ExelonGeneration

LaSalle County Station
2601 North 21st Road
Marseilles, IL 61341
815-415-2000 Telephone
www.exeloncorp.com

RA20-044

10 CFR 50.4

September 10, 2020

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

LaSalle County Station, Unit 1 and Unit 2
Renewed Facility Operating License No. NFP-11 and NPF-18
NRC Docket No. 50-373 and 50-374

Subject: Unit 1 Cycle 19 Core Operating Limits Report

In accordance with LaSalle County Station (LSCS) Technical Specifications (TS) 5.6.5.d, "CORE OPERATING LIMITS REPORT (COLR)," attached is a copy of the Unit 1 COLR revision 19. The Unit 1 COLR Cycle 19 was revised to implement having up to 50% of traversing in-core probe (TIP) strings out of service in accordance with applicable design analyses and procedures.

There are no regulatory commitments contained within this letter. Should you have any questions concerning this letter, please contact Mr. Dan Mearhoff, Regulatory Assurance Manager, at (815) 415-2800.

Respectfully,

Philip W. Hansett
Plant Manager
LaSalle County Station

Attachments: LaSalle Unit 1 COLR revision 19

cc: Regional Administrator - NRC Region III
NRC Senior Resident Inspector - LaSalle County Station

Core Operating Limits Report

For

LaSalle Unit 1 Cycle 19

Prepared By: Kevin Smith
Kevin Smith, NF CM
Date: 6/22/2020

Reviewed By: Kelly McClure
Kelly McClure, NF CM
Date: 6/24/2020

Reviewed By:
John Simmons, ESA
Date: 6-24-2020

Reviewed By: 2020.06.25 07:56:03 -05'00'
Karl Hachmuth, RE
Date:

Approved By: Ashley Kovacs Digitally signed by Kovacs, Ashley DN: cn=Kovacs, Ashley Date: 2020.06.29 11:16:55 -05'00'
Ashley Kovacs, NF CM
Date:

Station Qualified Review By: Joshua Shea Digitally signed by Shea, Joshua DN: cn=Shea, Joshua ou=LaSalle Reason: I have reviewed this document Location: Date: 2020-07-10 11:08:05 00
Joshua Shea, RE
Date:

Table of Contents

Record of COLR LaSalle 1 Cycle 19 Revisions

Revision	Description
19	Implementation of fleet wide technical evaluation for 50% TIP Strings Out-Of-Service .
18	Initial issuance for L1C19.

List of Tables

1. Terms and Definitions

ARO	All Rods Out
ARTS	Average Power Range Monitor, Rod Block Monitor and Technical Specification Improvement Program
BOC	Beginning of cycle
CRD	Control rod drive
DLO	Dual loop operation
EOC	End of cycle
EOOS	Equipment out of service
EOR	End of rated - Cycle exposure corresponding to all rods out, 100% power/100% flow, and normal feedwater temperature.
FFWTR	Final feedwater temperature reduction
FWHOOS	Feedwater heater out of service
GNF	Global Nuclear Fuels - Americas
ICF	Increased core flow
K_P	Power-dependent MCPR multiplier
L1C19	LaSalle Unit 1 Cycle 19
LHGR	Linear heat generation rate
$LHGRFAC_F$	Flow-dependent LHGR multiplier
$LHGRFAC_P$	Power-dependent LHGR multiplier
LPRM	Local power range monitor
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.
$MCPR_F$	Flow-dependent MCPR
MELLLA	Maximum extended load line limit analysis
MOC	Middle of Cycle Point for Licensing Purposes
MSIVOOS	Main steam isolation valve out of service
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
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
TBV	Turbine bypass valve
TBVOOS	Turbine bypass valve out of service
TCV	Turbine control valve

1. Terms and Definitions (continued)

TCVIS	All Turbine Control Valves/Turbine Stop Valves in-service
TCVSC	Turbine control valve slow closure
TIP	Traversing in-core probe
TSV	Turbine stop valve
3DM	3D Monicore

