LaSalle County Station
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RA16-011

10 CFR 50.4

March 10, 2016

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

LaSalle County Station, Unit 1
Facility Operating License No. NPF-11
NRC Docket No. 50-373

Subject: Unit 1 Cycle 17 Core Operating Limits Report (COLR)

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 COLR for Unit 1. This report was revised for LSCS Unit 1, Cycle 17.

Exelon Generation Company, LLC makes no new or revised regulatory commitments in this letter.

Should you have any questions concerning this letter, please contact Mr. Guy V. Ford, Jr., Regulatory Assurance Manager, at (815) 415-2800.

Respectfully,

William J. Trafton
Site Vice President
LaSalle County Station

Attachment: Core Operating Limits Report for LaSalle Unit 1 Cycle 17, Revision 0

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

Core Operating Limits Report for

LaSalle Unit 1

Cycle 17 Revision 0

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Revision History

Record of COLR LaSalle 1 Cycle 17 Revisions

Revision	Description
16	Initial issuance for L1C17.

List of Tables

1. References

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

2. NRC Generic Letter 88-16, from D. M. Crutchfield to All Power Reactor Licensees and Applicants, "Removal of Cycle-Specific Parameter Limits from Technical Specifications," October 3, 1988.

3. Exelon Nuclear Fuels Letter NFM:MW:01-0106, from A. Giancatarino to J. Nugent, "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. GE Nuclear Energy Document GE-NE-A1300384-07-01, Revision 1, "LaSalle County Station Power Uprate Project Task 201: Reactor Power/Flow Map", September 1999.

6. GE Hitachi Nuclear Energy Report, GE-NE-0000-0099-8344-R1, Revision 1, "Exelon Nuclear LaSalle Units 1 and 2 Thermal Power Optimization Task T0201: Operating Power/Flow Map", November 2009.

7. GNF Report 001N4873, Revision 0, "Supplemental Reload Licensing Report for LaSalle Unit 1 Reload 16 Cycle 17," January 2016.

8. GNF Letter MFN 13-029, from B. R. Moore to Document Control Desk, "GNF2 Advantage Generic Compliance with NEDE-24011-P-A (GESTAR II), NEDC-33270P, Revision 5, May 2013," May 24, 2013. (ADAMS Accession No. ML13148A318)

9. Exelon Transmittal ES1500023, Revision 0, "LaSalle 1 Cycle 17 Final Resolved OPL-3 Parameters," September 17, 2015.

10. GNF Letter DRF A12-00038-3, Vol. 4, from G.A. Watford to Distribution, "Scram Times versus Notch Position," May 22, 1992.

11. GEH Nuclear Energy DRF Section 0000-0151-0765, Revision 0, "Application of SLO SLMCPR", February 12, 2013.

12. NRC Letter from D. M. Skay to I. M. Johnson, "Issuance of Amendments (TAC NOS. M95156 and M95157)," October 29, 1996.

2. Terms and Definitions

ARTS	Average Power Range Monitor, Rod Block Monitor and Technical Specification Improvement Program
BOC	Beginning of cycle
BWR	Boiling water reactor
COLR	Core operating limits report
CRD	Control rod drive mechanism
DLO	Dual loop operation
ELLLA	Extended load line limit analysis
EOC	End of cycle
EOOS	Equipment out of service
EOR17	End of rated operation for Cycle 17
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
L1C17	LaSalle Unit 1 Cycle 17
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
$MCPR_F$	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
TCVIS	All Turbine Control Valves/Turbine Stop Valves in-service
TCVSC	Turbine control valve slow closure
TIP	Traversing in-core probe
TIPOOS	Traversing in-core probe out of service
TSV	Turbine stop valve
3DM	3D Monicore

3. General Information

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

Rated core flow is 108.5 Mlbm/hr. Operation up to 105% rated flow is licensed for this cycle. Licensed rated thermal power is 3546 MWth.

For thermal limit monitoring above 100% rated power or 100% rated core flow, the 100% rated power and the 100% core flow values, respectively, can be used unless otherwise indicated in the applicable table.

Table 3-1 defines the three exposure ranges used in the COLR. The end of rated (EOR) exposure is defined as the cycle exposure corresponding to all rods out, 100% power/100% flow, and normal feedwater temperature. The term (EOR – 2211 MWd/ST) means the EOR exposure minus 2211 MWd/ST of exposure. The value of the EOR exposure is based on actual plant operation and is thus determined from projections to this condition made near, but before, the time when the EOR17 – 2211 MWd/ST exposure will be reached. 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 3-1 Cycle Exposure Range Definitions
(Reference 7)

Nomenclature	Cycle Exposure Range
BOC to MOC	BOC17 to (EOR17 – 2211 MWd/ST)
MOC to EOC	(EOR17 – 2211 MWd/ST) to EOC17
BOC to EOC	BOC17 to EOC17

4. Average Planar Linear Heat Generation Rate

Technical Specification Sections 3.2.1 and 3.4.1

MAPLHGR values as a function of average planar exposure are given in Table 4-1. During SLO, these limits are multiplied by the SLO multiplier listed in Table 4-2. The MAPLHGR values in Table 4-1 along with the MAPLHGR SLO multiplier in Table 4-2 provide coverage for all modes of operation.

