

LG-22-040

April 29, 2022

Attn: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Limerick Generating Station, Unit 1
Renewed Facility Operating License Nos. NFP-39
NRC Docket Nos. 50-352

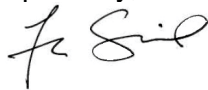
Subject: Issuance of the Core Operating Limits Report (COLR) for Unit 1 Reload 19,
Cycle 20

Enclosed is a copy of the Core Operating Limits Report (COLR) for Limerick
Generating Station (LGS) Unit 1 Reload 19 Cycle 20 which incorporates the revised
cycle specific parameters resulting from the new configuration implemented for LGS,
Unit 1.

The COLR is being submitted to the NRC in accordance with LGS, Unit 1 Technical
Specification 6.9.1.12.

If you have any questions or require additional information, please contact Shawn
Pinney at 610-718-3560.

Respectfully,



Digitally signed by Sturniolo,
Frank
Date: 2022.04.25 12:46:37
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Frank Sturniolo
Vice President – Limerick Generating Station
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Attachment: Core Operating Limits Report for Limerick Generating Station Unit 1
Reload 19 Cycle 20

cc: Regional Administrator, Region 1, USNRC
LGS USNRC Senior Resident Inspector

CORE OPERATING LIMITS REPORT

FOR

Limerick Generating Station Unit 1

Reload 19, Cycle 20









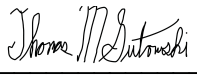
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Table of Contents

	Page
Revision History	3
List of Tables	4
1.0 Terms and Definitions	5
2.0 General Information	7
3.0 MAPLHGR Limits	8
4.0 MCPR Limits	10
5.0 Linear Heat Generation Rate Limits	16
6.0 Control Rod Block Setpoints	20
7.0 Turbine Bypass Valve Parameters	22
8.0 Stability Protection Setpoints	23
9.0 Modes of Operation	24
10.0 Methodology	26
11.0 References	27

Revision History

Revision

Description

Rev. Number – 16

New issue for Cycle 20

List of Tables

	Page	
Table 3-1	MAPLHGR Versus Average Planar Exposure for GNF2 Fuel	8
Table 3-2	MAPLHGR Versus Average Planar Exposure for GNF3 Fuel	8
Table 3-3	MAPLHGR Single Loop Operation (SLO) Multiplier	9
Table 4-1	Operating Limit Minimum Critical Power Ratio (OLMCPR) for GNF2 Fuel	11
Table 4-2	Operating Limit Minimum Critical Power Ratio (OLMCPR) for GNF3 Fuel	12
Table 4-3	Power Dependent MCPR Limits and Multipliers, $MCPR_P$ and K_p	13
Table 4-4	Flow Dependent MCPR Limits $MCPR_F$ for GNF2 Fuel	14
Table 4-5	Flow Dependent MCPR Limits $MCPR_F$ for GNF3 Fuel	14
Table 4-6	Single Loop Operation (SLO) Flow Dependent MCPR Limits $MCPR_F$ for GNF2 Fuel	14
Table 4-7	Single Loop Operation (SLO) Flow Dependent MCPR Limits $MCPR_F$ for GNF3 Fuel	15
Table 4-8	Cycle Specific SLMCPR ($MCPR_{99.9\%}$)	15
Table 5-1	Linear Heat Generation Rate Limits – UO_2 Rods	16
Table 5-2	Linear Heat Generation Rate Limits – Gadolinia Rods	16
Table 5-3	LHGR Single Loop Operation (SLO) Multiplier	17
Table 5-4	Power Dependent LHGR Multiplier $LHGRFAC_P$ for GNF2 Fuel	17
Table 5-5	Power Dependent LHGR Multiplier $LHGRFAC_P$ for GNF3 Fuel	18
Table 5-6	Flow Dependent LHGR Multiplier $LHGRFAC_F$ for GNF2 Fuel	19
Table 5-7	Flow Dependent LHGR Multiplier $LHGRFAC_F$ for GNF3 Fuel	19
Table 6-1	Rod Block Monitor Setpoints	20
Table 6-2	Reactor Coolant System Recirculation Flow Upscale Trip	20
Table 6-3	RBM Operability Limits	21
Table 7-1	Turbine Bypass System Response Time	22
Table 7-2	Minimum Required Bypass Valves To Maintain System Operability	22
Table 8-1	OPRM PBDA Trip Setpoints	23
Table 9-1	Modes of Operation	24
Table 9-2	“Base” EOOS Option – Included Conditions	24
Table 9-3	Power Level Restrictions	25

