Exelon Generation Company, LLC
Quad Cities Nuclear Power Station
22710 206th Avenue North
Cordova, IL 61242-9740

www.exeloncorp.com

Exelon. Nuclear

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U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Quad Cities Nuclear Power Station, Unit 2
Renewed Facility Operating License No. DPR-30
NRC Docket Number 50-265

Subject: Core Operating Limits Report for Quad Cities Unit 2 Cycle 18 (Revision 2)

Reference: Letter from Timothy J. Tulon (Exelon Generation Company, LLC) to U. S. NRC, "Core Operating Limits Report for Quad Cities Unit 2 Cycle 18 (Revision 1)," dated May 14, 2005

In accordance with Technical Specifications Section 5.6.5.d, enclosed is Revision 2 of the Core Operating Limits Report (COLR) for Quad Cities Unit 2 Cycle 18.

Revision 2 incorporated additional Operating Limit Minimum Critical Power Ratio (OLMCPR) values supported by the current licensing analyses for the cycle. This revision to the COLR is applicable until the end of Cycle 18, which is scheduled to conclude in March 2006.

Should you have any questions concerning this letter, please contact Mr. W. J. Beck at (309) 227-2800.

Respectfully,

Timothy J. Tulon
Site Vice President
Quad Cities Nuclear Power Station

Attachment: Core Operating Limits Report for Quad Cities Unit 2 Cycle 18 (Revision 2)

cc: Regional Administrator – NRC Region III
NRC Senior Resident Inspector – Quad Cities Nuclear Power Station

A001

Attachment

Core Operating Limits Report

for

Quad Cities Unit 2 Cycle 18

(Revision 2)

Quad Cities Unit 2, Cycle 18

Core Operating Limits Report

Revision 2

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1. References

1. Exelon Generation Company, LLC and MidAmerican Energy Company, Docket No. 50-265, Quad Cities Nuclear Power Station, Unit 2, Renewed Facility Operating License, License No. DPR-30.

2. 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. GNF Document, 0000-0024-0751-SRLR, Revision 1, "Supplemental Reload Licensing Report for Quad Cities Unit 2 Reload 17 Cycle 18", April 2005. (TODI NF0400018 Revision 1)

4. GNF Document, J11-03918-SRLR, Rev. 2, "Supplemental Reload Licensing Report for Quad Cities 2 Reload 16 Cycle 17," October 2003. (TODI NFM0200001 Sequence 1)

5. Exelon TODI, TODI NF0300068, Revision 0, "Quad Cities 2 Cycle 18 FRED (to GNF)", August 27, 2003.

6. Exelon TODI, TODI QDC-03-28.01, "OPL-3 for Quad Cities Unit 2 Cycle 18", September 22, 2003.

7. GNF Engineering Calculation, e-Matrix 0000-0005-9064, "GE14 LHGR Limits with Gd Suppression for Quad Cities 2, Cycle 17, Bundles 2507 and 2508," July 1, 2002.

8. GE Document, GE-NE-J11-03912-00-01-R2, "Dresden 2 and 3 Quad Cities 1 and 2 Equipment Out-Of-Service and Legacy Fuel Transient Analysis" September 2003. (TODI NFM0100091 Sequence 02)

9. GNF Letter, FRL-EXN-EE2-04-002, "Quad Cities Unit 2 Cycle 18 Fresh Fuel Peak Pellet LHGR Limits," F. Lindquist to F. Trikur, January 16, 2004.

10. Exelon Calculation Note, BNDQ:02-001, Revision 0, "Determination of Generic $MCPR_F$ Limits," May 17, 2002.

11. FANP Document, EMF-2563(P) Revision 1, "Fuel Mechanical Design Report Exposure Extension for ATRIUM-9B Fuel Assemblies at Dresden, Quad Cities, and LaSalle Units," August 2001 (TODI NFM0100107 Sequence 0).

12. GE Document, GE DRF C51-00217-01, "Instrument Setpoint Calculation Nuclear Instrumentation, Rod Block Monitor, Commonwealth Edison Company, Quad Cities 1 & 2," December 14, 1999.

13. Exelon Letter, NF-MW:02-0413, "Approval of GE Evaluation of Dresden and Quad Cities Pressure Regulator Out of Service Analysis", Carlos de la Hoz to Doug Wise and Alex Misak, October 22, 2002.

14. GE Design Basis Document, DB-0012.03, Revision 0, "Fuel-Rod Thermal-Mechanical Performance Limits for GE14C," May 2000.

15. Exelon Letter, NF-MW:02-0081, "Approval of GE Evaluation of Dresden and Quad Cities Extended Final Feedwater Temperature Reduction," Carlos de la Hoz to Doug Wise and Alex Misak, August 27, 2002.

