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Exelon Nuclear

RA08-008

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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 13 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 1 Cycle 13 reload under the provisions of 10 CFR 50.59, "Changes, tests and experiments," and to transmit the Core Operating Limits Report (COLR) for Cycle 13, 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 13 utilized NRC approved methodologies. The Unit 1 Cycle 13 core, which consists of NRC approved fuel designs developed by Global Nuclear Fuel (GNF) and Framatome Advanced Nuclear Fuel, Inc., (i.e., Framatome), 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.

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. Terrence W. Simpkin, Regulatory Assurance Manager, at (815) 415-2800.

Respectfully,

Daniel J. Enright
Site Vice President
LaSalle County Station

Attachment

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

A001
NRR

LaSalle Unit 1 Cycle 13

Core Operating Limits Report

Revision 0

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List of Tables

1. References

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

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. AREVA Report ANP-2678 Revision 0, "LaSalle Unit 1 Cycle 13 Reload Analysis," AREVA NP Inc., December 2007.

4. AREVA Report ANP-2620 (P) Revision 1, "LaSalle Unit 1 Cycle 13 Principal Transient Analysis Parameters", AREVA NP, Inc., October 2007.

5. 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.

6. Framatome ANP Letter from R. G. Grummer to N. J. Carr, "Plant Startup Testing with POWERPLEX-III", RGG:04:001, January 8, 2004.

7. GNF Report 0000-0017-8285-SRLR,"Supplemental Reload Licensing Report for LaSalle County Nuclear Station Unit 1 Reload 10 Cycle 11," December 2003.

8. GE Document GE-NE-0000-0026-4769-00, "GE14 Fuel Design Cycle-Independent Analyses for LaSalle Unit 1 and Unit 2," Revision 0, January 2005.

9. GNF Letter TGO-EXN-HA103-011, from T. Orr to R. Chin, "Transmittal of Peak Pellet LHGR Limits for LaSalle 1 Cycle 11 GE14 Bundles with Gad Suppression," July 3, 2003.

10. GE Document GE-NE-0000-0022-8684-R1, "Exelon LaSalle Units 1 and 2 SAFER/GESTR Loss-of-Coolant-Accident Analysis for GE14 Fuel", December 2004.

11. GE Document GE-NE-A1300384-07-01, Rev. 1, "LaSalle County Station Power Uprate Project, Task 201: Reactor Power/Flow Map", September 1999.

12. Framatome ANP Letter from N. Carr to M. Hsiao, "Startup with TIP Equipment Out of Service", NJC:04:031, April 20, 2004.

2. Terms and Definitions

APLHGR	Average planar linear heat generation rate
APRM	Average power range monitor
ATRM10	ATRIUM-10 fuel
BOC	Beginning of cycle
DLO	Dual loop operation
ELLLA	Extended load line limit analysis
EOC	End of cycle
EOOS	Equipment out of service
FANP	Framatome Advanced Nuclear Power
FFTR	Final feedwater temperature reduction
FHOOS	Feedwater heater out of service
GE14	GE14C fuel
GNF	Global Nuclear Fuel
ICF	Increased core flow
LHGR	Linear heat generation rate
LHGRFAC(F)	Flow dependent LHGR multiplier
LHGRFAC(P)	Power dependent LHGR multiplier
LPRM	Local power range monitor
MAPFAC(F)	Flow dependent MAPLHGR multiplier
MAPFAC(P)	Power dependent MAPLHGR multiplier
MAPLHGR	Maximum average planar linear heat generation rate
MCPR	Minimum critical power ratio
MCPR(F)	Flow dependent MCPR
MCPR(P)	Power dependent MCPR
MELLLA	Maximum extended load line limit analysis
MSIV	Main steam isolation valve
MSIVOOS	Main steam isolation valve out of service
NEOC	Near end of cycle
NSS	Nominal scram speed
OLMCPR	Operating limit minimum critical power ratio
OPRM	Oscillation power range monitor
PBDA	Period based detection algorithm
PLUOOS	Power load unbalance out of service
PPD	Plant Parameter Document
PROOS	Pressure regulator out of service
RBM	Rod block monitor
RPT	Recirculation pump trip
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
TCVOOS	Turbine control valve out of service
TIP	Traversing in-core probe
TIPOOS	Traversing in-core probe out of service
TSSS	Technical specification scram speed
TSV	Turbine stop valve
TSVOOS	Turbine stop valve out of service

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 Mlb/hr. Operation up to 105% rated flow is licensed for this cycle. Licensed rated thermal power is 3489 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 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.

Core Exposure Definitions (Reference 3):

Exposure Nomenclature	Core Average Exposure (MWD/MTU)
NEOC13	31192
EOC13	34209
Maximum Core Exposure	38209

4. Average Planar Linear Heat Generation Rate

The MAPLHGR values for the most limiting lattice (excluding natural uranium) of each fuel type as a function of average planar exposure is given in Tables 4-1 and 4-2. During single loop operation, these limits are multiplied by the SLO multiplier listed in Table 4-3.

