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RA13-010 10CFR50.59

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U. S. Nuclear Regulatory Commission
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LaSalle County Station, Unit 2
Facility Operating License No. NPF-12
NRC Docket No. 50-374

Subject: Unit 2 Cycle 15 Core Operating Limits Report (COLR)

The purpose of this letter is to advise you of the Exelon Generation Company, LLC (EGC) review and approval of the LaSalle Unit 2 Cycle 15 reload under the provisions of 10 CFR 50.59, "Changes, tests and experiments," and to transmit Revision 0 of the Core Operating Limits Report (COLR) for Cycle 15, consistent with Generic Letter 88-16, "Removal of Cycle-Specific Parameter Limits From Technical Specifications." This report is being submitted in accordance with LaSalle County Station Technical Specification (TS) 5.6.5, "Core Operating Limits (COLR)," item d.

The reload licensing analyses performed for Cycle 15 utilized NRC approved methodologies. The Unit 2 Cycle 15 core, which consists of NRC approved fuel designs developed by AREVA NP Inc. and Global Nuclear Fuel – Americas, LLC (GNF-A) was designed to operate within approved fuel design criteria provided in the Technical Specifications and related TS Bases. The core operating characteristics are bounded by the Updated Final Safety Analysis Report (UFSAR) allowable limits.

Some of the information in the Unit 2 Cycle 15 COLR (Revision 0) is proprietary to GNF-A, and is supported by a signed affidavit from the owner of the information. The affidavit, which is provided within the applicable document, sets forth the basis on which the information may be withheld from public disclosure by the NRC, and addresses with specificity the considerations listed in paragraph (b)(4) of 10 CFR 2.390, “Public inspections, exemptions, requests for withholding.”

Accordingly, it is respectfully requested that the information be withheld from public disclosure in accordance with 10 CFR 2.390. A non-proprietary version of the Unit 2 Cycle 15 COLR is provided.

EGC has performed a review of the relevant reload licensing documents, associated TS Bases, and references in accordance with 10 CFR 50.59. This review concluded that the reload does not require NRC review and approval.

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

Respectfully,

Peter J. Karaba
Site Vice President
LaSalle County Station

Attachments:

1. Core Operating Limits Report for LaSalle Unit 2 Cycle 15, Revision 0 (Proprietary)
2. Core Operating Limits Report for LaSalle Unit 2 Cycle 15, Revision 0 (Non-proprietary)

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

Core Operating Limits Report for

LaSalle Unit 2

Cycle 15 Revision 0

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List of Tables

1. References

1. Exelon Generation Company, LLC Docket No. 50-374 LaSalle County Station, Unit 2, License No. NPF-18.

2. NRC Letter from D. M. Crutchfield to All Power Reactor Licensees and Applicants, Generic Letter 88-16; Concerning the Removal of Cycle-Specific Parameter Limits from Tech Specs, October 3, 1988.

3. 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. AREVA document 51-9114888-000, "Plant Startup Testing Requirements for Power Distribution Uncertainty Verification", AREVA NP, Inc., July 6, 2009.

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 0000-0156-1147-SRLR, Revision 1, "Supplemental Reload Licensing Report for LaSalle Unit 2 Reload 14 Cycle 15," January 2013.

8. GNF Report 0000-0156-1147-FBIR-P, Revision 0, "Fuel Bundle Information Report for LaSalle Unit 2 Reload 14 Cycle 15," January 2013.

9. AREVA Report ANP-2914(P), Revision 1, "Mechanical Design Report for LaSalle Units 1 and 2 MUR ATRIUM-10 Fuel Assemblies," AREVA NP Inc., June 2010.

10. Exelon Transmittal ES1200013, Revision 0, "LaSalle Unit 2 Cycle 15 Final Resolved OPL-3 Parameters," August 22, 2012.

11. GNF DRF A12-00038-3, Vol. 4, "Scram Times Verses Notch Position," G. A. Watford, May 22, 1992.

12. GNF Transmittal CFL-EXN-HA2-12-173, transmitting results of DRF Section 0000-0155-9963, "LaSalle Unit 2 Cycle 15 Single LHGR Curve Determination (TSD NF-B483)," December 19, 2012.