1.0 Terms and Definitions

ARTS	Average Power Range Monitor, Rod Block Monitor, and Technical Specification Improvement Program
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 as well as operation with FWHOOS/FFWTR
BSP	Backup Stability Protection
DLO	Dual Loop Operation
DTSP	Rod Block Monitor Downscale Trip Setpoint
ECCS	Emergency Core Cooling System
EOOS	Equipment Out of Service
EOR	End of Rated. The cycle exposure at which reactor power is equal to 3515 MWth with recirculation system flow equal to 100%, all control rods fully withdrawn, all feedwater heating in service and equilibrium Xenon.
FFWTR	Final Feedwater Temperature Reduction
FWHOOS	Feedwater Heater(s) Out of Service
HTSP	Rod Block Monitor High Trip Setpoint
ICF	Increased Core Flow
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
LOCA	Loss of Coolant Accident
LTSP	Rod Block Monitor Low Trip Setpoint
$MAPFAC_F$	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
$MCPR_{99.9\%}$	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
MELLLA	Maximum Extended Load Line Limit Analysis
MSIVOOS	Main Steam Isolation Valve Out of Service

NFWT	Normal Feedwater Temperature
OLMCPR	Operating Limit Minimum Critical Power Ratio
OOS	Out of Service
OPRM	Oscillation Power Range Monitor
PBDA	Period Based Detection Algorithm
PLUOOS	Power Load Unbalance Out of Service
PROOS	Pressure Regulator Out of Service
RBM	Rod Block Monitor
RPTOOS	Recirculation Pump Trip Out of Service
RWE	Rod Withdrawal Error
SLMCPR	Safety Limit Minimum Critical Power Ratio
SLO	Single Loop Operation
SRVOOS	Safety Relief Valve Out of Service
TBSOOS	Turbine Bypass System Out of Service
TBVOOS	Turbine Bypass Valve(s) Out of Service
TCV	Turbine Control Valve
TCVFASVOOS	Turbine Control Valve Fast Action Solenoid Valve Out of Service
TCVSC	Turbine Control Valve Slow Closure
TCV/TSVOOS	Turbine Control Valve Out of Service and/or Turbine Stop Valve Out of Service
TSV	Turbine Stop Valve

2.0 General Information

This report provides the following cycle-specific parameter limits for Limerick Generating Station Unit 1 Cycle 20

- 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 multiplier
- Rod Block Monitor (RBM) Allowable Values, Setpoints, and MCPR Limits
- Turbine Bypass Valve Parameters
- Reactor Coolant System Recirculation Flow Upscale Trips
- Stability Protection Setpoints
- Power Level Restrictions

This report is prepared in accordance with (IAW) Technical Specification 6.9.1.9 of Reference 1. Preparation of this report was performed IAW Constellation Energy Generation, Nuclear Fuels T&RM NF-AB-120-3600. Power and flow dependent limits and multipliers are listed for various power and flow levels. Linear interpolation is to be used to find intermediate values unless otherwise specified.

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 82.9% of rated core flow during full power operation.
- Increased Core Flow (ICF) up to 110% of rated core flow.
- Final Feedwater Temperature Reduction (FFWTR) up to 105°F during cycle extension operation.
- Feedwater Heater Out of Service (FWHOOS) up to 60°F feedwater temperature reduction at any time during the cycle prior to cycle extension.
- End-of-cycle (EOC) power coastdown operation to a minimum power level of 40% of rated thermal power.

A variation of 2.0% in core flow, or 10 psi in dome pressure, or 10 degrees Fahrenheit in feedwater temperature does not have significant impact on the transient analysis results including calculated OLMCPR and LHGRFAC (Reference 9). Equipment out of service conditions are as defined in Section 1 and Section 9. Further information on the cycle-specific analyses for Limerick Unit 1 Cycle 20 and the associated operating domains discussed above is available in Reference 2.