2. General Information (Reference 7)

The data provided in this report is valid for:

- Maximum Extended Load Line Limit down to 82.8% of rated core flow during full power operation
  - Rated core flow is 108.5 Mlbm/hr (Reference 6)
- ICF to 105% of rated core flow
- Coastdown to 40% rated power
  - Rated core thermal power is 3546 MWth
  - Operation at a power level above that which can be achieved with ARO, ICF, FFWTR, and steady-state equilibrium Xenon concentrations is not supported
- Maximum reduction of 100°F of the feedwater temperature for FWHOOS/FFWTR

Throughout this report, power and flow dependent limits are listed for various power and flow levels. Linear interpolation is to be used to find intermediate values.

Table 2-1 defines the three exposure ranges used in the COLR. The term (EOR19 – 4361 MWd/ST) means the projected Cycle 19 EOR exposure minus 4361 MWd/ST of exposure. For cycle exposure dependent limits at the exact MOC exposure, the more limiting of the BOC to MOC and the MOC to EOC limits should be used. This can be achieved by applying the MOC to EOC limits to the MOC point as all cycle exposure dependent limits in the MOC to EOC limit sets are the same as, or more limiting than, those in the BOC to MOC limit sets.

Table 2-1 Cycle Exposure Range Definitions
(Reference 7)

Nomenclature	Cycle Exposure Range
BOC to MOC	BOC19 to (EOR19 – 4361 MWd/ST)
MOC to EOC	(EOR19 – 4361 MWd/ST) to EOC19
BOC to EOC	BOC19 to EOC19

3. MAPLHGR

Technical Specification Sections 3.2.1 and 3.4.1

MAPLHGR values as a function of average planar exposure are given in Table 3-1. During SLO, these limits are multiplied by the SLO multiplier listed in Table 3-2. Tables 3-1 and 3-2 provide coverage for all modes of operation.

Table 3-1 MAPLHGR versus Average Planar Exposure
GNF2 Fuel
(Reference 7)

Average Planar Exposure (GWd/ST)	MAPLHGR Limit (kW/ft)
0.00	13.78
17.15	13.78
60.78	6.87
63.50	5.50

Table 3-2 MAPLHGR SLO Multiplier
GNF2 Fuel
(Reference 7)

Fuel Type	SLO MAPLHGR Multiplier
GNF2	0.78

4. MCPR

Technical Specification Sections 3.2.2, 3.3.4.1, 3.4.1, and 3.7.7

4.1. MCPR Limits

The rated OLMCPRs given in Table 4-2 are the maximum values obtained from analysis of the pressurization events, non-pressurization events, and the Option III stability evaluation. MCPR values are determined by the cycle-specific fuel reload analyses in Reference 7. Table 4-2 is used in conjunction with the ARTS-based power (Kp) and flow ($MCPR_F$) dependencies presented in Tables 4-3, 4-4, and 4-5 below. The OLMCPR is determined for a given power and flow condition by evaluating the power and flow dependent MCPR values and selecting the greater of the two.

4.1.1. Power-Dependent MCPR

The power-dependent MCPR multiplier, K_P, is determined from Table 4-3, and is dependent only on the power level and the Application Group (EOOS). The product of the rated OLMCPR and the proper K_P provides the power-dependent OLMCPR.

4.1.2. Flow-Dependent MCPR

Tables 4-4 through 4-5 give the $MCPR_F$ limit as a function of the core flow, based on the applicable plant conditions. The $MCPR_F$ limit determined from these tables is the flow-dependent OLMCPR.

4.1.3. Safety Limit MCPR

The cycle-specific SLMCPR, known as $MCPR_{99.9\%}$, can be found in Table 4-6 for dual loop and single loop operating conditions. The values in Table 4-6 were used to calculate the rated MCPR limits.