13. LaSalle Transmittal SEAG 13-000010, Revision 0, "LaSalle L2C15 OPRM Successive Confirmation Count Setpoint and OPRM Amplitude," January 28, 2013.

14. GNF Report NEDC-33647-P, Revision 2, "GNF2 Fuel Design Cycle-Independent Analyses for Exelon LaSalle County Station Units 1 and 2," February, 2012.

15. GNF DRF Section 0000-0151-0765 Rev. 0, "Application of SLO MCPR", 2/12/13.

2. Terms and Definitions

ARTS	Average Power Range Monitor, Rod Block Monitor and Technical Specification Improvement Program
ATRM10	AREVA ATRIUM-10 fuel type
BOC	Beginning of cycle
BWR	Boiling water reactor
CFR	Code of Federal Regulations
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
EOR15	End of rated operation for Cycle 15
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
L2C15	LaSalle Unit 2 Cycle 15
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
TCVSC	Turbine control valve slow closure
TIP	Traversing in-core probe
TIPOOS	Traversing in-core probe out of service
TSV	Turbine stop valve

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.

The thermal limits provided in the COLR support SLO for all analyzed equipment out of service options.

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 – 3331 MWd/MTU) means the EOR exposure minus 3331 MWd/MTU 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 EOR15 – 3331 MWd/MTU 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	BOC15 to (EOR15 – 3331 MWd/MTU)
MOC to EOC	(EOR15 – 3331 MWd/MTU) to EOC15
BOC to EOC	BOC15 to EOC15

4. Average Planar Linear Heat Generation Rate

The MAPLHGR values for the most limiting lattice of each fuel type as a function of average planar exposure are given in Tables 4-1 and 4-2. During single loop operation, these limits are multiplied by the fuel-dependent SLO multiplier listed in Table 4-3. The MAPLHGR values in Tables 4-1 and 4-2 along with the MAPLHGR SLO multipliers in Table 4-3 provide coverage for all modes of operation.

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

Avg. Planar Exposure (GWd/MTU)	MAPLHGR (kW/FT)
0.00	13.78
18.91	13.78
67.00	6.87
70.00	5.50

Table 4-2 MAPLHGR for ATRIUM-10 Fuel
(Reference 7)

Avg. Planar Exposure (GWd/MTU)	MAPLHGR (kW/FT)
0.00	12.81
23.61	12.81
61.10	9.10
70.40	7.30

Table 4-3 MAPLHGR SLO Multiplier for GNF2 and ATRIUM-10 Fuel, BOC to EOC
(Reference 7)

Fuel Type	SLO MAPLHGR Multiplier
GNF2	0.78
ATRIUM-10	0.78

5. Operating Limit Minimum Critical Power Ratio

5.1. Manual Flow Control MCPR Limits

The steady-state 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 and flow dependencies presented in the sections below.

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 steady state 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. Table 5-5, for SLO, was created by adjusting the Table 5-4 limits by the delta of the SLO and DLO SLMCPR values (0.03) as stated in Reference 7 and clarified in Reference 15. The data in Table 5-4 is taken from Reference 7.

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 15 Option A MCPR limits utilized a 20% core average insertion time of 0.900 seconds (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 10) (0.672 seconds at notch position 39, Reference 11). 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 11). Note that making interpolations using the Table 5-2 data is conservative because the stability based OLMCPR sets the limit in many conditions. The Option A to Option B linear interpolation need not include the stability OLMCPR penalty on the endpoints when the calculation is made. However, the result of the linear interpolation is required to be 1.48 or greater for the steady state OLMCPR due to the OPRM PBDA setpoint (see Section 9 of the COLR and Reference 7).

Table 5-1 Scram Times Required for Option A and Option B Application at Notch Position 39
(References 10 and 11)

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 11.