3.0 MAPLHGR Limits

3.1 Technical Specification

Section 3.2.1

3.2 Description

The MAPLHGR values for the most limiting lattice for all GNF2 fuel as a function of average planar exposure are given in Table 3-1. The MAPLHGR values for the most limiting lattice for GNF3 fuel as a function of average planar exposure are given in Table 3-2.

For single loop operation, a multiplier is used, which is shown in Table 3-3 for both GNF2 and GNF3 fuel. The power and flow dependent LHGR multipliers are sufficient to provide adequate protection for the off-rated conditions from an ECCS-LOCA analysis perspective and there is no need for MAPLHGR multipliers, in addition to off-rated LHGR multipliers (Reference 2). LHGRFAC_P and LHGRFAC_F are addressed in Section 5.0.

**Table 3-1
 MAPLHGR Versus Average Planar Exposure
 GNF2 Fuel
 (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 Versus Average Planar Exposure
 GNF3 Fuel
 (Reference 2)**

Average Planar Exposure (GWd/ST)	MAPLHGR Limit (kW/ft)
0.00	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
All Fuel Types
(Reference 2)

GNF2 SLO Multiplier	0.80
GNF3 SLO Multiplier	0.90

4.0 MCPR Limits

4.1 Technical Specification

Section 3.2.3

4.2 Description

The OLMCPR is provided in Table 4-1 for GNF2 fuel and Table 4-2 for GNF3 fuel. These values are determined by the cycle-specific reload analyses in Reference 2 and are valid for all Cycle 20 domains of operation. Table 4-1 and Table 4-2 includes treatment of these MCPR limits for all conditions listed in Section 9.0, Modes of Operation. Limerick Unit 1 Cycle 20 has two (2) cycle breakpoints as defined in Table 4-1 and Table 4-2. The first breakpoint is the result of exposure dependent RWE MCPR limits, and the second is the mid-cycle MCPR breakpoint.

The control rod maximum scram insertion time operability requirement is defined in Technical Specification 3.1.3.2. Tau, a measure of scram time performance, is determined based on the cumulative scram time test results. The calculation of Tau shall be performed in accordance with site procedures and Technical Specifications. Linear interpolation shall be used to calculate the OLMCPR values if Tau is between 0.0 (Tau Option B) and 1.0 (Tau Option A).

ARTS provides for power and flow dependent thermal limit adjustments and multipliers, which allow for more reliable administration of the MCPR thermal limit. $MCPR_P$ and $MCPR_F$ are independent of Scram Time Option. The PROOS+TBSOOS and PROOS+RPTOOS combinations were developed by selecting the more limiting OLMCPR from the PROOS condition and the other EOOS condition (TBSOOS or RPTOOS) (Reference 8).

$MCPR_P$ and K_P multipliers are provided in Table 4-3. The off-rated flow dependent $MCPR_F$ limits are provided in Tables 4-4, 4-5, 4-6, and 4-7. The OLMCPR is determined for a given power and flow condition by evaluating the power dependent MCPR and the flow dependent MCPR and selecting the greater of the two.

The cycle-specific SLMCPR, known as $MCPR_{99.9\%}$ can be found in Table 4-8 for dual loop and single loop operating conditions. The values in Table 4-8 or conservative values were used to calculate the rated and off-rated MCPR limits in this section.

**Table 4-1
 Operating Limit Minimum Critical Power Ratio (OLMCPR)
 GNF2 Fuel
 (References 2 and 8)**

EOOS Combination	SCRAM Time Option ¹	Cycle Exposure		
		< 3335 MWd/ST	≥ 3335 MWd/ST & < EOR - 4499 MWd/ST	≥ EOR – 4499 MWd/ST
BASE	B	1.33	1.31	1.33
	A	1.37	1.37	1.39
BASE SLO ²	B	1.58	1.58	1.58
	A	1.58	1.58	1.58
TBSOOS	B	1.41	1.33	1.36
	A	1.41	1.39	1.42
TBSOOS SLO ²	B	1.58	1.58	1.58
	A	1.58	1.58	1.58
RPTOOS	B	1.33	1.33	1.35
	A	1.40	1.40	1.42
RPTOOS SLO ²	B	1.58	1.58	1.58
	A	1.58	1.58	1.58
PROOS	B	1.33	1.31	1.33
	A	1.37	1.37	1.39
PROOS SLO ²	B	1.58	1.58	1.58
	A	1.58	1.58	1.58
PROOS+TBSOOS	B	1.41	1.33	1.36
PROOS+RPTOOS	B	1.33	1.33	1.35

