference as described in Reference 8. There is no AFTO penalty for a FWT difference less than or equal to 20°F. For a difference between 20 and 55°F there is a 4% LHGR penalty, a 3% MAPLHGR penalty, and a 2% MCPR penalty for GNF3 fuel. Thermal limits are unanalyzed for a difference above 55°F. The more limiting GNF2 penalties are no longer required since GNF2 fuel is only loaded in non-limiting locations in the core per Reference 8. GNF3 AFTO penalties will be applied to all fuel types in the core. The MCPR penalty for AFTO also applies to RBM Operability MCPR Limits, which are addressed in Section 6.0.

10.1 MAPLHGR LIMITS

An appropriate penalty must be applied to MAPLHGR limits under AFTO for varying temperature differentials per Reference 8. The reduction factor listed in Table 10-1 is the maximum penalty for the full range of analyzed FWT mismatches, bounding all smaller temperature deltas for all fuel types.

TABLE 10-1
AFTO MAPLHGR Reduction Factor
(Asymmetric Feedwater Heating)
All Fuel Types
(Reference 8)

AFTO Reduction Factor	
20°F < FWT DELTA ≤ 55°F	0.970

10.2 MCPR LIMITS

The OLMCPRs during AFTO with a FWT difference greater than 20°F are provided in Table 10-2. The ARTS-based MCPR(P) limits and multipliers (K_p) for use during AFTO conditions are provided in Table 10-3. The MCPR(F) limits for AFTO are provided in Table 10-4 for GNF2 fuel and Table 10-5 for GNF3 fuel. The power- and flow-dependent OLMCPR curves were obtained from Reference 2 and were adjusted with a penalty for feedwater temperature difference greater than 20°F as per Reference 8. PR/PLUOOS + TBSOOS and PR/PLUOOS + RPTOOS values were obtained by taking the most limiting values of the two EOOS conditions (Reference 11).

TABLE 10-2
AFTO Operating Limit Minimum Critical Power Ratio 20°F < FWT DELTA ≤ 55°F
(Asymmetric Feedwater Heating)
All Fuel Types
(References 2, 8, and 11)

EOOS Combination	SCRAM Time Option(1)	Cycle Exposure	
		< 3277 MWd/ST	≥ 3277 MWd/ST
BASE	B	1.40	1.37
	A	1.45	1.45
TBSOOS	B	1.48	1.40
	A	1.48	1.48
RPTOOS	B	1.40	1.40
	A	1.47	1.47
PR/PLUOOS	B	1.40	1.37
	A	1.45	1.45
PR/PLUOOS + TBSOOS	B	1.48	1.40
	A	N/A	N/A
PR/PLUOOS + RPTOOS	B	1.40	1.40
	A	N/A	N/A

(1) When Tau does not equal 0 or 1, use linear interpolation.

TABLE 10-3
AFTO Power Dependent MCPR Limit Adjustments and Multipliers MCPR(P) 20°F < FWT DELTA ≤ 55°F
(Asymmetric Feedwater Heating)
All Fuel Types
(References 2, 8, and 11)

EOOS Combination	Core Flow (% of rated)	Core Thermal Power (% of rated)									
		0	22.6	≤26.3	>26.3	40	55	65	≤ 85	> 85	100
		OLMCPR			OLMCPR Multiplier, Kp						
Base	< 60	2.52	2.52	2.36	1.405	1.285	1.210	1.130	1.056	1.056	1.000
	≥ 60	2.52	2.52	2.42							
TBSOOS	< 60	2.96	2.96	2.68	1.405	1.285	1.210	1.130	1.061	1.061	1.000
	≥ 60	2.96	2.96	2.91							
RPTOOS	< 60	2.52	2.52	2.36	1.405	1.285	1.210	1.130	1.056	1.056	1.000
	≥ 60	2.52	2.52	2.42							
PR/PLUOOS	< 60	2.52	2.52	2.36	1.405	1.285	1.210	1.170	1.119	1.066	1.000
	≥ 60	2.52	2.52	2.42							
PR/PLUOOS + TBSOOS	< 60	2.96	2.96	2.68	1.405	1.285	1.210	1.170	1.119	1.066	1.000
	≥ 60	2.96	2.96	2.91							
PR/PLUOOS + RPTOOS	< 60	2.52	2.52	2.36	1.405	1.285	1.210	1.170	1.119	1.066	1.000
	≥ 60	2.52	2.52	2.42							