16. GE Document, GE-NE-0000-0023-3737-R0, "ICA Stability Evaluation for Quad Cities Unit 2 Cycle 18," January 2004 (TODI NF0400017 Revision 0).

17. Exelon Letter, NF-MW:03-069, "Dresden and Quad Cities Operation with one TSV OOS," Candice Chou to Alex Misak and Doug Wise, July 28, 2003.

18. Exelon TODI, TODI NF0500045, Revision 1, "Quad Cities Unit 2 OPRM Trip Setpoints", February 23, 2005.

19. GE Document, NEDO-33187 Revision 1, DRF 0000-0038-8843, "Safety Evaluation in Support of the New Steam Dryer for Quad Cities Unit 1 & 2," May 2005.

20. FANP Letter, NJC:04:031/FAB04-496, "Startup with TIP Equipment Out of Service," April 20, 2004 (EC 348897-00)

21. GE Document, GE-NE-0000-0040-2860-R0, "Dresden Units 2 and 3 and Quad Cities Units 1 and 2 Offrated Analyses Below the PLU Power Level", July 2005.

22. Exelon EC #356770, "Quad Cities Unit 2 Cycle 18 (Q2C18) Operating Limit at Nominal Feedwater Temperature," August 30, 2005.

2. Terms and Definitions

APLHGR	Average planar linear heat generation rate
APRM	Average power range monitor
ATRM9	ATRIUM-9B fuel
BOC	Beginning of cycle
DLO	Dual loop operation
EOC	End of cycle
EOOS	Equipment out of service
EOR	End of rated conditions (i.e cycle exposure at 100% power, 100% flow, all-rods-out)
FANP	Framatome Advanced Nuclear Power
FFTR	Final feedwater temperature reduction
FWHOOS	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
OLMCPR	Operating limit minimum critical power ratio
OPRM	Oscillation power range monitor
PBDA	Period based detection algorithm
PLUOOS	Power load unbalance out of service
PROOS	Pressure regulator out of service
RBM	Rod block monitor
SLMCPR	Safety limit minimum critical power ratio
SLO	Single loop operation
SRVOOS	Safety-relief valve out of service
TBPOOS	Turbine bypass system out of service
TCV	Turbine control valve
TCVOOS	Turbine control valve out of service
TIP	Traversing Incore Probe
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 98 Mlb/hr. Operation up to 108% rated flow is licensed for this cycle. Licensed rated thermal power is 2957 MWth.

MCPR(P) and MCPR(F) values are independent of scram time.

LHGRFAC(P) and LHGRFAC(F) values are independent of scram speed.

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.

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):
ATRM9-P9DATB381-13GZ-SPC100T-9WR-144-T6-3919
ATRM9-P9DATB383-11GZ-SPC100T-9WR-144-T6-3918
(Reference 4)

Avg. Planar Exposure (GWd/MT)	MAPLHGR (kW/ft)
0.00	13.52
17.25	13.52
70.00	7.84

Table 4-2 MAPLHGR for bundle(s):
GE14-P10DNAB389-18GZ-100T-145-T6-2650
GE14-P10DNAB418-16GZ-100T-145-T6-2646
GE14-P10DNAB406-16GZ-100T-145-T6-2508
GE14-P10DNAB409-15GZ-100T-145-T6-2507
(References 3 and 4)

Avg. Planar Exposure (GWd/MT)	MAPLHGR (kW/ft)
0.00	11.68
16.00	11.68
22.05	11.34
55.12	8.19
63.50	6.97
70.00	4.36

Table 4-3 MAPLHGR SLO multiplier for GE and FANP Fuel
(Reference 3)

Fuel Type	SLO Multiplier
ATRM9	0.84
GE14	0.77

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

For operation at less than 38.5% core thermal power, the OLMCPR as a function of core thermal power is shown in Table 5-3. For operation at greater than 38.5% core thermal power, the OLMCPR as a function of core thermal power is determined by multiplying the applicable rated condition OLMCPR limit shown in Table 5-1 or 5-2 by the applicable MCPR multiplier K(P) given in Table 5-3. For operation at exactly 38.5% core thermal power, the OLMCPR as a function of core thermal power is the higher of either of the two methods evaluated at 38.5% core thermal power.

5.1.2. Flow - Dependent MCPR

Tables 5-4 and 5-5 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

Option A and Option B refer to scram speeds.

Option A scram speed is the Improved Technical Specification scram speed. The core average scram speed insertion time for 20% insertion must be less than or equal to the Technical Specification scram speed to utilize Option A MCPR limits. Reload analyses performed by (GNF) for cycle 18 Option A MCPR limits utilized a 20% core average insertion time of 0.900 seconds (Reference 6).