Table 4-1 MAPLHGR for GNF2 Fuel
(Reference 7)

Avg. Planar Exposure (GWd/ST)	MAPLHGR (kW/FT)
0.00	13.78
17.15	13.78
60.78	6.87
63.50	5.50

Table 4-2 MAPLHGR SLO Multiplier for GNF2 Fuel, BOC to EOC
(Reference 7)

Fuel Type	SLO MAPLHGR Multiplier
GNF2	0.78

5. Operating Limit Minimum Critical Power Ratio

Technical Specification Sections 3.2.2, 3.3.4.1, 3.4.1, and 3.7.7

5.1. Manual Flow Control MCPR Limits

The rated OLMCPRs given in Table 5-2 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 5-2 is used in conjunction with the ARTS-based power (Kp) and flow ($MCPR_F$) dependencies presented in Tables 5-3, 5-4, and 5-5 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.

5.1.1. Power-Dependent MCPR

The power-dependent MCPR multiplier, K_P, is determined from Table 5-3, 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.

5.1.2. Flow-Dependent MCPR

Tables 5-4 through 5-5 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.

5.2. 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. The core average scram speed insertion time for 20% insertion must be less than or equal to the Technical Specification scram speed insertion time to utilize the Option A MCPR limits. Reload analyses performed by GNF for Cycle 17 Option A MCPR limits utilized a 20% core average insertion time of 0.900 seconds (Reference 9).

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 5-1 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 5-1 Scram Times Required for Option A and Option B Application at Notch Position 39
(References 9 and 10)

Notch Position*	Scram Time Required for Option A Application	Scram Time Required for Option B Application
39	≤ 0.875 sec.	≤ 0.672 sec.

*The insertion time to a notch position is conservatively calculated using the CRD reed switch drop-out time per Reference 10.

5.3. Recirculation Flow Control Valve Settings

Cycle 17 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.

Table 5-2 Operating Limit Minimum Critical Power Ratio (OLMCPR) for GNF2 Fuel
(Reference 7)

Application Group	DLO/ SLO	Exposure Range	Option A	Option B
Base Case	DLO	BOC-MOC	1.42	1.38
		MOC-EOC	1.43	1.39
Base Case	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	1.53	1.45
Base Case + TCVSC + RPTOOS + PROOS	SLO	BOC-MOC	1.59	1.59
		MOC-EOC	1.59	1.59
Base Case + TCVSC + TBVOOS (all 5 valves)	DLO	BOC-MOC	1.45	1.41
		MOC-EOC	1.46	1.42
Base Case + TCVSC + TBVOOS (all 5 valves)	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	1.56	1.48
Base Case + TCVSC + TBVOOS (all 5 valves) + RPTOOS + PROOS	SLO	BOC-MOC	1.59	1.59
		MOC-EOC	1.59	1.59
Base Case with TCVIS	DLO	BOC-MOC	1.42	1.38
		MOC-EOC	1.43	1.39
Base Case with TCVIS	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	1.56	1.48
Base Case + TCVSC + TBVOOS (all 5 valves) + RPTOOS + PROOS with TCVIS	SLO	BOC-MOC	1.59	1.59
		MOC-EOC	1.59	1.59

Table 5-3 Power-Dependent MCPR Multipliers (K_P) for GNF2 Fuel, DLO and SLO, BOC to EOC, Option A and Option B
(Reference 7)

Application Group	K_P, MCPR Limit Multiplier (as a function of % rated power)						
	0% P	25% P	45% P	60% P	85% P	85.01%P	100% P
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 5-4 DLO Flow-Dependent MCPR Limits ($MCPR_F$) for GNF2 Fuel, BOC to EOC, All Application Groups, Option A and Option B
(Reference 7)

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

Table 5-5 SLO Flow-Dependent MCPR Limits ($MCPR_F$) for GNF2 Fuel, BOC to EOC, All Application Groups, Option A and Option B
(References 7 and 11)

Flow (% Rated)	$MCPR_F$
0.0	1.90
30.0	1.72
105.0	1.26

6. Linear Heat Generation Rate

Technical Specification Sections 3.2.3 and 3.4.1

The LHGR limit is the product of the exposure dependent LHGR limit from Table 6-1 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 6-2. The $LHGRFAC_F$ multiplier is determined from Table 6-3 or Table 6-4. The SLO multipliers in Table 6-3 and Table 6-4 have been limited to a maximum value of 0.78, the SLO LHGR multiplier for GNF2 fuel.