TABLE 10-4
AFTO Flow Dependent MCPR Limits MCPR(F) 20°F < FWT DELTA ≤ 55°F
(Asymmetric Feedwater Heating)
GNF2 Fuel
(References 2 and 8)

Flow (% rated)	MCPR(F) Limit
0.0	1.74
30.0	1.56
79.0	1.28
110.0	1.28

TABLE 10-5
AFTO Flow Dependent MCPR Limits MCPR(F) 20°F < FWT DELTA ≤ 55°F
(Asymmetric Feedwater Heating)
GNF3 Fuel
(References 2 and 8)

Flow (% rated)	MCPR(F) Limit
0.0	1.77
30.0	1.59
90.4	1.22
110.0	1.22

10.3 LHGR LIMITS

The ARTS-based LHGRFAC(P) values for AFTO operation are provided in Table 10-6 for GNF2 fuel and Table 10-7 for GNF3 fuel. The LHGRFAC(F) values for AFTO in DLO are provided in Table 10-8 for GNF2 fuel and Table 10-9 for GNF3 fuel. The power- and flow-dependent LHGR multipliers were obtained from Reference 2 and were adjusted with the GNF3 penalties as per Reference 8. PR/PLUOOS + TBSOOS and PR/PLUOOS + RPTOOS values were obtained by taking the most limiting values of the two EOOS conditions (Reference 11).

TABLE 10-6
AFTO Power Dependent LHGR Multiplier LHGRFAC(P) 20°F < FWT DELTA ≤ 55°F
(Asymmetric Feedwater Heating)
GNF2 Fuel
(References 2, 8, and 11)

EOOS Combination	Core Flow (% of rated)	Core Thermal Power (% of rated)								
		0	22.6	≤26.3	>26.3	40	55	65	85	100
Base	< 60	0.488	0.488	0.501	0.595	0.668	0.721	0.784	0.893	0.960
	≥ 60	0.488	0.488	0.501						
TBSOOS	< 60	0.381	0.381	0.424	0.595	0.629	0.685	0.784	0.893	0.960
	≥ 60	0.381	0.381	0.400						
RPTOOS	< 60	0.488	0.488	0.501	0.595	0.668	0.721	0.784	0.893	0.960
	≥ 60	0.488	0.488	0.501						
PR/PLUOOS	< 60	0.488	0.488	0.501	0.595	0.668	0.721	0.784	0.893	0.960
	≥ 60	0.488	0.488	0.501						
PR/PLUOOS + TBSOOS	< 60	0.381	0.381	0.424	0.595	0.629	0.685	0.784	0.893	0.960
	≥ 60	0.381	0.381	0.400						
PR/PLUOOS + RPTOOS	< 60	0.488	0.488	0.501	0.595	0.668	0.721	0.784	0.893	0.960
	≥ 60	0.488	0.488	0.501						

TABLE 10-7
AFTO Power Dependent LHGR Multiplier LHGRFAC(P) 20°F < FWT DELTA ≤ 55°F
(Asymmetric Feedwater Heating)
GNF3 Fuel
(References 2, 8 and 11)

