Exelon Generation®

T.S. 6.9.1.12

LG-21-048

May 21, 2021

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

Limerick Generating Station, Unit 2
Renewed Facility Operating License No NPF-85
NRC Docket Nos. 50-353

Subject: Issuance of the Core Operating Limits Report (COLR) for Unit 2 Reload 16, Cycle 17

Enclosed is a copy of the Core Operating Limits Report (COLR) for Limerick Generating Station (LGS) Unit 2 Reload 16, Cycle 17 which incorporates the revised cycle specific parameters resulting from the new configuration implemented for LGS, Unit 2.

The COLR is being submitted to the NRC in accordance with LGS, Unit 2 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: 2021.05.18 11:29:27 -04'00'

Frank Sturniolo
Site Vice President-Limerick Generating Station
Exelon Generation Company, LLC

Attachment: Core Operating Limits Report for Limerick Generating Station Unit 2 Reload 16, Cycle 17

cc: Administrator, Region I, USNRC (w/attachments)
USNRC Sr. Resident Inspector, LGS (w/attachments)
V. Sreenivas, USNRC Project Manager for LGS (w/attachments)
W. DeHaas, PADEP-BRP (w/attachments)

CORE OPERATING LIMITS REPORT

FOR

Limerick Generating Station Unit 2

Reload 16, Cycle 17

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Revision History

Revision	Description
Rev. Number – 14	New issue for Cycle 17

List of Tables

1.0 Terms and Definitions

ARTS	APRM and RBM 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at which reactor power is equal to 3515 MWth with recirculation system flow equal to 100%, all control rods fully withdrawn, all feedwater heating in service and equilibrium Xenon.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
HBLUA	High Burnup Lead Use Assembly
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 multipliers
$LHGRFAC_P$	Off-rated power dependent LHGR multipliers
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
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 2 Cycle 17

- 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 Exelon Nuclear, 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.

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.

There are eight (8) GNF2 High Burnup Lead Use Assemblies loaded in Cycle 17. The eight (8) HBLUAs were chosen from the fuel batch with bundle number GNF2-P10CG2B376-8G7.0/3G6.0-100T2-150-T6-4488 (Bundle Number 4488) (Reference 2). The HBLUA specific IDs are provided in the High Burnup Lead Use Assembly Information Report (Reference 13).

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 10). Equipment out of service conditions are as defined in Section 1 and Section 9. Further information on the cycle-specific analyses for Limerick Unit 2 Cycle 17 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, except GNF fuel from Bundle Number 4488, as a function of average planar exposure are given in Table 3-1. The MAPLHGR values for GNF2 fuel of Bundle Number 4488, including the eight (8) High Burnup Lead Use Assemblies (HBLUA)s, as a function of average planar exposure are given in Table 3-2. Although the MAPLHGR limits given in Table 3-2 are applicable to all GNF2 bundles with Bundle Number 4488, only the 8 HBLUAs can operate at exposures greater than 63.50 GWd/ST. The MAPLHGR values for the most limiting lattice for GNF3 fuel as a function of average planar exposure are given in Table 3-3.

For single loop operation, a multiplier is used, which is shown in Table 3-4 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 (except Bundle Number 4488 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
Bundle Number 4488 GNF2 Fuel[1]
(Reference 11)

Average Planar Exposure (GWd/ST)	MAPLHGR Limit (kW/ft)
0.00	13.78
17.52	13.78
60.78	7.50
77.11	3.00

Table 3-3
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 3-4
MAPLHGR Single Loop Operation (SLO) Multiplier
All Fuel Types
(Reference 2)

GNF2 SLO Multiplier	0.80
GNF3 SLO Multiplier	0.90

[1] Table 3-2 applies to all Bundle Number 4488 GNF2 fuel, however only the eight (8) HBLUAs identified in Reference 13 can exceed an exposure of 63.50 MWd/ST.