Table 4-1 MAPLHGR for bundle(s):
A10-4046B-13GV80
A10-3537B-12GV80
A10-3537B-12GV80a
A10-3913B-12GV80
A10-4041B-14GV80
A10-3924B-14GV80
(Reference 3)

Avg. Planar Exposure (GWd/MT)	MAPLHGR (kW/ft)
0.00	12.5
15.00	12.5
55.00	9.1
67.00	7.1

Table 4-2 MAPLHGR for bundle(s):
GE14-P10CNAB421-18GZ-120T-150-T6-2673
GE14-P10CNAB422-19GZ-120T-150-T6-2677
(Reference 7)

Avg. Planar Exposure (GWd/MT)	MAPLHGR (kW/ft)
0.00	13.40
16.00	13.40
63.50	8.00
70.00	5.00

Table 4-3 MAPLHGR SLO multiplier for GNF and AREVA Fuel
(Reference 3 and 7)

Fuel Type	SLO Multiplier
ATRM10	0.82
GE14	0.78

5. Operating Limit Minimum Critical Power Ratio

5.1. Manual Flow Control MCPR Limits

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.

5.1.1. Power-Dependent MCPR

The power-dependent MCPR limit, MCPR(P), is determined from Tables 5-1 through 5-12, and is dependent on exposure, fuel type, and scram speed, in addition to power level. Tables 5-1, 5-2, 5-5, 5-6, 5-9 and 5-10 are applicable to ATRIUM-10 fuel and Tables 5-3, 5-4, 5-7, 5-8, 5-11 and 5-12 are applicable to GE14 fuel.

5.1.2. Flow - Dependent MCPR

Tables 5-13 through 5-18 give the MCPR(F) limit as a function of the flow based on the applicable plant condition. The MCPR(F) limit determined from these tables is the flow dependent OLMCPR.

5.2. Automatic Flow Control MCPR Limits

Automatic Flow Control MCPR Limits are not provided.

5.3. Scram Time

NSS and TSSS refer to scram speeds.

To utilize the MCPR limits for Technical Specification Scram Speed (TSSS), the scram speed insertion time must be equal to or less than the values provided below.

To utilize the MCPR limits for Nominal Scram Speed (NSS), the scram speed insertion time must be equal to or less than the values provided below (Reference 4).

Notch Position	TSSS Time (sec.)	NSS Time (sec.)
45	0.53	0.38
39	0.85	0.68
25	1.90	1.68
05	3.45	2.68

5.4. Recirculation Flow Control Valve Settings

Cycle 13 was analyzed with a maximum core flow runout of 105%; therefore the recirculation pump flow control valve must be set to maintain core flow less than 105% (113.9 Mlb/hr) for all runout events (Reference 4). This value is consistent with the analyses of Reference 3.

Table 5-1 MCPR(P) for ATRIUM-10 Fuel
BOC to NEOC
Nominal Scram Speed (NSS)
(Reference 3)

EOOS Combination	Core Thermal Power (% of rated)					
	0	25	60	80	80(80.1)	100
	$MCPR_P$					
Base Case	2.21	2.21	1.55			1.40 *
Base Case SLO	2.22	2.22	1.56			1.41 *
FHOOS	2.31	2.31	1.59			1.40
FHOOS SLO	2.32	2.32	1.60			1.41
Combined EOOS 1	2.34	2.34		1.73	1.52	1.45
Combined EOOS 1 SLO	2.35	2.35		1.74	1.53	1.46
Combined EOOS 2	2.34	2.34		1.73	1.49	1.43
Combined EOOS 2 SLO	2.35	2.35		1.74	1.50	1.44
Combined EOOS 3	2.34	2.34		1.73	1.52	1.45
Combined EOOS 3 SLO	2.35	2.35		1.74	1.53	1.46

* The actual value for DLO case found in Reference 3 is 1.39; however, the minimum steady state OLMCPR is 1.40 based on the cycle specific stability requirements identified in Reference 3 and is reflected above. The SLO value was revised accordingly.

Table 5-2 MCPR(P) for ATRIUM-10 Fuel
BOC to NEOC
Technical Specification Scram Speed (TSSS)
(Reference 3)

EOOS Combination	Core Thermal Power (% of rated)					
	0	25	60	80	80(80.1)	100
	$MCPR_P$					
Base Case	2.29	2.29	1.57			1.43
Base Case SLO	2.30	2.30	1.58			1.44
FHOOS	2.39	2.39	1.61			1.43
FHOOS SLO	2.40	2.40	1.62			1.44
Combined EOOS 1	2.39	2.39		1.73	1.54	1.48
Combined EOOS 1 SLO	2.40	2.40		1.74	1.55	1.49
Combined EOOS 2	2.35	2.35		1.73	1.52	1.45
Combined EOOS 2 SLO	2.36	2.36		1.74	1.53	1.46
Combined EOOS 3	2.40	2.40		1.73	1.54	1.47
Combined EOOS 3 SLO	2.41	2.41		1.74	1.55	1.48

Table 5-3 MCPR(P) for GE14 Fuel
BOC to NEOC
Nominal Scram Speed (NSS)
(Reference 3)

EOOS Combination	Core Thermal Power (% of rated)					
	0	25	60	80	80(80.1)	100
	$MCPR_P$					
Base Case	2.07	2.07	1.49			1.40 *
Base Case SLO	2.08	2.08	1.50			1.41 *
FHOOS	2.16	2.16	1.55			1.41
FHOOS SLO	2.17	2.17	1.56			1.42
Combined EOOS 1	2.24	2.24		1.72	1.53	1.48
Combined EOOS 1 SLO	2.25	2.25		1.73	1.54	1.49
Combined EOOS 2	2.24	2.24		1.72	1.49	1.44
Combined EOOS 2 SLO	2.25	2.25		1.73	1.50	1.45
Combined EOOS 3	2.24	2.24		1.72	1.55	1.50
Combined EOOS 3 SLO	2.25	2.25		1.73	1.56	1.51

* The actual value for DLO case found in Reference 3 is 1.39; however, the minimum steady state OLMCPR is 1.40 based on the cycle specific stability requirements identified in Reference 3 and is reflected above. The SLO value was revised accordingly.