EOOS Combination	Core Flow (% of rated)	Core Thermal Power (% of rated)								
		0	22.6	≤26.3	>26.3	40	55	65	85	100
Base	< 60	0.422	0.422	0.442	0.614	0.758	0.912	0.960	0.960	0.960
	≥ 60	0.422	0.422	0.442						
TBSOOS	< 60	0.394	0.394	0.442	0.614	0.758	0.912	0.960	0.960	0.960
	≥ 60	0.394	0.394	0.413						
RPTOOS	< 60	0.422	0.422	0.442	0.614	0.758	0.912	0.960	0.960	0.960
	≥ 60	0.422	0.422	0.442						
PR/PLUOOS	< 60	0.422	0.422	0.442	0.614	0.758	0.912	0.950	0.960	0.960
	≥ 60	0.422	0.422	0.442						
PR/PLUOOS + TBSOOS	< 60	0.394	0.394	0.442	0.614	0.758	0.912	0.950	0.960	0.960
	≥ 60	0.394	0.394	0.413						
PR/PLUOOS + RPTOOS	< 60	0.422	0.422	0.442	0.614	0.758	0.912	0.950	0.960	0.960
	≥ 60	0.422	0.422	0.442						

TABLE 10-8
AFTO Flow Dependent LHGR Multiplier LHGRFAC(F) 20°F < FWT DELTA ≤ 55°F
(Asymmetric Feedwater Heating)
GNF2 Fuel
(References 2 and 8)

EOOS Combination	Core Flow (% of rated)					
	0	30	33.6	70	80	110
	LHGRFAC(F) Multiplier					
Dual Loop	0.486	0.678	0.701	0.934	0.960	0.960

TABLE 10-9
AFTO Flow Dependent LHGR Multiplier LHGRFAC(F) 20°F < FWT DELTA ≤ 55°F
(Asymmetric Feedwater Heating)
GNF3 Fuel
(References 2 and 8)

EOOS Combination	Core Flow (% of rated)				
	0	30	65.5	80.3	110
	LHGRFAC(F) Multiplier				
Dual Loop	0.439	0.634	0.864	0.960	0.960

11.0 MODES OF OPERATION

The following conditions are supported by the Peach Bottom 3 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 11-1 provides allowed modes of operation with thermal limit sets in the COLR. Table 11-2 provides all EOOS included in the "Base" condition. Table 11-3 provides power level restrictions that support specific operating conditions.

TABLE 11-1
Modes of Operation
(References 2 and 11)

EOOS Options	Supported Scram Speed Option	Supported Recirculation Loop Operation	Supported SFTO/AFTO
Base(1,2)	A or B	DLO or SLO(3)	SFTO or AFTO
TBSOOS	A or B	DLO or SLO(3)	SFTO or AFTO
RPTOOS	A or B	DLO or SLO(3)	SFTO or AFTO
PLUOOS/PROOS	A or B	DLO or SLO(3)	SFTO or AFTO
PR/PLUOOS + TBSOOS(6)	B	DLO	SFTO or AFTO
PR/PLUOOS + RPTOOS	B	DLO	AFTO(4)

TABLE 11-2
EOOS Options Included in 'Base' Conditions
(Reference 2)

Condition
1 TBVOOS
2 SRVOOS
1 MSIVOOS(5)
1 TCV/TSVOOS(5)

TABLE 11-3
Power Level Restrictions
(Reference 2)

Condition	Power Level Restriction (% rated)
1 TCVOOS and/or 1 TSVOOS	≤ 90
1 TCVOOS and/or 1 TSVOOS + TBSOOS	≤ 85
1 MSIVOOS	≤ 75

(1) The 'Base' condition includes the options listed in Table 11-2.
(2) The 'Base' condition includes operation with FWHOOS/FFWTR. Operation not permitted in the MELLLA+ Region for reduced FWT conditions as controlled by station procedures.
(3) Operation in SLO not permitted in the MELLLA+ Region as controlled by station procedures.
(4) AFTO limits bound SFTO limits.
(5) Permitted at power levels provided in Table 11-3 and in the applicable station procedure.
(6) TCVSC event is bounded by the PR/PLUOOS + TBSOOS condition per Reference 4.