5.3. Recirculation Flow Control Valve Settings

Cycle 15 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 ATRIUM-10 and GNF2 Fuel
(Reference 7)

Application Group	DLO/ SLO	Exposure Range	Option A		Option B	
			GNF2	ATRM10	GNF2	ATRM10
Base Case	DLO	BOC-MOC	1.50	1.48 (2)	1.48 (2)	1.48 (2)
		MOC-EOC	1.56	1.53 (3)	1.51	1.48
Base Case	SLO(1)	BOC-MOC	1.59	1.48	1.59	1.48 (2)
		MOC-EOC	1.59	1.56 (3)	1.59	1.51
Base Case + TCVSC + RPTOOS + PROOS	DLO	BOC-MOC	1.58	1.57	1.48	1.48 (2)
		MOC-EOC	1.64	1.68	1.54	1.51
Base Case + TCVSC + RPTOOS + PROOS	SLO(1)	BOC-MOC	1.61	1.60	1.59	1.49
		MOC-EOC	1.67	1.71	1.59	1.54
Base Case + TCVSC + TBVOOS (all 5 valves)	DLO	BOC-MOC	1.53	1.48	1.48	1.48 (2)
		MOC-EOC	1.59	1.53	1.54	1.50
Base Case + TCVSC + TBVOOS (all 5 valves)	SLO(1)	BOC-MOC	1.59	1.51	1.59	1.48
		MOC-EOC	1.62	1.56	1.59	1.53
Base Case + TCVSC + TBVOOS (all 5 valves) + RPTOOS + PROOS	DLO	BOC-MOC	1.61	1.59	1.51	1.48
		MOC-EOC	1.68	1.71	1.58	1.54
Base Case + TCVSC + TBVOOS (all 5 valves) + RPTOOS + PROOS	SLO(1)	BOC-MOC	1.64	1.62	1.59	1.51
		MOC-EOC	1.71	1.74	1.61	1.57

(1) For single loop operation, the OLMCPR is the greater of (a) the OPRM based OLMCPR value of 1.48 or (b) 0.03 greater than the two loop limit. However, a minimum value of 1.59 is required for GNF2 fuel to protect the OLMCPR set by the single loop operation recirculation pump seizure event (Reference 7). The single loop operation recirculation pump seizure event is less limiting than the OPRM setpoint for ATRIUM-10 fuel.

(2) OLMCPR is set to reflect OPRM amplitude setpoint of 1.11 (OLMCPR of 1.48) (References 7 and 13). The OPRM amplitude setpoint and resultant OLMCPR are applicable to both DLO and SLO, without alteration.

(3) As part of the Kp improvement analysis (see Reference 7), a requirement is added that the ATRIUM 10 Option A Base Case MOC-EOC DLO OLMCPR have a minimum value of 1.53. The minimum SLO value needs to be increased by the SLO adder of 0.03 resulting in a value of 1.56.

Table 5-3 Power-Dependent MCPR Multipliers (K_P) for ATRIUM-10 and 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	1.338	1.338	1.191	1.191	1.061	1.061	1.000
Base Case + TCVSC + RPTOOS + PROOS	1.488	1.488	1.378	1.296	1.174	1.097	1.000
Base Case + TCVSC + TBVOOS (all 5 valves)	1.379	1.379	1.228	1.207	1.097	1.097	1.000
Base Case + TCVSC + TBVOOS (all 5 valves) + RPTOOS + PROOS	1.488	1.488	1.378	1.296	1.174	1.097	1.000

Table 5-4 DLO Flow-Dependent MCPR Limits ($MCPR_F$) for ATRIUM-10 and GNF2 Fuel, BOC to EOC, All Application Groups, Option A and Option B
(Reference 7)

Flow (% Rated)	$MCPR_F$
0.0	1.91
30.0	1.72
105.0	1.25

Table 5-5 SLO Flow-Dependent MCPR Limits ($MCPR_F$) for ATRIUM-10 and GNF2 Fuel, BOC to EOC, All Application Groups, Option A and Option B
(References 7 and 15)

Flow (% Rated)	$MCPR_F$
0.0	1.94
30.0	1.75
105.0	1.28

6. Linear Heat Generation Rate

The linear heat generation rate (LHGR) limit is the product of the exposure dependent LHGR limit from Table 6-1 or Table 6-2 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 6-3. The $LHGRFAC_F$ multiplier is determined from either Table 6-4 or Table 6-5. The SLO multipliers in Tables 6-4 and 6-5 have been limited to a maximum value of 0.78, the SLO LHGR multiplier for GNF2 and ATRIUM-10 fuel.