¹ When Tau (as defined per Technical Specification 3.2.3) is between 0.0 and 1.0, determine OLMCPR via linear interpolation

² For single-loop operation, the MCPR operation limit is 0.03 greater than the analyzed two loop value. However, a minimum value of 1.58 for GNF2 fuel is required to obtain an OLMCPR limit set by the Single Loop Operation Recirculation Pump Seizure Event. (Reference 2)

Table 4-2
Operating Limit Minimum Critical Power Ratio (OLMCPR)
GNF3 Fuel
(References 2 and 8)

EOOS Combination	SCRAM Time Option ³	Cycle Exposure		
		< 3335 MWd/ST	≥3335 MWd/ST & < EOR - 4499 MWd/ST	≥ EOR – 4499 MWd/ST
BASE	B	1.33	1.31	1.33
	A	1.37	1.37	1.39
BASE SLO ⁴	B	1.61	1.61	1.61
	A	1.61	1.61	1.61
TBSOOS	B	1.41	1.33	1.36
	A	1.41	1.39	1.42
TBSOOS SLO ⁴	B	1.61	1.61	1.61
	A	1.61	1.61	1.61
RPTOOS	B	1.33	1.33	1.35
	A	1.40	1.40	1.42
RPTOOS SLO ⁴	B	1.61	1.61	1.61
	A	1.61	1.61	1.61
PROOS	B	1.33	1.31	1.33
	A	1.37	1.37	1.39
PROOS SLO ⁴	B	1.61	1.61	1.61
	A	1.61	1.61	1.61
PROOS+TBSOOS	B	1.41	1.33	1.36
PROOS+RPTOOS	B	1.33	1.33	1.35

³ When Tau (as defined per Technical Specification 3.2.3) is between 0.0 and 1.0, determine OLMCPR via linear interpolation

⁴ For single-loop operation, the MCPR operation limit is 0.03 greater than the analyzed two loop value. However, a minimum value of 1.61 for GNF3 fuel is required to obtain an OLMCPR limit set by the Single Loop Operation Recirculation Pump Seizure Event. (Reference 2)

TABLE 4-3
Power Dependent MCPR Limits and Multipliers, MCPR_P and K_p
All Fuel Types
(References 2 and 8)

EOOS Combination	Core Flow (% of rated)	Core Thermal Power (% of rated)								
		0	25	≤ 30	> 30	45	65	≤ 85	> 85	100
		Operating Limit MCPR, MCPR _P				Operating Limit MCPR Multiplier, K _p				
Base	< 60	2.14	2.14	1.93	1.135	1.130	1.130	1.066	1.066	1.000
	≥ 60	2.14	2.14	2.04						
Base SLO	< 60	2.17	2.17	1.96	1.135	1.130	1.130	1.066	1.066	1.000
	≥ 60	2.17	2.17	2.07						
TBSOOS	< 60	2.53	2.53	2.22	1.142	1.134	1.130	1.066	1.066	1.000
	≥ 60	2.54	2.54	2.47						
TBSOOS SLO	< 60	2.56	2.56	2.25	1.142	1.134	1.130	1.066	1.066	1.000
	≥ 60	2.57	2.57	2.50						
RPTOOS	< 60	2.14	2.14	1.93	1.155	1.142	1.130	1.067	1.067	1.000
	≥ 60	2.14	2.14	2.04						
RPTOOS SLO	< 60	2.17	2.17	1.96	1.155	1.142	1.130	1.067	1.067	1.000
	≥ 60	2.17	2.17	2.07						
PROOS	< 60	2.14	2.14	1.93	1.348	1.255	1.162	1.137	1.066	1.000
	≥ 60	2.14	2.14	2.04						
PROOS SLO	< 60	2.17	2.17	1.96	1.348	1.255	1.162	1.137	1.066	1.000
	≥ 60	2.17	2.17	2.07						
PROOS+TBSOOS	< 60	2.53	2.53	2.22	1.348	1.255	1.162	1.137	1.066	1.000
	≥ 60	2.54	2.54	2.47						
PROOS+RPTOOS	< 60	2.14	2.14	1.93	1.348	1.255	1.162	1.137	1.067	1.000
	≥ 60	2.14	2.14	2.04						