12.0 METHODOLOGY

The analytical methods used in determining the core operating limits have been previously reviewed and approved by the NRC, specifically those described in the following document:

1. “General Electric Standard Application for Reactor Fuel”, Global Nuclear Fuel Document No. NEDE-24011-P-A-31, November 2020 and U.S. Supplement NEDE-24011-P-A-31-US, November 2020.

13.0 REFERENCES

1. "Subsequent Renewed Facility Operating License ", Constellation Document, Docket No. 50-278, Subsequent Renewed License No. DPR-56.

2. "Supplemental Reload Licensing Report for Peach Bottom Unit 3 Reload 24 Cycle 25”, Global Nuclear Fuel Document No. 007N0499, Revision 0, August 2023.

3. “GNF3 Fuel Design Cycle-Independent Analyses for Peach Bottom Atomic Power Station Units 2 and 3”, Global Nuclear Fuel Document No. 006N4378, Revision 1, October 2022.

4. “Thermal Limits Evaluation for the TCV Slow Closure Event for Peach Bottom”, Constellation Technical Evaluation EC 632705, Revision 1, November 2021.

5. “Clarify Rated Feedwater Temp for Feedwater Temp Reduction Curves”, Constellation Technical Evaluation EC 628049, Revision 0, August 2019.

6. “Safety Analysis Report for Peach Bottom Atomic Power Station, Units 2 and 3, Thermal Power Optimization”, General Electric Hitachi Document NEDO-33873, Revision 0, February 2017.

7. “Determination of Time Required to Initiate Trip Signal to the RPT CKT”, Constellation Calculation No. PE-0173, Revision 1A, January 2019.

8. “Evaluation of Peach Bottom Atomic Power Station Units 2 and 3 Asymmetric Feedwater Temperature Operation with GNF3 Fuel”, Global Nuclear Fuel Document No. 006N0624, Revision 0, December 2020.

9. “Provide Allowable Values (AV) and Nominal Trip Setpoints (NTSP) for Various Setpoint Functions of the NUMAC PRNM System”, Constellation Calculation No. PE-0251, Revision 4, July 2017.

10. "Fuel Bundle Information Report for Peach Bottom Unit 3 Reload 24 Cycle 25 Global Nuclear Fuel Document No. 007N0500, Revision 0, August 2023.

11. “Peach Bottom Atomic Power Station Units 2 and 3 GNF3 PROOS and/or PLUOOS and EOOS Combination Limits Report”, Global Nuclear Fuel Document No. 006N7704, Revision 1, September 2021.