4.2. Scram Time

Option A and Option B MCPR analyses and results are dependent upon core average control rod blade scram speed insertion times.

The Option A scram time is the Improved Technical Specification scram speed based insertion time. To utilize the MCPR limits for the Option A scram speed insertion times, the core average scram speed insertion time for 20% insertion must be less than or equal to 0.900 seconds (Reference 9) (0.875 seconds at notch position 39, Reference 10).

To utilize the MCPR limits for the Option B scram speed insertion times, the core average scram speed insertion time for 20% insertion must be less than or equal to 0.694 seconds (Reference 9) (0.672 seconds at notch position 39, Reference 10). See Table 4-1 for a summary of scram time requirements related to the use of Option A and Option B MCPR limits.

If the core average scram insertion time does not meet the Option B criteria, but is within the Option A criteria, the appropriate steady state MCPR value may be determined from a linear interpolation between the Option A and B limits with standard mathematical rounding to two decimal places. When performing the linear interpolation to determine MCPR limits, ensure that the time used for Option A is 0.900 seconds (0.875 seconds to notch position 39, Reference 10).

Table 4-1 Scram Times Required for Option A and Option B Application at Notch Position 39
(References 9 and 10)

Notch Position*	Option A	Option B
39	≤ 0.875 sec.	≤ 0.672 sec.

*The insertion time to a notch position is calculated using the CRD reed switch drop-out insertion fraction per Reference 10 and interpolation with scram time values per Reference 9.

4.3. Recirculation Flow Control Valve Settings

Cycle 19 was analyzed with a maximum core flow runout of 105%; therefore, the recirculation pump flow control valves must be set to maintain core flow less than 105% (113.925 Mlbm/hr) for all runout events (Reference 7).

Table 4-2 Operating Limit Minimum Critical Power Ratio (OLMCPR)
GNF2 Fuel
(Reference 7)

Application Group	DLO/ SLO	Exposure Range	Option A	Option B
Base Case	DLO	BOC-MOC	1.41	1.37
		MOC-EOC	1.45	1.41
	SLO	BOC-MOC	1.59	1.59
		MOC-EOC	1.59	1.59
Base Case + TCVSC + RPTOOS + PROOS	DLO	BOC-MOC	1.47	1.39
		MOC-EOC	1.51	1.43
	SLO	BOC-MOC	1.59	1.59
		MOC-EOC	1.59	1.59
Base Case + TCVSC + TBVOOS (all 5 valves)	DLO	BOC-MOC	1.44	1.40
		MOC-EOC	1.48	1.44
	SLO	BOC-MOC	1.59	1.59
		MOC-EOC	1.59	1.59
Base Case + TCVSC + TBVOOS (all 5 valves) + RPTOOS + PROOS	DLO	BOC-MOC	1.50	1.42
		MOC-EOC	1.54	1.46
	SLO	BOC-MOC	1.59	1.59
		MOC-EOC	1.59	1.59
Base Case with TCVIS	DLO	BOC-MOC	1.41	1.37
		MOC-EOC	1.45	1.41
	SLO	BOC-MOC	1.59	1.59
		MOC-EOC	1.59	1.59
Base Case + TCVSC + TBVOOS (all 5 valves) + RPTOOS + PROOS with TCVIS	DLO	BOC-MOC	1.50	1.42
		MOC-EOC	1.54	1.46
	SLO	BOC-MOC	1.59	1.59
		MOC-EOC	1.59	1.59

Table 4-3 Power Dependent MCPR Multipliers (K_P)
GNF2 Fuel
(Reference 7)