TABLE 4-4
Flow Dependent MCPR Limits $MCPR_F$
GNF2 Fuel
(Reference 2)

Flow (% rated)	$MCPR_F$ Limit
0.0	1.70
30.0	1.53
79.0	1.25
110.0	1.25

TABLE 4-5
Flow Dependent MCPR Limits $MCPR_F$
GNF3 Fuel
(Reference 2)

Flow (% rated)	$MCPR_F$ Limit
0.0	1.73
30.0	1.55
89.7	1.20
110.0	1.20

TABLE 4-6
Single Loop Operation (SLO) Flow Dependent MCPR Limits $MCPR_F$
GNF2 Fuel
(Reference 2)

Flow (% rated)	$MCPR_F$ Limit
0.0	1.73
30.0	1.56
79.0	1.28
110.0	1.28

TABLE 4-7
Single Loop Operation (SLO) Flow Dependent MCPR Limits $MCPR_F$
GNF3 Fuel
(Reference 2)

Flow (% rated)	$MCPR_F$ Limit
0.0	1.76
30.0	1.58
89.7	1.23
110.0	1.23

TABLE 4-8
Cycle Specific SLMCPR ($MCPR_{99.9\%}$)
All Fuel Types
(Reference 2)

Loop Operation	$MCPR_{99.9\%}$ Limit
DLO	1.09
SLO	1.11

5.0 LINEAR HEAT GENERATION RATE LIMITS

5.1 Technical Specification

Section 3.2.4

5.2 Description

The LHGR limits for the GNF2 and GNF3 fuel types are the product of the exposure dependent LHGR limit (from Table 5-1 for UO₂ 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. For single loop operation (SLO), a multiplier is used, which is shown in Table 5-3 and applied in Tables 5-6 and 5-7. No further SLO multipliers need to be applied to the values in Tables 5-4 through 5-7.

ARTS provides for power and flow dependent thermal limit multipliers, which allow for more reliable administration of the LHGR thermal limits. The PROOS+TBSOOS and PROOS+RPTOOS combinations were developed by selecting the more limiting LHGRFAC_P from the PROOS condition and the other EOOS condition (TBSOOS or RPTOOS) (Reference 8).

The ARTS LHGR multipliers are shown in Tables 5-4 through 5-7 and are applicable to all operating domains. Linear interpolation should be used for Table 5-1 and Table 5-2 as directed in Reference 7 and Reference 10.

**TABLE 5-1
 Linear Heat Generation Rate Limits – UO₂ Rods
 All Fuel Types
 (References 5, 7, and 10)**

Fuel Type	LHGR Limits
GNF2	See Table B-1 of Reference 7
GNF3	See Table A-1 of Reference 10

**TABLE 5-2
 Linear Heat Generation Rate Limits – Gadolinia Rods
 All Fuel Types
 (References 5, 7, and 10)**

Fuel Type	LHGR Limits
GNF2	See Table B-2 of Reference 7
GNF3	See Table A-2 of Reference 10

TABLE 5-3
LHGR Single Loop Operation (SLO) Multiplier
All Fuel Types
(Reference 2)

GNF2 SLO Multiplier ⁵	0.80
GNF3 SLO Multiplier ⁶	0.90

TABLE 5-4
Power Dependent LHGR Multiplier LHGRFAC_P
GNF2 Fuel
(References 2 and 8)