Table 5-4 MCPR(P) for GE14 Fuel
BOC to NEOC
Technical Specification Scram Speed (TSSS)
(Reference 3)

EOOS Combination	Core Thermal Power (% of rated)					
	0	25	60	80	80(80.1)	100
	$MCPR_P$					
Base Case	2.13	2.13	1.51			1.41
Base Case SLO	2.14	2.14	1.52			1.42
FHOOS	2.22	2.22	1.57			1.45
FHOOS SLO	2.23	2.23	1.58			1.46
Combined EOOS 1	2.25	2.25		1.72	1.57	1.52
Combined EOOS 1 SLO	2.26	2.26		1.73	1.58	1.53
Combined EOOS 2	2.25	2.25		1.72	1.52	1.48
Combined EOOS 2 SLO	2.26	2.26		1.73	1.53	1.49
Combined EOOS 3	2.25	2.25		1.72	1.59	1.53
Combined EOOS 3 SLO	2.26	2.26		1.73	1.60	1.54

Table 5-5 MCPR(P) for ATRIUM-10 Fuel
NEOC to EOC
Nominal Scram Speed (NSS)
(Reference 3)

EOOS Combination	Core Thermal Power (% of rated)					
	0	25	60	80	80(80.1)	100
	$MCPR_P$					
Base Case	2.21	2.21	1.55			1.41
Base Case SLO	2.22	2.22	1.56			1.42
FHOOS	2.31	2.31	1.59			1.41
FHOOS SLO	2.32	2.32	1.60			1.42
Combined EOOS 1	2.34	2.34		1.73	1.52	1.47
Combined EOOS 1 SLO	2.35	2.35		1.74	1.53	1.48
Combined EOOS 2	2.34	2.34		1.73	1.49	1.46
Combined EOOS 2 SLO	2.35	2.35		1.74	1.50	1.47
Combined EOOS 3	2.34	2.34		1.73	1.52	1.46
Combined EOOS 3 SLO	2.35	2.35		1.74	1.53	1.47

Table 5-6 MCPR(P) for ATRIUM-10 Fuel
NEOC to EOC
Technical Specification Scram Speed (TSSS)
(Reference 3)

EOOS Combination	Core Thermal Power (% of rated)					
	0	25	60	80	80(80.1)	100
	$MCPR_P$					
Base Case	2.29	2.29	1.57			1.43
Base Case SLO	2.30	2.30	1.58			1.44
FHOOS	2.39	2.39	1.61			1.43
FHOOS SLO	2.40	2.40	1.62			1.44
Combined EOOS 1	2.39	2.39		1.73	1.54	1.51
Combined EOOS 1 SLO	2.40	2.40		1.74	1.55	1.52
Combined EOOS 2	2.35	2.35		1.73	1.53	1.51
Combined EOOS 2 SLO	2.36	2.36		1.74	1.54	1.52
Combined EOOS 3	2.40	2.40		1.73	1.54	1.51
Combined EOOS 3 SLO	2.41	2.41		1.74	1.55	1.52

Table 5-7 MCPR(P) for GE14 Fuel
NEOC to EOC
Nominal Scram Speed (NSS)
(Reference 3)

EOOS Combination	Core Thermal Power (% of rated)					
	0	25	60	80	80(80.1)	100
	$MCPR_P$					
Base Case	2.07	2.07	1.49			1.40
Base Case SLO	2.08	2.08	1.50			1.41
FHOOS	2.16	2.16	1.55			1.41
FHOOS SLO	2.17	2.17	1.56			1.42
Combined EOOS 1	2.24	2.24		1.72	1.53	1.49
Combined EOOS 1 SLO	2.25	2.25		1.73	1.54	1.50
Combined EOOS 2	2.24	2.24		1.72	1.50	1.49
Combined EOOS 2 SLO	2.25	2.25		1.73	1.51	1.50
Combined EOOS 3	2.24	2.24		1.72	1.55	1.50
Combined EOOS 3 SLO	2.25	2.25		1.73	1.56	1.51

Table 5-8 MCPR(P) for GE14 Fuel
NEOC to EOC
Technical Specification Scram Speed (TSSS)
(Reference 3)

EOOS Combination	Core Thermal Power (% of rated)					
	0	25	60	80	80(80.1)	100
	$MCPR_P$					
Base Case	2.13	2.13	1.51			1.41
Base Case SLO	2.14	2.14	1.52			1.42
FHOOS	2.22	2.22	1.57			1.45
FHOOS SLO	2.23	2.23	1.58			1.46
Combined EOOS 1	2.25	2.25		1.72	1.57	1.54
Combined EOOS 1 SLO	2.26	2.26		1.73	1.58	1.55
Combined EOOS 2	2.25	2.25		1.72	1.54	1.54
Combined EOOS 2 SLO	2.26	2.26		1.73	1.55	1.55
Combined EOOS 3	2.25	2.25		1.72	1.59	1.54
Combined EOOS 3 SLO	2.26	2.26		1.73	1.60	1.55