Application Group	Core Thermal Power (% rated)						
	0	25	45	60	≤ 85	> 85	100
	K_P, Operating Limit MCPR Multiplier						
Base Case	1.156	1.156	1.156	1.156	1.045	1.045	1.000
Base Case + TCVSC + RPTOOS + PROOS	1.244	1.244	1.178	1.164	1.077	1.045	1.000
Base Case + TCVSC + TBVOOS (all 5 valves)	1.244	1.244	1.178	1.164	1.077	1.045	1.000
Base Case + TCVSC + TBVOOS (all 5 valves) + RPTOOS + PROOS	1.244	1.244	1.178	1.164	1.077	1.069	1.000
Base Case with TCVIS	1.156	1.156	1.156	1.156	1.045	1.045	1.000
Base Case + TCVSC + TBVOOS (all 5 valves) + RPTOOS + PROOS with TCVIS	1.244	1.244	1.178	1.164	1.077	1.069	1.000

Table 4-4 DLO Flow Dependent MCPR Limits ($MCPR_F$)
GNF2 Fuel
(Reference 7)

Flow (% Rated)	$MCPR_F$ Limit
0.0	1.88
30.0	1.70
105.0	1.24*

*This value is lower than the initial MCPR analyzed in the LOCA analysis. However, because PANACEA calculates the off rated MCPR by taking the maximum of the MCPRp, MCPRf, and OLMCPR, the off rated MCPR is inherently higher than analyzed in the LOCA analysis and the LOCA analysis remains applicable at all conditions.

Table 4-5 SLO Flow Dependent MCPR Limits ($MCPR_F$)
GNF2 Fuel
(Reference 7)

Flow (% Rated)	$MCPR_F$
0.0	1.92
30.0	1.74
105.0	1.28

Table 4-6 Cycle Specific SLMCPR ($MCPR_{99.9\%}$)
(Reference 7)

Flow	$MCPR_{99.9\%}$
DLO	1.10
SLO	1.13

5. LHGR

Technical Specification Sections 3.2.3 and 3.4.1

The LHGR limit is the product of the exposure dependent LHGR limit from Table 5-1 and the minimum of the power dependent LHGR Factor, $LHGRFAC_P$, or the flow dependent LHGR Factor, $LHGRFAC_F$, as applicable. The $LHGRFAC_P$ multiplier is determined from Table 5-2. The $LHGRFAC_F$ multiplier is determined from Table 5-3 or Table 5-4. The SLO multipliers in Table 5-3 and Table 5-4 have been limited to a maximum value of 0.78, the SLO LHGR multiplier for GNF2 fuel.

Table 5-1 LHGR Limit
GNF2 Fuel
(References 5 and 8)

Peak Pellet Exposure	UO_2 LHGR Limit
See Table B-1 of Reference 8	

Peak Pellet Exposure	Gadolinia LHGR Limit
See Table B-2 of Reference 8	

Table 5-2 Power Dependent LHGR Multipliers ($LHGRFAC_P$)
GNF2 Fuel
DLO and SLO
(Reference 7)

Application Group	Core Thermal Power (% rated)					
	0	25	45	60	85	100
	$LHGRFAC_P$ Multiplier					
Base Case	0.608	0.608	0.713	0.791	0.922	1.000
Base Case + TCVSC + RPTOOS + PROOS	0.608	0.608	0.703	0.761	0.831	1.000
Base Case + TCVSC + TBVOOS (all 5 valves)	0.608	0.608	0.713	0.791	0.922	1.000
Base Case + TCVSC + TBVOOS (all 5 valves) + RPTOOS + PROOS	0.608	0.608	0.703	0.761	0.822	1.000
Base Case with TCVIS	0.608	0.608	0.713	0.791	0.922	1.000
Base Case + TCVSC + TBVOOS (all 5 valves) + RPTOOS + PROOS with TCVIS	0.608	0.608	0.703	0.761	0.822	1.000

Table 5-3 Flow-Dependent LHGR Multipliers ($LHGRFAC_F$)
GNF2 Fuel
BOC to EOC, Pressurization (Application Groups with 1 TCV/TSV Closed or OOS)
(Reference 7)