Table 6-1 LHGR Limit for GNF2 Fuel
(References 8 and 12)

See Appendix A (1)

Table 6-2 LHGR Limit for ATRIUM-10 Fuel
(Reference 9)

Peak Pellet Exposure (GWd/MTU)	LHGR Limit (kW/ft)
0.0	13.4
17.7	13.4
61.1	9.1
70.4	7.3

(1) The only LHGR limits required to be used to monitor GNF2 fuel for L2C15 are the UO2 pin limits (Reference 12). Gadolinia containing pins are non-limiting in L2C15 for the GNF2 fuel designs.

Table 6-3 Power-Dependent LHGR Multipliers ($LHGRFAC_P$) for ATRIUM-10 and 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	0.713	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	0.713	0.761	0.822	1.000

Table 6-4 Flow-Dependent LHGR Multipliers ($LHGRFAC_F$) for ATRIUM-10 and 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 6-5 Flow-Dependent LHGR Multipliers ($LHGRFAC_F$) for ATRIUM-10 and 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

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	$0.66\ W_d + 48.7\%$

The setpoint may be lower/higher and will still comply with the rod withdrawal error (RWE) analysis because RWE is analyzed unblocked. 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%.

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

8. Traversing In-Core Probe System

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 of the SUBTIP methodology (Reference 4):

The total number of failed and bypassed LPRMs does not exceed 50%. With one or more TIP measurement locations inoperable, the TIP data for an inoperable measurement location may be replaced by data obtained from a 3-dimensional BWR core monitoring software system algorithm, provided the total number of simulated channels (measurement locations) does not exceed 42% (18 channels).

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.

Substitute TIP data, if needed, are derived from adjusted 3-dimensional BWR core monitoring software calculated data, which is based on measured and calculated axial and radial factors. Since the simulation and adjustment process could introduce uncertainty, a maximum of 18 channels may be simulated to ensure that the uncertainties assumed in the substitution process methodology remain valid.

9. Stability Protection Setpoints

The OPRM PBDA trip settings are shown in Table 9-1 and were taken from the Reference 13 transmittal.

Table 9-1 OPRM PBDA Trip Setpoints
(References 7 and 13)

PBDA Trip Amplitude Setpoint (Sp)	Corresponding Maximum Confirmation Count Setpoint (Np)
1.11	14

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 based, in part, on the cycle specific OLMCPR and the power dependent MCPR limits. Any change to the OLMCPR values and/or the power dependent MCPR limits should be evaluated for potential impact on the OPRM PBDA trip settings.

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) (4) (5)	**Short Name**
Base Case (Option A or B) (3)	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

(1) Base case includes 1 SRVOOS + 1 TCV/TSV OOS + FWHOOS/FFWTR + 1 MSIVOOS + 2 TBVOOS + PLUOOS, and also includes 2 TIPOOS (or the equivalent number of TIP channels) any time during the cycle, including BOC, and up to 50% of the LPRMs out-of-service. 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 L2C15.

(2) TBVOOS (all 5 valves) is the turbine bypass system out of service which means that 5 TBVs are **<u>not</u>** credited for fast opening and 3 TBVs are **<u>not</u>** 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.

(3) With all TCV/TSV In-Service, the Base Case should be used with the $LHGRFAC_F$ values from Table 6-5 (Reference 7). With 1 TCV/TSV OOS, the Base Case must be used with the $LHGRFAC_F$ values from Table 6-4. 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.

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

(5) 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 19).