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, including the eight (8) HBLUAs, 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 17 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 2 Cycle 17 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 maximum scram insertion time verification is required per 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. 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. The flow dependent adjustment $MCPR_F$ is sufficiently generic to apply to all operation domains. $MCPR_P$ and $MCPR_F$ are independent of Scram Time Option. In addition, there are ten sets of power dependent MCPR multipliers (K_P) for use with the BASE, TBSOOS, RPTOOS, and PROOS equipment out of service combinations, in both DLO and SLO, as well as PROOS+TBSOOS and PROOS+RPTOOS equipment out of service combinations for DLO only. 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). Section 7.0 contains the conditions for Turbine Bypass Valve Operability. $MCPR_P$ 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[2]	Cycle Exposure		
		< 2934 MWd/ST	≥ 2934 MWd/ST & < EOR - 4200 MWd/ST	≥ EOR – 4200 MWd/ST
BASE	B	1.37	1.30	1.32
	A	1.37	1.36	1.38
BASE SLO[3]	B	1.58	1.58	1.58
	A	1.58	1.58	1.58
TBSOOS	B	1.37	1.34	1.35
	A	1.40	1.40	1.41
TBSOOS SLO[3]	B	1.58	1.58	1.58
	A	1.58	1.58	1.58
RPTOOS	B	1.37	1.34	1.35
	A	1.41	1.41	1.42
RPTOOS SLO[3]	B	1.58	1.58	1.58
	A	1.58	1.58	1.58
PROOS	B	1.37	1.30	1.32
	A	1.37	1.36	1.38
PROOS SLO[3]	B	1.58	1.58	1.58
	A	1.58	1.58	1.58
PROOS+TBSOOS	B	1.37	1.34	1.35
PROOS+RPTOOS	B	1.37	1.34	1.35

[2] When Tau is not equal to 0 or 1, determine OLMCPR via linear interpolation
[3] 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, 8)

EOOS Combination	SCRAM Time Option[4]	Cycle Exposure		
		< 2934 MWd/ST	≥ 2934 MWd/ST & < EOR - 4200 MWd/ST	≥ EOR – 4200 MWd/ST
BASE	B	1.37	1.30	1.32
	A	1.37	1.36	1.38
BASE SLO[5]	B	1.61	1.61	1.61
	A	1.61	1.61	1.61
TBSOOS	B	1.37	1.34	1.35
	A	1.40	1.40	1.41
TBSOOS SLO[5]	B	1.61	1.61	1.61
	A	1.61	1.61	1.61
RPTOOS	B	1.37	1.34	1.35
	A	1.41	1.41	1.42
RPTOOS SLO[5]	B	1.61	1.61	1.61
	A	1.61	1.61	1.61
PROOS	B	1.37	1.30	1.32
	A	1.37	1.36	1.38
PROOS SLO[5]	B	1.61	1.61	1.61
	A	1.61	1.61	1.61
PROOS+TBSOOS	B	1.37	1.34	1.35
PROOS+RPTOOS	B	1.37	1.34	1.35

[4] When Tau is not equal to 0 or 1, determine OLMCPR via linear interpolation
[5] 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 Kp
All Fuel Types
(References 2, 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, Kp					
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 HBLUAs, GNF2, and GNF3 fuel types are 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 power and flow dependent LHGR multipliers are sufficient to provide adequate protection for the off-rated conditions from an ECCS-LOCA analysis perspective (Reference 2). 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. There are two sets of flow dependent LHGR multipliers for dual-loop and single-loop operation. In addition, there are ten sets of power dependent LHGR multipliers for use with the BASE, TBSOOS, RPTOOS, and PROOS equipment out of service combinations, in both DLO and SLO, as well as PROOS+TBSOOS and PROOS+RPTOOS equipment out of service combinations for DLO only. The PROOS+TBSOOS and PROOS+RPTOOS combinations were developed by selected the more limiting $LHGRFAC_P$ from the PROOS condition and the other EOOS condition (TBSOOS or RPTOOS) (Reference 8). Section 7.0 contains the conditions for Turbine Bypass Valve Operability. 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 points not listed in Appendix B of Reference 7, Appendix A of Reference 12, and Reference 13.