Table 5-9 MCPR(P) for ATRIUM-10 Fuel
Coastdown Operation
Nominal Scram Speed (NSS)
(Reference 3)

EOOS Combination	Core Thermal Power (% of rated)					
	0	25	60	80	80(80.1)	100
	$MCPR_P$					
Base Case	2.21	2.21	1.55			1.42
Base Case SLO	2.22	2.22	1.56			1.43
FHOOS	2.31	2.31	1.59			1.42
FHOOS SLO	2.32	2.32	1.60			1.43
Combined EOOS 1	2.34	2.34		1.73	1.53	1.48
Combined EOOS 1 SLO	2.35	2.35		1.74	1.54	1.49
Combined EOOS 2	2.34	2.34		1.73	1.52	1.48
Combined EOOS 2 SLO	2.35	2.35		1.74	1.53	1.49
Combined EOOS 3	2.34	2.34		1.73	1.52	1.48
Combined EOOS 3 SLO	2.35	2.35		1.74	1.53	1.49

Table 5-10 MCPR(P) for ATRIUM-10 Fuel
Coastdown Operation
Technical Specification Scram Speed (TSSS)
(Reference 3)

EOOS Combination	Core Thermal Power (% of rated)					
	0	25	60	80	80(80.1)	100
	$MCPR_P$					
Base Case	2.29	2.29	1.57			1.43
Base Case SLO	2.30	2.30	1.58			1.44
FHOOS	2.39	2.39	1.61			1.43
FHOOS SLO	2.40	2.40	1.62			1.44
Combined EOOS 1	2.39	2.39		1.73	1.56	1.52
Combined EOOS 1 SLO	2.40	2.40		1.74	1.57	1.53
Combined EOOS 2	2.35	2.35		1.73	1.56	1.52
Combined EOOS 2 SLO	2.36	2.36		1.74	1.57	1.53
Combined EOOS 3	2.40	2.40		1.73	1.56	1.52
Combined EOOS 3 SLO	2.41	2.41		1.74	1.57	1.53

Table 5-11 MCPR(P) for GE14 Fuel
Coastdown Operation
Nominal Scram Speed (NSS)
(Reference 3)

EOOS Combination	Core Thermal Power (% of rated)					
	0	25	60	80	80(80.1)	100
	$MCPR_P$					
Base Case	2.07	2.07	1.49			1.40
Base Case SLO	2.08	2.08	1.50			1.41
FHOOS	2.16	2.16	1.55			1.41
FHOOS SLO	2.17	2.17	1.56			1.42
Combined EOOS 1	2.24	2.24		1.72	1.53	1.51
Combined EOOS 1 SLO	2.25	2.25		1.73	1.54	1.52
Combined EOOS 2	2.24	2.24		1.72	1.52	1.51
Combined EOOS 2 SLO	2.25	2.25		1.73	1.53	1.52
Combined EOOS 3	2.24	2.24		1.72	1.55	1.51
Combined EOOS 3 SLO	2.25	2.25		1.73	1.56	1.52

Table 5-12 MCPR(P) for GE14 Fuel
Coastdown Operation
Technical Specification Scram Speed (TSSS)
(Reference 3)

EOOS Combination	Core Thermal Power (% of rated)					
	0	25	60	80	80(80.1)	100
	$MCPR_P$					
Base Case	2.13	2.13	1.51			1.41
Base Case SLO	2.14	2.14	1.52			1.42
FHOOS	2.22	2.22	1.57			1.45
FHOOS SLO	2.23	2.23	1.58			1.46
Combined EOOS 1	2.25	2.25		1.72	1.57	1.55
Combined EOOS 1 SLO	2.26	2.26		1.73	1.58	1.56
Combined EOOS 2	2.25	2.25		1.72	1.56	1.55
Combined EOOS 2 SLO	2.26	2.26		1.73	1.57	1.56
Combined EOOS 3	2.25	2.25		1.72	1.59	1.55
Combined EOOS 3 SLO	2.26	2.26		1.73	1.60	1.56

Table 5-13 MCPR(F) Limits for AREVA Fuel, DLO and SLO Supports Base Case, FHOOS, and Combined EOOS 1 with All TBV Opening via the Pressure Control System
(Reference 3)

Flow (% rated)	MCPR(F) Limit
105.0	1.11
100.0	1.19
30.0	1.55
0.0	1.55

Table 5-14 MCPR(F) Limits for AREVA Fuel, DLO and SLO Supports Base Case, FHOOS, and Combined EOOS 1 with 2 or more TBV Opening via the Pressure Control System
(Reference 3)

Flow (% rated)	MCPR(F) Limit
105.0	1.11
100.0	1.25
30.0	1.65
0.0	1.65

Table 5-15 MCPR(F) Limits for AREVA Fuel, DLO and SLO Supports Combined EOOS 2 and Combined EOOS 3 with 2 or more TBV Opening via the Pressure Control System
(Reference 3)