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. XN-NF-81-58 (P)(A), Revision 2 and Supplements 1 and 2, "RODEX2 Fuel Rod Thermal-Mechanical Response Evaluation Model," March 1984.
2. ANF-524 (P)(A) Revision 2 and Supplements 1 and 2, "ANF Critical Power Methodology for Boiling Water Reactors," November 1990 [XN-NF-524 (P)(A)].
3. ANF-913 (P)(A) Volume 1 Revision 1, and Volume 1 Supplements 2, 3, 4, "COTRANSA2: A Computer Program for Boiling Water Reactor Transient Analyses," August 1990.
4. XN-NF-84-105 (P)(A), Volume 1 and Volume 1 Supplements 1 and 2; Volume 1 Supplement 4, "XCOBRA-T: A Computer Code for BWR Transient Thermal-Hydraulic Core Analysis," February 1987 and June 1988, respectively.
5. EMF-2209 (P)(A), Revision 3, "SPCB Critical Power Correlation," September 2009.
6. ANF-89-98 (P)(A), Revision 1 and Revision 1 Supplement 1, "Generic Mechanical Design Criteria for BWR Fuel Designs," May 1995.
7. EMF-85-74 (P) Revision 0 Supplement 1(P)(A) and Supplement 2(P)(A), "RODEX2A (BWR) Fuel Rod Thermal-Mechanical Evaluation Model," February 1998.
8. EMF-CC-074 (P)(A) Volume 4 Revision 0, "BWR Stability Analysis: Assessment of STAIF with Input from MICROBURN-B2," August 2000.
9. ANF-CC-33 (P)(A) Supplement 1 Revision 1 and Supplement 2, "HUXY: A Generalized Multirod Heatup Code with 10 CFR 50, Appendix K Heatup Option," August 1986 and January 1991, respectively.
10. XN-NF-80-19 (P)(A) Volume 4 Revision 1, "Exxon Nuclear Methodology for Boiling Water Reactors: Application of the ENC Methodology to BWR Reloads," June 1986.
11. XN-NF-85-67 (P)(A) Revision 1, "Generic Mechanical Design for Exxon Nuclear Jet Pump BWR Reload Fuel," September 1986.
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18. ANF-1358 (P)(A), Revision 3, "The Loss of Feedwater Heating Transient in Boiling Water Reactors," September 2005.
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Appendix A

Global Nuclear Fuel

A Joint Venture of GE, Toshiba, & Hitachi

Global Nuclear Fuel

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Revision 0
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Non-Proprietary Information-Class I (Public)

FUEL BUNDLE INFORMATION REPORT FOR LASALLE UNIT 2 RELOAD 14 CYCLE 15

Important Notice Regarding Contents of This Report

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1. Introduction and Summary

This report, which supplements the *Supplemental Reload Licensing Report*, contains thermal-mechanical linear heat generation rate (LHGR) limits for the GNF-A fuel designs to be loaded into LaSalle Unit 2 for Cycle 15. These LHGR limits are obtained from thermal-mechanical considerations only. Approved GNF-A calculation models documented in Reference 1 were used in performing this analysis.

LHGR limits as a function of exposure for each bundle of the core design are given in Appendix A. The LHGR values provided in Appendix A provide upper and lower exposure dependent LHGR boundaries which envelope the actual gadolinia dependent LHGR limits. The LHGRs reported have been rounded to two places past the decimal.

Appendix B contains a description of the fuel bundles. Table B-1 contains a summary of bundle-specific information, and the figures provide the enrichment distribution and gadolinium distribution for the fuel bundles included in this appendix. These bundles have been approved for use under the fuel licensing acceptance criteria of Reference 1.

2. References

1. *General Electric Standard Application for Reactor Fuel*, NEDE-24011-P-A-19, May 2012; and the U.S. Supplement, NEDE-24011-P-A-19-US, May 2012.

Appendix A
UO_2/Gd Thermal-Mechanical LHGR Limits

Bundle Type: GNF2-P10CG2B408-12GZ-120T2-150-T6-4069 (GNF2)

Bundle Number: 4069

Peak Pellet Exposure	**UO_2 LHGR Limit**
GWd/MT (GWd/ST)	**kW/ft**
[[	
	]]

Peak Pellet Exposure	**Most Limiting Gadolinia LHGR Limit [1]**
GWd/MT (GWd/ST)	**kW/ft**
[[	
	]]

[1] Bounding gadolinia LHGR limit for all gadolinium concentrations occurring in this bundle design [[ ]].

UO_2/Gd Thermal-Mechanical LHGR Limits

Bundle Type: GNF2-P10CG2B410-17GZ-120T2-150-T6-4070 (GNF2)

Bundle Number: 4070

Peak Pellet Exposure	UO_2 LHGR Limit
GWd/MT (GWd/ST)	kW/ft
[[	
	]]

Peak Pellet Exposure	Most Limiting Gadolinia LHGR Limit [2]
GWd/MT (GWd/ST)	kW/ft
[[	
	]]

[2] Bounding gadolinia LHGR limit for all gadolinium concentrations occurring in this bundle design [[ ]].