EOOS Combination	Core Flow (% of rated)	Core Thermal Power (% of rated)						
		0	25	≤ 30	> 30	65	85	100
		LHGRFAC _P Multiplier						
Base	< 60	0.485	0.485	0.490	0.750	0.817	0.922	1.000
	≥ 60	0.434	0.434	0.473				
Base SLO	< 60	0.485	0.485	0.490	0.750	0.817	0.922	1.000
	≥ 60	0.434	0.434	0.473				
TBSOOS	< 60	0.463	0.463	0.490	0.750	0.817	0.922	1.000
	≥ 60	0.352	0.352	0.386				
TBSOOS SLO	< 60	0.463	0.463	0.490	0.750	0.817	0.922	1.000
	≥ 60	0.352	0.352	0.386				
RPTOOS	< 60	0.485	0.485	0.490	0.750	0.817	0.922	1.000
	≥ 60	0.434	0.434	0.473				
RPTOOS SLO	< 60	0.485	0.485	0.490	0.750	0.817	0.922	1.000
	≥ 60	0.434	0.434	0.473				
PROOS	< 60	0.485	0.485	0.490	0.725	0.817	0.922	1.000
	≥ 60	0.434	0.434	0.473				
PROOS SLO	< 60	0.485	0.485	0.490	0.725	0.817	0.922	1.000
	≥ 60	0.434	0.434	0.473				
PROOS+TBSOOS	< 60	0.463	0.463	0.490	0.725	0.817	0.922	1.000
	≥ 60	0.352	0.352	0.386				
PROOS+RPTOOS	< 60	0.485	0.485	0.490	0.725	0.817	0.922	1.000
	≥ 60	0.434	0.434	0.473				

⁵ Applied to Table 5-6

⁶ Applied to Table 5-7

TABLE 5-5
Power Dependent LHGR Multiplier LHGRFAC_P
GNF3 Fuel
(References 2 and 8)

EOOS Combination	Core Flow (% of rated)	Core Thermal Power (% of rated)							
		0	25	≤ 30	> 30	45	65	85	100
		LHGRFAC _P Multiplier							
Base	< 60	0.510	0.510	0.510	1.000	1.000	1.000	1.000	1.000
	≥ 60	0.510	0.510	0.510					
Base SLO	< 60	0.510	0.510	0.510	1.000	1.000	1.000	1.000	1.000
	≥ 60	0.510	0.510	0.510					
TBSOOS	< 60	0.470	0.470	0.510	1.000	1.000	1.000	1.000	1.000
	≥ 60	0.420	0.420	0.420					
TBSOOS SLO	< 60	0.470	0.470	0.510	1.000	1.000	1.000	1.000	1.000
	≥ 60	0.420	0.420	0.420					
RPTOOS	< 60	0.510	0.510	0.510	1.000	1.000	1.000	1.000	1.000
	≥ 60	0.510	0.510	0.510					
RPTOOS SLO	< 60	0.510	0.510	0.510	1.000	1.000	1.000	1.000	1.000
	≥ 60	0.510	0.510	0.510					
PROOS	< 60	0.510	0.510	0.510	0.620	0.740	0.950	1.000	1.000
	≥ 60	0.510	0.510	0.510					
PROOS SLO	< 60	0.510	0.510	0.510	0.620	0.740	0.950	1.000	1.000
	≥ 60	0.510	0.510	0.510					
PROOS+TBSOOS	< 60	0.470	0.470	0.510	0.620	0.740	0.950	1.000	1.000
	≥ 60	0.420	0.420	0.420					
PROOS+RPTOOS	< 60	0.510	0.510	0.510	0.620	0.740	0.950	1.000	1.000
	≥ 60	0.510	0.510	0.510					

TABLE 5-6
Flow Dependent LHGR Multiplier LHGRFAC_F
GNF2 Fuel
(Reference 2)

EOOS Combination	Core Flow (% of rated)					
	0	30	44.1	70	80	110
	LHGRFAC _F Multiplier					
Dual Loop	0.506	0.706		0.973	1.000	1.000
Single Loop	0.506	0.706	0.800			0.800

TABLE 5-7
Flow Dependent LHGR Multiplier LHGRFAC_F
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		1.000	1.000
Single Loop	0.457	0.660	0.900		0.900

6.0 CONTROL ROD BLOCK SETPOINTS

6.1 Technical Specification

Section 3.1.4.3 and 3.3.6

6.2 Description

The ARTS Rod Block Monitor provides for power dependent RBM trips. Technical Specification 3.3.6 states control rod block instrumentation channels shall be OPERABLE with their trip setpoints consistent with the values shown in the Trip Setpoint column of Technical Specification Table 3.3.6-2. The trip setpoints/allowable values and applicable RBM signal filter time constant data are shown in Table 6-1.