Table 6-1 LHGR Limit for GNF2 Fuel
(Reference 8)

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

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

Table 6-2 Power-Dependent LHGR Multipliers ($LHGRFAC_P$) for GNF2 Fuel, DLO and SLO, BOC to EOC
(Reference 7)

Application Group	$LHGRFAC_P$ (as a function of % rated power)					
	0% P	25% P	45% P	60% P	85% P	100% P
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 6-3 Flow-Dependent LHGR Multipliers ($LHGRFAC_F$) for GNF2 Fuel, BOC to EOC, Pressurization (1 TCV/TSV Closed or OOS), All Application Groups
(Reference 7)

Flow (% Rated)	DLO $LHGRFAC_F$	SLO $LHGRFAC_F$
0.0	0.110	0.110
30.0	0.410	0.410
67.0	0.78	0.78
89.0	1.000	0.78
105.0	1.000	0.78

Table 6-4 Flow-Dependent LHGR Multipliers ($LHGRFAC_F$) for GNF2 Fuel, BOC to EOC, No Pressurization (All TCV/TSV In-Service), All Application Groups
(Reference 7)

Flow (% Rated)	DLO $LHGRFAC_F$	SLO $LHGRFAC_F$
0.0	0.250	0.250
30.0	0.550	0.550
53.0	0.78	0.78
75.0	1.000	0.78
105.0	1.000	0.78

7. 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 (Reference 3):

Table 7-1 Rod Block Monitor Setpoints

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 rod withdrawal error (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%.

8. Traversing In-Core Probe System (Reference 12)

8.1. 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 (Reference 4):

The total number of failed and/or bypassed LPRMs does not exceed 25%. In addition, no more than 14 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.

8.2. 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.

9. Stability Protection Setpoints

Technical Specification Section 3.3.1.3

Table 9-1 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.

10. Modes of Operation

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

Table 10-1 Allowed Modes of Operation and EOOS Combinations
(Reference 7)

Equipment Out of Service Options (1) (2) (3) (4)	Short Name
Base Case (Option A or B)	Base
Base Case + SLO (Option A or B)	Base SLO
Base Case + TCVSC + RPTOOS + PROOS (Option A or B)	Combined EOOS 1
Base Case + TCVSC + RPTOOS + PROOS + SLO (Option A or B)	Combined EOOS 1 SLO
Base Case + TCVSC + TBVOOS (all 5 valves) (Option A or B)	Combined EOOS 2
Base Case + TCVSC + TBVOOS (all 5 valves) + SLO (Option A or B)	Combined EOOS 2 SLO
Base Case + TCVSC + TBVOOS (all 5 valves) + RPTOOS + PROOS (Option A or B)	Combined EOOS 3
Base Case + TCVSC + TBVOOS (all 5 valves) + RPTOOS + PROOS + SLO (Option A or B)	Combined EOOS 3 SLO
Base Case with TCVIS (Option A or B)	Base TCVIS
Base Case + SLO with TCVIS (Option A or B)	Base SLO TCVIS
Base Case + TCVSC + TBVOOS (all 5 valves) + RPTOOS + PROOS with TCVIS (Option A or B)	Combined EOOS 3 TCVIS
Base Case + TCVSC + TBVOOS (all 5 valves) + RPTOOS + PROOS + SLO with TCVIS (Option A or B)	Combined EOOS 3 SLO TCVIS

(1) Base case includes 1 SRVOOS + 1 TCV/TSV OOS + FWHOOS/FFWTR + 1 MSIVOOS + 2 TBVOOS + PLUOOS, and also includes 1 TIPOOS (up to 14 TIP channels not available) any time during the cycle, including BOC, and up to 25% of the LPRMs out-of-service (failed or rejected) (Reference 4). The one Stuck Closed TCV and/or TSV EOOS conditions require power level ≤ 85% of rated. The one MSIVOOS condition is also supported as long as thermal power is maintained ≤ 75% of the rated (Reference 7). The FWHOOS/FFWTR analyses cover a maximum reduction of 100°F for the feedwater temperature. A nominal LPRM calibration interval of 2000 EFPH (2500 EFPH maximum) is supported for L1C17.

(2) TBVOOS (all 5 valves) is the turbine bypass system out of service which means that 5 TBVs are **not** credited for fast opening and 3 TBVs are **not** credited to open in pressure control. For the 2 TBVOOS condition that is a part of the base case, the assumption is that both of the 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). The MCFL is currently set at 126.6 (Reference 9) and will only allow opening of TBV's #1, #2, #3, and #4 during a slow pressurization event. The MCFL does not use the TBV position feedback signal to know how many TBVs have opened or how far each has opened. The #5 TBV is not available based on the current MCFL setpoint and thus cannot be used as one of the credited valves to open in pressure control.

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

(4) All EOOS Options (Reference 7 Application Groups) are applicable to ELLLA, MELLLA, ICF and Coastdown realms of operation with the exception that SLO is not applicable to MELLLA or ICF (References 5 and 6). The MOC to EOC exposure range limit sets are generated by GNF to include application to coastdown operation (Methodology Reference 1).

11. 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-22 (Revision 22), "General Electric Standard Application for Reactor Fuel," November 2015 and the U.S. Supplement NEDE-24011-P-A-22-US, November 2015.
2. BWR Owners' Group Report NEDO-32465-A (Revision 0), "BWR Owners' Group Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology and Reload Applications," August 1996.