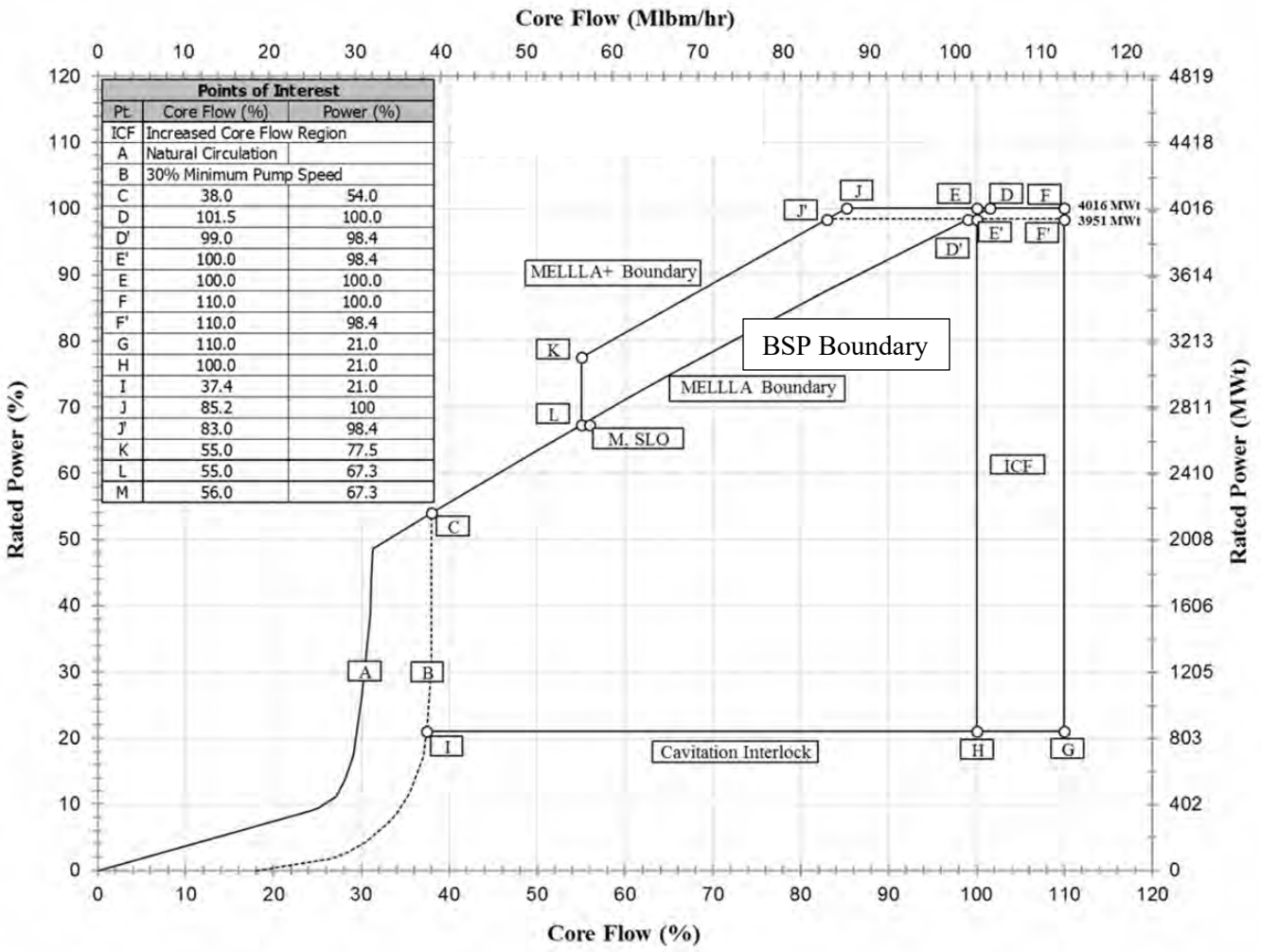
12. “Peach Bottom Unit 3 Cycle 25 OPL-3”, Constellation TODI NF230268, Revision 0, May 2023.

13. “PRIME-Based GNF2 LHGR Envelopes for Peach Bottom Atomic Power Station Units 2 and 3”, Global Nuclear Fuel Document No. 004N7833-P, Revision 0, April 2018.

14. “GE Hitachi Boiling Water Reactor Detect and Suppress Solution – Confirmation Density”, General Electric Hitachi Document NEDC-33075P-A, Revision 8, November 2013.

15. “GNF3 Generic Compliance with NEDE-24011-P-A (GESTAR II)”, Global Nuclear Fuel Document NEDC-33879P, Revision 4, August 2020.

APPENDIX A
POWER/FLOW OPERATING MAP FOR MELLLA+ WITH TPO
(Reference 6)



Points of Interest		
Pt.	Core Flow (%)	Power (%)
ICF	Increased Core Flow Region	
A	Natural Circulation	
B	30% Minimum Pump Speed	
C	38.0	54.0
D	101.5	100.0
D'	99.0	98.4
E'	100.0	98.4
E	100.0	100.0
F	110.0	100.0
F'	110.0	98.4
G	110.0	21.0
H	100.0	21.0
I	37.4	21.0
J	85.2	100
J'	83.0	98.4
K	55.0	77.5
L	55.0	67.3
M	56.0	67.3