UO_2/Gd Thermal-Mechanical LHGR Limits

Bundle Type: GNF2-P10CG2B408-15GZ-120T2-150-T6-4206 (GNF2)

Bundle Number: 4206

Peak Pellet Exposure	UO_2 LHGR Limit
GWd/MT (GWd/ST)	kW/ft
[[	
	]]

Peak Pellet Exposure	Most Limiting Gadolinia LHGR Limit [3]
GWd/MT (GWd/ST)	kW/ft
[[	
	]]

[3] Bounding gadolinia LHGR limit for all gadolinium concentrations occurring in this bundle design [[ ]].

UO_2/Gd Thermal-Mechanical LHGR Limits

Bundle Type: GNF2-P10CG2B403-16GZ-120T2-150-T6-4205 (GNF2)

Bundle Number: 4205

Peak Pellet Exposure	UO_2 LHGR Limit
GWd/MT (GWd/ST)	kW/ft
[[	
	]]

Peak Pellet Exposure	Most Limiting Gadolinia LHGR Limit [4]
GWd/MT (GWd/ST)	kW/ft
[[	
	]]

[4] Bounding gadolinia LHGR limit for all gadolinium concentrations occurring in this bundle design [[ ]].

UO_2/Gd Thermal-Mechanical LHGR Limits

Bundle Type: GNF2-P10CG2B402-17GZ-120T2-150-T6-4207 (GNF2)

Bundle Number: 4207

Peak Pellet Exposure	UO_2 LHGR Limit
GWd/MT (GWd/ST)	kW/ft
[[	
	]]

Peak Pellet Exposure	Most Limiting Gadolinia LHGR Limit [5]
GWd/MT (GWd/ST)	kW/ft
[[	
	]]

[5] Bounding gadolinia LHGR limit for all gadolinium concentrations occurring in this bundle design [[ ]].

Appendix B
Fuel Bundle Information

Table B-1 Bundle Specific Information						
Fuel Bundle	**Bundle Number**	**Enrichment (wt% U-235)**	**Weight of UO_2 (kg)**	**Weight of U (kg)**	**Max k_∞ at 20°C [6]**	**Exposure at Max k_∞ GWd/MT (GWd/ST)**
GNF2-P10CG2B408-12GZ-120T2-150-T6-4069 (GNF2)	4069	[[				
GNF2-P10CG2B410-17GZ-120T2-150-T6-4070 (GNF2)	4070					
GNF2-P10CG2B408-15GZ-120T2-150-T6-4206 (GNF2)	4206					
GNF2-P10CG2B403-16GZ-120T2-150-T6-4205 (GNF2)	4205					
GNF2-P10CG2B402-17GZ-120T2-150-T6-4207 (GNF2)	4207					]]

[6] Maximum lattice k_∞ for the most reactive uncontrolled state plus a [[ ]] adder for uncertainties.

[[

]]

**Figure B-1 Enrichment and Gadolinium Distribution for EDB No. 4069
Fuel Bundle GNF2-P10CG2B408-12GZ-120T2-150-T6-4069 (GNF2)**

[[

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Figure B-2 Enrichment and Gadolinium Distribution for EDB No. 4070
Fuel Bundle GNF2-P10CG2B410-17GZ-120T2-150-T6-4070 (GNF2)

[[

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Figure B-3 Enrichment and Gadolinium Distribution for EDB No. 4206 Fuel Bundle GNF2-P10CG2B408-15GZ-120T2-150-T6-4206 (GNF2)

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Figure B-4 Enrichment and Gadolinium Distribution for EDB No. 4205 Fuel Bundle GNF2-P10CG2B403-16GZ-120T2-150-T6-4205 (GNF2)

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Figure B-5 Enrichment and Gadolinium Distribution for EDB No. 4207
Fuel Bundle GNF2-P10CG2B402-17GZ-120T2-150-T6-4207 (GNF2)