Flow (% rated)	MCPR(F) Limit
105.0	1.11
100.0	1.35
30.0	1.80
0.0	1.80

Table 5-16 MCPR(F) Limits for GNF Fuel, DLO and SLO
Supports Base Case, FHOOS, and Combined EOOS 1 with All TBV Opening via the Pressure Control System
(Reference 3)

Flow (% rated)	MCPR(F) Limit
105.0	1.11
100.0	1.19
30.0	1.60
0.0	1.60

Table 5-17 MCPR(F) Limits for GNF Fuel, DLO and SLO
Supports Base Case, FHOOS, and Combined EOOS 1 with 2 or more TBV Opening via the Pressure Control System
(Reference 3)

Flow (% rated)	MCPR(F) Limit
105.0	1.11
100.0	1.30
30.0	1.75
0.0	1.75

Table 5-18 MCPR(F) Limits for GNF Fuel, DLO and SLO
Supports Combined EOOS 2 and Combined EOOS 3 with 2 or more TBV Opening via the Pressure Control System
(Reference 3)

Flow (% rated)	MCPR(F) Limit
105.0	1.11
100.0	1.35
30.0	1.90
0.0	1.90

6. Linear Heat Generation Rate

The linear heat generation rate (LHGR) limit is the product of the exposure dependent LHGR limit from Tables 6-1 through 6-7 and the minimum of: the power dependent LHGR Factor, LHGRFAC(P), or the flow dependent LHGR Factor, LHGRFAC(F) as applicable. The LHGRFAC(P) is determined from Tables 6-8 through 6-15. The LHGRFAC(F) is determined from Table 6-16 through 6-21.

Table 6-1: LHGR Limit for GE14-P10CNAB421-18GZ-120T-150-T6-2673
(Reference 9)

Lattices 6095, 6096, 6097, and 6100 LHGR Limit kW/ft	
UO2 Pellet Burnup (GWd/MTU)	**LHGR Limit (kW/ft)**
0.0	13.4
16.0	13.4
63.5	8.0
70.0	5.0

Table 6-2: LHGR Limit for GE14-P10CNAB422-19GZ-120T-150-T6-2677
(Reference 9)

Lattices 6095, 6118, 6119, and 6122 LHGR Limit kW/ft	
UO2 Pellet Burnup (GWd/MTU)	**LHGR Limit (kW/ft)**
0.0	13.4
16.0	13.4
63.5	8.0
70.0	5.0

Table 6-3: LHGR Limit for GE14-P10CNAB421-18GZ-120T-150-T6-2673
Lattice 6098
(Reference 9)

Lattice 6098 LHGR Limit kW/ft	
UO2 Pellet Burnup (GWd/MTU)	**LHGR Limit (kW/ft)**
0.0000	13.4000
15.5218	13.4000
16.8142	13.3074
17.5176	13.2275
18.7876	13.0831
20.0443	12.9402
22.5182	12.659
26.1598	12.245
32.1441	11.5647
38.0565	10.8925
43.8915	10.2292
49.6458	9.5177
55.3237	8.7773
60.9382	8.1186
66.5101	6.6107
70.0000	5.0000

Table 6-4: LHGR Limit for GE14-P10CNAB421-18GZ-120T-150-T6-2673
Lattice 6099
(Reference 9)

Lattice 6099 LHGR Limit kW/ft	
UO2 Pellet Burnup (GWd/MTU)	**LHGR Limit (kW/ft)**
0.0000	13.4000
15.0262	13.4000
16.3231	13.3633
17.6075	13.2172
18.8785	13.0728
20.1351	12.9299
22.6064	12.6490
26.2427	12.2356
32.2182	11.5562
38.1199	10.8609
43.9416	10.1559
49.6801	9.4886
55.3399	8.7823
60.9347	8.1259
66.4861	6.6218
70.0000	5.0000

Table 6-5: LHGR Limit for GE14-P10CNAB422-19GZ-120T-150-T6-2677
Lattice 6120
(Reference 9)

Lattice 6120 LHGR Limit kW/ft	
UO2 Pellet Burnup (GWd/MTU)	**LHGR Limit (kW/ft)**
0.0000	13.4000
15.6543	13.4000
16.9580	13.2911
17.6320	13.2145
18.9097	13.0692
20.1735	12.9255
22.6582	12.6431
26.3052	12.2285
32.2788	11.5494
38.1764	10.8789
43.9971	10.2172
49.7379	9.5062
55.4034	8.7676
61.0066	8.1105
66.5684	6.5838
70.0000	5.0000

Table 6-6: LHGR Limit for GE14-P10CNAB422-19GZ-120T-150-T6-2677
Lattice 6121
(Reference 9)

Lattice 6121 LHGR Limit kW/ft	
UO2 Pellet Burnup (GWd/MTU)	**LHGR Limit (kW/ft)**
0.0000	13.4000
15.1319	13.4000
16.4377	13.3502
17.7308	13.2032
19.0101	13.0578
20.2742	12.9141
22.7569	12.6318
26.3988	12.2178
32.3629	11.5398
38.2490	10.8484
44.0557	10.1457
49.7801	9.4804
55.4267	8.7718
61.0096	8.1170
66.5504	6.5921
70.0000	5.0000