TABLE 5-1
Linear Heat Generation Rate Limits – UO_2 Rods
All Fuel Types
(References 5, 7, 12, and 13)

Fuel Type	LHGR
GNF2	See Table B-1 of Reference 7
GNF3	See Table A-1 of Reference 12
HBLUA	See Table 4-1 of Reference 13

TABLE 5-2
Linear Heat Generation Rate Limits – Gadolinia Rods
All Fuel Types
(References 5, 7, 12, and 13)

Fuel Type	LHGR
GNF2	See Table B-2 of Reference 7
GNF3	See Table A-2 of Reference 12
HBLUA	See Table 4-1 of Reference 13

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

GNF2 SLO Multiplier[6]	0.80
GNF3 SLO Multiplier[7]	0.90

[6] Applied to Table 5-6
[7] Applied to Table 5-7

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				

TABLE 5-5
Power Dependent LHGR Multiplier $LHGRFAC_P$
GNF3 Fuel
(References 2, 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 3.3.6-2. The trip setpoints/allowable values and applicable RBM signal filter time constant data 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 17. 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 Setpoints[8]
(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)

Analytical Limit	N/A
Allowable Value	115.6%
Nominal Trip Setpoint	113.4%

[8] 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 Limits[9]
(Reference 2)

Power (% rated)	RBM Operability Limit
30 ≤ Power < 90	MCPR < 1.73
Power ≥ 90	MCPR < 1.43

[9] 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[10]	0.11 sec
Maximum time after initial turbine inlet valve movement[10] 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

[10] 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 2 Cycle 17 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 2 Cycle 17 are documented in the Supplemental Reload Licensing Report (Reference 2) and the Limerick Unit 2 Cycle 17 BSP Evaluation at Rated NFWT (Reference 14).

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 2 Cycle 17 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.

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

EOOS Options[11]	Supported Scram Speed Option	Supported Recirculation Loops
BASE[12,13,14]	Option A or B	DLO or SLO
TBSOOS[15]	Option A or B	DLO or SLO
RPTOOS[15]	Option A or B	DLO or SLO
PROOS	Option A or B	DLO or SLO
PROOS+TBSOOS[15]	Option B	DLO
PROOS+RPTOOS15	Option B	DLO

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

Condition
PLUOOS
1 MSIVOOS[15]
1 TCV/TSVOOS[15]
1 TBVOOS
2 SRVOOS

[11] All EOOS Options include the "BASE" EOOS Option. Any restrictions beyond the "BASE" condition's restrictions are noted on the applicable EOOS option.
[12] The "BASE" condition includes the conditions listed in Table 9-2
[13] The "BASE" condition includes operation with or without FWHOOS/FFWTR
[14] Deleted
[15] 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 2", Exelon Document, Docket No. 50-353, License No. NPF-85

2. "Supplemental Reload Licensing Report for Limerick Unit 2 Reload 16 Cycle 17", Global Nuclear Fuel Document No. 006N3623, Rev. 0, March 2021

3. "Limerick Unit 2 Cycle 17 OPL-3", Exelon TODI NF206038, Rev. 0, November 10, 2020

4. "GE NUMAC PRNM Setpoint Study", Exelon Design Analysis LE-0107, Rev 2, February 23, 2012

5. "Fuel Bundle Information Report for Limerick Unit 2 Reload 16 Cycle 17", Global Nuclear Fuel Document No. 005N3468, Rev. 0, March 2021

6. "Tech Eval Stop Valve Load Limit Documentation", Exelon 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. 066N6029, Rev. 0, May 2021

9. Deleted

10. "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

11. "Technical Evaluation Report to Support Limerick Unit 2 High Burnup Lead Use Assemblies", Global Nuclear Fuel Document No. 006N3535, Rev. 0, February 2021

12. "GNF3 Generic Compliance with NEDE-24011-P-A (GESTAR II)", Global Nuclear Fuel Document No. NEDC-33879P, Rev. 4, August 2020

13. "High Burnup Lead Use Assembly (HBLUA) Information Report for Limerick 2", Global Nuclear Fuel Document Number 006N3997P, Rev. 1, February 2021

14. "Limerick Unit 2 (HH2) Cycle 17 BSP Evaluation at Rated NFWT of 427.1°F", Global Nuclear Fuel Document No. 006N5032, Rev. 0, April 2021