Flow (% Rated)	DLO $LHGRFAC_F$	SLO $LHGRFAC_F$
0.0	0.11	0.11
30.0	0.41	0.41
67.0	0.78	0.78
89.0	1.00	0.78
105.0	1.00	0.78

Table 5-4 Flow-Dependent LHGR Multipliers ($LHGRFAC_F$)
GNF2 Fuel
BOC to EOC, No Pressurization (Application Groups with TCV/TSV In-Service)
(Reference 7)

Flow (% Rated)	DLO $LHGRFAC_F$	SLO $LHGRFAC_F$
0.0	0.25	0.25
30.0	0.55	0.55
53.0	0.78	0.78
75.0	1.00	0.78
105.0	1.00	0.78

6. Rod Block Monitor

Technical Specification Sections 3.3.2.1 and 3.4.1

The Rod Block Monitor Upscale Instrumentation Setpoints are determined from the relationships shown below:

Table 6-1 Rod Block Monitor Setpoints
(Reference 3)

Rod Block Monitor Upscale Trip Function	Allowable Value
Two Recirculation Loop Operation	0.66 W_d + 54.0%
Single Recirculation Loop Operation	0.66 W_d + 48.7%

W_d – percent of recirculation loop drive flow required to produce a rated core flow of 108.5 Mlbm/hr.

The setpoint may be lower/higher and will still comply with the RWE analysis because RWE is analyzed unblocked (Reference 7). The allowable value is clamped with a maximum value not to exceed the allowable value for a recirculation loop drive flow (W_d) of 100%.

7. Traversing In-Core Probe System (References 2, 4, and 12)

7.1. Description

When the traversing in-core probe (TIP) system (for the required measurement locations) is used for recalibration of the LPRM detectors and monitoring thermal limits, the TIP system shall be operable with the following:

1. movable detectors, drives, and readout equipment to map the core in the required measurement locations, and
2. indexing equipment to allow all required detectors to be calibrated in a common location.

The following applies for use with 3DM:

At any time, including BOC, the total number of failed and/or bypassed LPRMs does not exceed 25%. In addition, no more than 22 TIP channels can be OOS (failed or rejected).

Otherwise, with the TIP system inoperable, suspend use of the system for the above applicable calibration functions.

7.2. Bases

The operability of the TIP system with the above specified minimum complement of equipment ensures that the measurements obtained from use of this equipment accurately represent the spatial neutron flux distribution of the reactor core. The normalization of the required detectors is performed internal to the core monitoring software system.

8. Stability Protection Setpoints

Technical Specification Section 3.3.1.3

Table 8-1 OPRM PBDA Trip Setpoints
(Reference 7)

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

The PBDA is the only OPRM setting credited in the safety analysis as documented in the licensing basis for the OPRM system.

The OPRM PBDA trip settings are applicable when the OPRM system is declared operable, and the associated Technical Specifications are implemented.

9. Modes of Operation

The allowed modes of operation with combinations of equipment out-of-service are as described below (Reference 7).

Table 9-1 Allowed Modes of Operation and EOOS Combinations
(Reference 7)

Equipment Out of Service Options (1) (2) (3) (4) (5) (6)	Short Names
Base Case	BASE_DLO_OPTB(A)
Base Case + SLO	BASE_SLO_OPTB(A)
Base Case + TCVSC + RPTOOS + PROOS	EOOS1_DLO_OPTB(A)
Base Case + TCVSC + RPTOOS + PROOS + SLO	EOOS1_SLO_OPTB(A)
Base Case + TCVSC + TBVOOS (all 5 valves)	EOOS2_DLO_OPTB(A)
Base Case + TCVSC + TBVOOS (all 5 valves) + SLO	EOOS2_SLO_OPTB(A)
Base Case + TCVSC + TBVOOS (all 5 valves) + RPTOOS + PROOS	EOOS3_DLO_OPTB(A)
Base Case + TCVSC + TBVOOS (all 5 valves) + RPTOOS + PROOS + SLO	EOOS3_SLO_OPTB(A)
Base Case with TCVIS	BASE_TCVIS_DLO_OPTB(A)
Base Case + SLO with TCVIS	BASE_TCVIS_SLO_OPTB(A)
Base Case + TCVSC + TBVOOS (all 5 valves) + RPTOOS + PROOS with TCVIS	EOOS3_TCVIS_DLO_OPTB(A)
Base Case + TCVSC + TBVOOS (all 5 valves) + RPTOOS + PROOS + SLO with TCVIS	EOOS3_TCVIS_SLO_OPTB(A)