Table 6-7: LHGR Limit for AREVA ATRIUM-10 Fuel
A10-4046B-13GV80
A10-3537B-12GV80
A10-3537B-12GV80a
A10-3913B-12GV80
A10-4041B-14GV80
A10-3924B-14GV80
(Reference 3)

Pellet Exposure (GWd/MTU)	LHGR Limit (kW/ft)
0.00	13.40
17.70	13.40
61.10	9.10
70.40	7.30

Table 6-8 LHGRFAC(P) for ATRIUM-10 Fuel
BOC to NEOC
Nominal Scram Speed (NSS)
(Reference 3)

EOOS Combination	Core Thermal Power (% of rated)					
	0	25	60	80	80(80.1)	100
	$LHGRFAC_P$ Multiplier					
Base Case	0.71	0.71	1.00			1.00
Base Case SLO	0.71	0.71	1.00			1.00
FHOOS	0.67	0.67	0.94			1.00
FHOOS SLO	0.67	0.67	0.94			1.00
Combined EOOS 1	0.65	0.65		0.89	0.96	1.00
Combined EOOS 1 SLO	0.65	0.65		0.89	0.96	1.00
Combined EOOS 2	0.65	0.65		0.89	0.98	1.00
Combined EOOS 2 SLO	0.65	0.65		0.89	0.98	1.00
Combined EOOS 3	0.65	0.65		0.89	0.95	1.00
Combined EOOS 3 SLO	0.65	0.65		0.89	0.95	1.00

Table 6-9 LHGRFAC(P) for ATRIUM-10 Fuel
BOC to NEOC
Technical Specification Scram Speed (TSSS)
(Reference 3)

EOOS Combination	Core Thermal Power (% of rated)					
	0	25	60	80	80(80.1)	100
	$LHGRFAC_P$ Multiplier					
Base Case	0.69	0.69	1.00			1.00
Base Case SLO	0.69	0.69	1.00			1.00
FHOOS	0.66	0.66	0.93			1.00
FHOOS SLO	0.66	0.66	0.93			1.00
Combined EOOS 1	0.64	0.64		0.89	0.93	0.97
Combined EOOS 1 SLO	0.64	0.64		0.89	0.93	0.97
Combined EOOS 2	0.64	0.64		0.89	0.96	1.00
Combined EOOS 2 SLO	0.64	0.64		0.89	0.96	1.00
Combined EOOS 3	0.64	0.64		0.89	0.93	0.97
Combined EOOS 3 SLO	0.64	0.64		0.89	0.93	0.97

Table 6-10 LHGRFAC(P) for ATRIUM-10 Fuel
NEOC to EOC
Nominal Scram Speed (NSS)
(Reference 3)

EOOS Combination	Core Thermal Power (% of rated)					
	0	25	60	80	80(80.1)	100
	$LHGRFAC_P$ Multiplier					
Base Case	0.71	0.71	1.00			1.00
Base Case SLO	0.71	0.71	1.00			1.00
FHOOS	0.67	0.67	0.94			1.00
FHOOS SLO	0.67	0.67	0.94			1.00
Combined EOOS 1	0.65	0.65		0.89	0.96	1.00
Combined EOOS 1 SLO	0.65	0.65		0.89	0.96	1.00
Combined EOOS 2	0.65	0.65		0.89	0.98	1.00
Combined EOOS 2 SLO	0.65	0.65		0.89	0.98	1.00
Combined EOOS 3	0.65	0.65		0.89	0.95	0.99
Combined EOOS 3 SLO	0.65	0.65		0.89	0.95	0.99

Table 6-11 LHGRFAC(P) for ATRIUM-10 Fuel
NEOC to EOC
Technical Specification Scram Speed (TSSS)
(Reference 3)

EOOS Combination	Core Thermal Power (% of rated)					
	0	25	60	80	80(80.1)	100
	$LHGRFAC_P$ Multiplier					
Base Case	0.69	0.69	1.00			1.00
Base Case SLO	0.69	0.69	1.00			1.00
FHOOS	0.66	0.66	0.93			1.00
FHOOS SLO	0.66	0.66	0.93			1.00
Combined EOOS 1	0.64	0.64		0.89	0.93	0.97
Combined EOOS 1 SLO	0.64	0.64		0.89	0.93	0.97
Combined EOOS 2	0.64	0.64		0.89	0.96	0.97
Combined EOOS 2 SLO	0.64	0.64		0.89	0.96	0.97
Combined EOOS 3	0.64	0.64		0.89	0.93	0.97
Combined EOOS 3 SLO	0.64	0.64		0.89	0.93	0.97

Table 6-12 LHGRFAC(P) for ATRIUM-10 Fuel
Coastdown Operation
Nominal Scram Speed (NSS)
(Reference 3)

EOOS Combination	Core Thermal Power (% of rated)					
	0	25	60	80	80(80.1)	100
	$LHGRFAC_P$ Multiplier					
Base Case	0.71	0.71	1.00			1.00
Base Case SLO	0.71	0.71	1.00			1.00
FHOOS	0.67	0.67	0.94			1.00
FHOOS SLO	0.67	0.67	0.94			1.00
Combined EOOS 1	0.65	0.65		0.89	0.96	0.98
Combined EOOS 1 SLO	0.65	0.65		0.89	0.96	0.98
Combined EOOS 2	0.65	0.65		0.89	0.97	0.98
Combined EOOS 2 SLO	0.65	0.65		0.89	0.97	0.98
Combined EOOS 3	0.65	0.65		0.89	0.95	0.98
Combined EOOS 3 SLO	0.65	0.65		0.89	0.95	0.98