The Reactor Coolant System Recirculation Flow Upscale Trip is shown in Table 6-2, in percent of rated drive flow. These setpoints are set high enough to allow full utilization of the enhanced ICF domain up to 110% of rated core flow.

The ARTS RWE analysis validated the MCPR values in Table 6-3 for use in Cycle 20. The RBM operability requirements have been evaluated and shown to be sufficient to ensure that SLMCPR and the cladding strain criteria will not be exceeded in the event of an RWE.

**TABLE 6-1
 Rod Block Monitor Setpoints⁷
 (References 2 and 4)**

Power Level	Analytical Limit	Allowable Value	Nominal Trip Setpoint
LTSP	125.8%	124.3%	123.0%
ITSP	121.0%	119.5%	117.0%
HTSP	116.0%	114.5%	111.0%
DTSP	No Limitation	2.0%	5.0%

**TABLE 6-2
 Reactor Coolant System Recirculation Flow Upscale Trip
 (Reference 4)**

Allowable Value	115.6%
Nominal Trip Setpoint	113.4%

⁷ These setpoints are based on a Rod Block Monitor filter time constant between 0.1 seconds and 0.55 seconds.

TABLE 6-3
RBM Operability Limits⁸
(References 1 and 2)

Power (% rated)	RBM Operability Limit
$30 \leq \text{Power} < 90$	MCPR < 1.73
$\text{Power} \geq 90$	MCPR < 1.43

⁸ These are the MCPR limits below which the RBM is required to be operable (Reference 2).

7.0 TURBINE BYPASS VALVE PARAMETERS

7.1 Technical Specification

Section 3.7.8 and 4.7.8.c

7.2 Description

The operability requirements for the steam bypass system for use in Technical Specifications 3.7.8 and 4.7.8.c are found in Tables 7-1 and 7-2. If these requirements cannot be met, the MCPR, MCPR_P and LHGRFAC_P limits for inoperable Steam Bypass System, known as Turbine Bypass System Out Of Service, TBSOOS, must be used. Additional information on the operability of the turbine bypass system can be found in Reference 6.

**TABLE 7-1
 Turbine Bypass System Response Time
 (Reference 3)**

Maximum delay time before start of bypass valve opening following initial turbine inlet valve movement ⁹	0.11 sec
Maximum time after initial turbine inlet valve movement ⁹ for bypass valve position to reach 80% of rated bypass valve flow (includes the above delay time)	0.31 sec

**TABLE 7-2
 Minimum Required Bypass Valves to Maintain System Operability
 (References 1 and 3)**

Reactor Power	No. of Valves in Service
P ≥ 25%	8

⁹ First Movement of any TSV or any TCV (whichever occurs first)

8.0 STABILITY PROTECTION SETPOINTS

8.1 Technical Specification

Section 2.2.1

8.2 Description

The Limerick Unit 1 Cycle 20 OPRM PBDA Trip Setpoints for the OPRM System are found in Table 8-1. These values are based on the cycle specific analysis documented in Reference 2. The setpoints provided in Table 8-1 are bounding for all modes of operation shown in Table 9-1.

Backup Stability Protection regions calculated for Limerick Unit 1 Cycle 20 are documented in the Supplemental Reload Licensing Report (Reference 2).