(1) Base case includes 1 SRVOOS + 1 TCV/TSV OOS + FWHOOS/FFWTR + 1 MSIVOOS + 2 TBVOOS + PLUOOS. The one TCV and/or TSV OOS conditions require power level ≤ 85% of rated. The one MSIVOOS condition is also supported if thermal power is maintained ≤ 75% of rated (Reference 7).

(2) The 2 TBVOOS in the Base Case are not credited for fast opening or opening on pressure control (Reference 6). The assumption is that two TBVs do not open on any signal and thus remain shut for the transients analyzed (i.e. 3 TBVs are credited to open in pressure control) (Reference 9).

(3) For Application Conditions involving 5 TBVOOS, the 5 TBVs are **NOT** credited for fast opening and 3 TBVs will **not** open on pressure control (Reference 6). The #5 TBV is not available for pressure relief and thus cannot be used as one of the credited valves to open in pressure control.

(4) The + sign that is used in the Equipment Out of Service Option / Application Group descriptions designates an "and/or" (Reference 6).

(5) All EOOS Options are applicable to the entire range of licensed flow and feedwater temperature (MELLLA, ICF, FFWTR, and coastdown) unless otherwise specified (Reference 7). SLO is not applicable to MELLLA or ICF.

(6) All EOOS options in Table 9-1 can be used with Option A or B MCPR limits (Reference 7).

10. 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 documents:

1. GNF Report NEDE-24011-P-A-29 (Revision 29), "General Electric Standard Application for Reactor Fuel (GESTAR II)," October 2019 and the U.S. Supplement NEDE-24011-P-A-29-US, October 2019.

11. References

1. Exelon Generation Company, LLC Docket No. 50-373 LaSalle County Station, Unit 1, Facility Operating License No. NPF-11.

2. GNF Report 005N6665, "Exelon BWR Fleetwide Technical Evaluation of 50% TIP Strings Out-of-Service on Methods Uncertainties," March 2020.

3. Exelon Nuclear Fuels Letter NFM:MW:01-0106, "LaSalle Unit 1 and Unit 2 Rod Block Monitor COLR Setpoint Change," April 3, 2001.

4. GE Nuclear Energy Report NEDC-32694P-A, Revision 0, "Power Distribution Uncertainties for Safety Limit MCPR Evaluations," August 1999.

5. GNF Report 004N8325, Revision 0, "Fuel Bundle Information Report for LaSalle Unit 1 Reload 18 Cycle 19," December 2019.

6. Exelon Transmittal NF194844, Revision 0, "LaSalle Unit 1 Cycle 19 FRED Form," July 26, 2019.

7. GNF Report 004N8324, Revision 0, "Supplemental Reload Licensing Report for LaSalle Unit 1 Reload 18 Cycle 19," December 2019.

8. GNF Document No. NEDC-33270P Revision 9, "GNF2 Advantage Generic Compliance with NEDE-24011-P-A (GESTAR II)", December 2017.

9. Exelon Transmittal ES1900014, Revision 0, "LaSalle Unit 1 Cycle 19 Completed OPL-3 Form," October 2, 2019.

10. GNF Letter DRF A12-00038-3, Vol. 4, "Scram Times versus Notch Position," May 22, 1992.

11. Deleted.

12. NRC Letter, "Issuance of Amendments (TAC Nos. M95156 and M95157)," October 29, 1996.