Table 6-13 LHGRFAC(P) for ATRIUM-10 Fuel
Coastdown Operation
Technical Specification Scram Speed (TSSS)
(Reference 3)

EOOS Combination	Core Thermal Power (% of rated)					
	0	25	60	80	80(80.1)	100
	$LHGRFAC_P$ Multiplier					
Base Case	0.69	0.69	1.00			1.00
Base Case SLO	0.69	0.69	1.00			1.00
FHOOS	0.66	0.66	0.93			1.00
FHOOS SLO	0.66	0.66	0.93			1.00
Combined EOOS 1	0.64	0.64		0.89	0.91	0.95
Combined EOOS 1 SLO	0.64	0.64		0.89	0.91	0.95
Combined EOOS 2	0.64	0.64		0.89	0.95	0.96
Combined EOOS 2 SLO	0.64	0.64		0.89	0.95	0.96
Combined EOOS 3	0.64	0.64		0.89	0.93	0.96
Combined EOOS 3 SLO	0.64	0.64		0.89	0.93	0.96

Table 6-14 LHGRFAC(P) for GE14 Fuel
DLO, All Exposures
Nominal Scram Speed (NSS)/Technical Specification Scram Speed (TSSS)
(Reference 3)

EOOS Combination	Core Thermal Power (% of rated)				
	0	25	40	60	100
	$LHGRFAC_P$ Multiplier				
Base Case	0.57	0.57		0.79	1.00
FHOOS	0.52	0.52		0.79	1.00
Combined EOOS 1	0.40	0.40	0.52		0.99
Combined EOOS 2	0.40	0.40	0.52		0.99
Combined EOOS 3	0.40	0.40	0.52		0.99

Table 6-15 LHGRFAC(P) for GE14 Fuel
SLO, All Exposures
Nominal Scram Speed (NSS)/Technical Specification Scram Speed (TSSS)
(Reference 3 and 7)

EOOS Combination	Core Thermal Power (% of rated)					
	0	25	40	CP *	60	100
	$LHGRFAC_P$ Multiplier					
Base Case SLO	0.57	0.57		0.78	0.78	0.78
FHOOS SLO	0.52	0.52		0.78	0.78	0.78
Combined EOOS 1 SLO	0.40	0.40	0.52	0.78		0.78
Combined EOOS 2 SLO	0.40	0.40	0.52	0.78		0.78
Combined EOOS 3 SLO	0.40	0.40	0.52	0.78		0.78

*** CP is the cutoff power level and equal to 58.40% for Base Case SLO, 58.70% FHOOS SLO; and 73.19% for Combined EOOS 1 SLO, Combined EOOS 2 SLO and Combined EOOS 3 SLO conditions.**

Table 6-16 LHGRFAC(F) Multipliers for ATRIUM-10 Fuel, DLO and SLO Supports Base Case, FHOOS, and Combined EOOS 1 with all TBV Opening Via the Pressure Control System
(Reference 3)

Flow (% rated)	LHGRFAC(F) Multiplier
105.00	1.00
80.00	1.00
30.00	0.75
0.00	0.75

Table 6-17 LHGRFAC(F) Multipliers for GE14 Fuel, DLO Supports Base Case, FHOOS, and Combined EOOS 1 with all TBV Opening via the Pressure Control System
(Reference 3)

Flow (% rated)	LHGRFAC(F) Multiplier
105.00	1.00
75.00	1.00
30.00	0.55
0.00	0.55

Table 6-18 LHGRFAC(F) Multipliers for GE14 Fuel, SLO Supports Base Case, FHOOS, and Combined EOOS 1 with all TBV Opening via the Pressure Control System
(Reference 3 and 7)

Flow (% rated)	LHGRFAC(F) Multiplier
105.00	0.78
75.00	0.78
53.00	0.78
30.00	0.55
0.00	0.55

Table 6-19 LHGRFAC(F) Multipliers for ATRIUM-10 Fuel, DLO and SLO Supports Base Case, FHOOS, Combined EOOS 1, Combined EOOS 2 and Combined EOOS 3 with 2 or more TBV Opening via the Pressure Control System
(Reference 3)

Flow (% rated)	LHGRFAC(F) Multiplier
105.00	1.00
80.00	1.00
30.00	0.75
0.00	0.75

Table 6-20 LHGRFAC(F) Multipliers for GE14 Fuel, DLO Supports Base Case, FHOOS, Combined EOOS 1, Combined EOOS 2 and Combined EOOS 3 with 2 or more TBV Opening via the Pressure Control System
(Reference 3)

Flow (% rated)	LHGRFAC(F) Multiplier
105.00	1.00
89.00	1.00
30.00	0.41
0.00	0.41

Table 6-21 LHGRFAC(F) Multipliers for GE14 Fuel, SLO Supports Base Case, FHOOS, Combined EOOS 1, Combined EOOS 2 and Combined EOOS 3 with 2 or more TBV Opening via the Pressure Control System
(Reference 3 and 7)