**TABLE 8-1
OPRM PBDA Trip Setpoints
(Reference 2)**

PBDA Trip Amplitude Setpoint (Sp)	Corresponding Maximum Confirmation Count Setpoint (Np)
1.15	16

9.0 MODES OF OPERATION

9.1 Description

The following conditions are supported by the Limerick Unit 1 Cycle 20 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 all modes of operation with thermal limit sets in this COLR. Table 9-2 provides all EOOS included in the “BASE” case. Table 9-3 provides power level restrictions that support specific operation conditions. One or more TCVFASVOOS resulting in TCVSC event is bound by the PLUOOS condition (Reference 11). In the event of one or more TCVFASVOOS, apply limitations associated with PLUOOS described in Tables 9-1, 9-2, and 9-3.

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

EOOS Options¹⁰	Supported Scram Speed Option	Supported Recirculation Loops
BASE ^{11,12}	Option A or B	DLO or SLO
TBSOOS ¹³	Option A or B	DLO or SLO
RPTOOS ¹³	Option A or B	DLO or SLO
PROOS ¹³	Option A or B	DLO or SLO
PROOS+TBSOOS ¹³	Option B	DLO
PROOS+RPTOOS ¹³	Option B	DLO

**TABLE 9-2
 “BASE” EOOS Option – Included Conditions
 (Reference 2)**

Condition
PLUOOS ¹³
1 MSIVOOS ¹³
1 TCV/TSSVOOS ¹³
1 TBVOOS ¹³
2 SRVOOS

¹⁰ All EOOS Options include the “BASE” EOOS Option. Any restrictions beyond the “BASE” condition’s restrictions are noted on the applicable EOOS option.

¹¹ The “BASE” condition includes the conditions listed in Table 9-2

¹² The “BASE” condition includes operation with or without FWHOOS/FFWTR

¹³ See Table 9-3 for power restrictions that may apply to this condition.

TABLE 9-3
Power Level Restrictions
(Reference 2)

Condition	Power Level Restriction (% rated)
1TCVOOS and/or 1 TSVOOS	≤ 90
1 TCVOOS and/or 1 TSVOOS + PROOS	≤ 90
1 TCVOOS and/or 1 TSVOOS + 1 TBVOOS	≤ 90
1 TCVOOS and/or 1 TSVOOS + TBSOOS	≤ 85
PLUOOS + RPTOOS	≤ 55
1 MSIVOOS	≤ 75

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-31, November 2020; and U.S. Supplement NEDE-24011-P-A-31-US, November 2020.

11.0 **REFERENCES**

1. “Technical Specifications and Bases for Limerick Generating Station Unit 1”, Constellation Document, Docket No. 50-352, License No. NPF-39
2. “Supplemental Reload Licensing Report for Limerick Unit 1 Reload 19 Cycle 20”, Global Nuclear Fuel Document No. 006N2164, Rev. 0, February 2022
3. “Limerick Unit 1 Cycle 20 OPL-3”, Constellation TODI NF210678, Rev. 0, October 19, 2021
4. “GE NUMAC PRNM Setpoint Study”, Constellation Design Analysis LE-0107, Rev 2, February 23, 2012
5. “Fuel Bundle Information Report for Limerick Unit 1 Reload 19 Cycle 20”, Global Nuclear Fuel Document No. 006N2165, Rev. 0, February 2022
6. “Tech Eval Stop Valve Load Limit Documentation”, Constellation Document IR 917231 Assignment 7, November 11, 2009
7. “GNF2 Advantage Generic Compliance with NEDE-24011-P-A (GESTAR II)”, Global Nuclear Fuel Document No. NEDC-33270P, Rev 11, August 2020
8. “Limerick Generating Station GNF3 PROOS and EOOS Combination Limits Report”, Global Nuclear Fuel Document No. 006N6029, Rev. 0, April 2021
9. “Sensitivity Evaluation of Variation in Key Reactor Heat Balance Parameters for Exelon BWRs with GNF Fuel - Transient Analysis”, GE Hitachi Document No. 0000-0166-3223-R0, Rev. 0, August 22, 2014
10. “GNF3 Generic Compliance with NEDE-24011-P-A (GESTAR II)”, Global Nuclear Fuel Document No. NEDC-33879P, Rev. 4, August 2020
11. “Operating Limits Evaluation for TCV FASV OOS Condition and TCV SC Event”, Constellation Technical Evaluation No. 636198, Rev. 0, March 2022