Flow (% rated)	LHGRFAC(F) Multiplier
105.00	0.78
89.00	0.78
67.00	0.78
30.00	0.41
0.00	0.41

7. Rod Block Monitor

The Rod Block Monitor Upscale Instrumentation Setpoints are determined from the relationships shown below (Reference 5):

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 Mlb/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:

The total number of failed and bypassed LPRMs does not exceed 50% (Reference 12). 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 adjusted using the previously calculated uncertainties, provided the following conditions are met:

(A) When there is not a prior complete TIP-calibrated data set available:

1. To comply with Technical Specification SR 3.3.1.1.8, LPRMs, within their calibration frequency, in locations without a TIP trace are not recalibrated,
2. LPRMs in locations without a TIP trace will not be used by POWERPLEX in any core power distribution calculations, and
3. The total number of out-of-service TIPs does not exceed 42% (18 channels).

(B) When there is a prior complete TIP-calibrated data set available:

1. All TIP traces have previously been obtained at least once in the current operating cycle when the reactor core was operating above 20% power, (Reference 6) and
2. 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 monitoring or 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, is 3-dimensional BWR core monitoring software calculated data which is adjusted based on axial and radial factors calculated from previous TIP sets. 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 (Reference 3):

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:

Equipment Out of Service Options *{1}{2}*	**Thermal Limit set**
Base Case	Base
Base Case + SLO	Base SLO
Base Case + feedwater heater out-of-service (FHOOS) (Up to 100 degree F reduction)	FHOOS
Base Case + TCV slow closure + EOCRPTOOS + PROOS	Combined EOOS 1
Base Case + TCV slow closure + EOCRPTOOS + 5 turbine bypass valves out of service (5 TBVOOS) (i.e., base case + 4)	
Base Case + TCV slow closure + EOCRPTOOS + FHOOS (Up to 100 degree F reduction)	
Base Case + TCV slow closure +EOCRPTOOS + one Stuck Closed TCV and/or TSV*{3}* + one MSIVOOS*{3}*	Combined EOOS 2
Base Case + TCV Slow Closure + EOCRPTOOS + one Stuck Closed TCV and/or TSV*{3}* + one MSIVOOS*{3}* + FHOOS (up to 100 degree reduction) + PROOS + 2 TBVOOS (i.e., base case + 1)	Combined EOOS 3
Base Case + TCV Slow Closure + EOCRPTOOS + one Stuck Closed TCV and/or TSV*{3}* + one MSIVOOS*{3}* + FHOOS (up to 100 degree reduction) + PROOS + 2 TBVOOS (i.e., base case + 1) + SLO	Combined EOOS 3 SLO

{1} Base case includes a feedwater temperature reduction of up to 30 F + 1 SRVOOS + 1 TBVOOS + PLUOOS, and also includes 2 TIPOOS (or the equivalent number of TIP channels) and up to 50% of the LPRMs out-of-service. The base case limits support the ICF, ELLLA, and MELLLA operating domains and coastdown operation. ICF and MELLLA are not valid during SLO.

{2} The TBVOOS nomenclature described in the specific equipment out of service options represents the number of turbine bypass valves that the specific analysis supports not fast opening on either turbine control valve fast closure or turbine stop valve position. Additionally, the thermal limit sets in place to support all EOOS options (including the base case) require at least two turbine bypass valves opening on pressure control.

{3} The one Stuck Closed TCV and/or TSV EOOS conditions assume initial power level ≤ 85% of rated. The one MSIVOOS condition is also supported as long as initial thermal power is maintained ≤ 75% of the rated.

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 2, "SPCB Critical Power Correlation," September 2003.

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)(A) Revision 0 and Supplement 1(P)(A) and Supplement 2(P)(A), "RODEX2A (BWR) Fuel Rod Thermal-Mechanical Evaluation Model," February 1998.

8. EMF-CC-074 (P) 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 10CFR50, 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.

12. XN-NF-80-19 (P)(A) Volume 3 Revision 2, "Exxon Nuclear Methodology for Boiling Water Reactors, THERMEX: Thermal Limits Methodology Summary Description," January 1987.

13. XN-NF-80-19 (P)(A) Volume 1 and Supplements 1 and 2, "Exxon Nuclear Methodology for Boiling Water Reactors – Neutronic Methods for Design and Analysis," March 1983.

14. NEDE-24011-P-A-14, June 2000 and the U.S. Supplement NEDE-24011-P-A-14-US, June 2000, "General Electric Standard Application for Reactor Fuel".

15. EMF-2158 (P)(A), Revision 0, "Siemens Power Corporation Methodology for Boiling Water Reactors: Evaluation and Validation of CASMO-4/MICROBURN-B2", Siemens Power Corporation, October 1999.

16. EMF-2245 (P)(A), Revision 0, "Application of Siemens Power Corporation's Critical Power Correlations to Co-Resident Fuel", August 2000.

17. EMF-2361 (P)(A), Revision 0, "EXEM BWR-2000 ECCS Evaluation Model", May 2001.

18. NEDO-32465-A, "BWR Owner's Group Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology for Reload Applications", August 1996.

19. ANF-1358 (P)(A), Revision 3, "The Loss of Feedwater Heating Transient in Boiling Water Reactors", September 2005.