To utilize the MCPR limits for the Option B scram speed, the core average scram insertion time for 20% insertion must be less than or equal to 0.694 seconds (Reference 6). If the core average scram insertion time does not meet the Option B criteria, but is within the Option A criteria, the appropriate 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 a linear interpolation to determine MCPR limits, ensure that the time used for Option A is 0.900 seconds.

5.4. Recirculation Pump Motor Generator Settings

Cycle 18 was analyzed with a maximum core flow runout of 110%; therefore the recirculation pump motor generator scoop tube mechanical and electrical stops must be set to maintain core flow less than 110% (107.8 Mlb/hr) for all runout events (Reference 5). This value is consistent with the analyses of References 3 and 8.

Table 5-1 MCPR Option A Based Operating Limits
(References 3, 8, and 22)

EOOS Combination	Fuel Type	Cycle Exposure < EOR - 2110 MWd/MT	Cycle Exposure ≥ EOR - 2110 MWd/MT
BASE (with FFTR)	ATRM9	1.52	1.63
	GE14	1.57	1.67
BASE SLO	ATRM9	1.53	1.64
	GE14	1.58	1.68
BASE (without FFTR)	ATRM9	1.50	1.61
	GE14	1.55	1.65
PLUOOS	ATRM9	1.57	1.63
	GE14	1.64	1.67
PLUOOS SLO	ATRM9	1.58	1.64
	GE14	1.65	1.68
TBPOOS	ATRM9	1.69	1.71
	GE14	1.76	1.78
TBPOOS SLO	ATRM9	1.70	1.72
	GE14	1.77	1.79
TCV SLOW CLOSURE	ATRM9	1.52	1.63
	GE14	1.59	1.67
TCV SLOW CLOSURE SLO	ATRM9	1.53	1.64
	GE14	1.60	1.68
TCV STUCK CLOSED	ATRM9	1.52	1.63
	GE14	1.57	1.67
TCV STUCK CLOSED SLO	ATRM9	1.53	1.64
	GE14	1.58	1.68

Table 5-2 MCPR Option B Based Operating Limits
(References 3, 8 and 22)

EOOS Combination	Fuel Type	Cycle Exposure < EOR - 2110 MWd/MT	Cycle Exposure ≥ EOR - 2110 MWd/MT
BASE (with FFTR)	ATRM9	1.45	1.46
	GE14C	1.46	1.50
BASE SLO	ATRM9	1.46	1.47
	GE14C	1.47	1.51
BASE (without FFTR)	ATRM9	1.45	1.45
	GE14C	1.45	1.48
PLUOOS	ATRM9	1.45	1.46
	GE14C	1.47	1.50
PLUOOS SLO	ATRM9	1.46	1.47
	GE14C	1.48	1.51
TBPOOS	ATRM9	1.52	1.54
	GE14C	1.59	1.61
TBPOOS SLO	ATRM9	1.53	1.55
	GE14C	1.60	1.62
TCV SLOW CLOSURE	ATRM9	1.45	1.46
	GE14C	1.46	1.50
TCV SLOW CLOSURE SLO	ATRM9	1.46	1.47
	GE14C	1.47	1.51
TCV STUCK CLOSED	ATRM9	1.45	1.46
	GE14C	1.46	1.50
TCV STUCK CLOSED SLO	ATRM9	1.46	1.47
	GE14C	1.47	1.51

Table 5-3 MCPR(P) for GE and FANP Fuel
(Reference 8)

EOOS Combination	Core Flow (% of rated)	Core Thermal Power (% of rated)								
		0	25	38.5	38.5	45	60	70	70	100
		Operating Limit MCPR			Operating Limit MCPR Multiplier, Kp					
Base[1]	≤ 60	3.14	2.56	2.25	1.32	1.28	1.15			1.00
	> 60	3.74	2.96	2.54						
Base SLO	≤ 60	3.15	2.57	2.26	1.32	1.28	1.15			1.00
	> 60	3.75	2.97	2.55						
PLUOOS	≤ 60	5.50	3.74	2.79	1.64		1.45	1.26	1.11	1.00
	> 60	6.73	4.58	3.42						
PLUOOS SLO	≤ 60	5.51	3.75	2.80	1.64		1.45	1.26	1.11	1.00
	> 60	6.74	4.59	3.43						
TBPOOS	≤ 60	5.50	3.74	2.79	1.37	1.28	1.15			1.00
	> 60	6.73	4.58	3.42						
TBPOOS SLO	≤ 60	5.51	3.75	2.80	1.37	1.28	1.15			1.00
	> 60	6.74	4.59	3.43						
TCV Slow Closure	≤ 60	5.50	3.74	2.79	1.64		1.45	1.26	1.11	1.00
	> 60	6.73	4.58	3.42						
TCV Slow Closure SLO	≤ 60	5.51	3.75	2.80	1.64		1.45	1.26	1.11	1.00
	> 60	6.74	4.59	3.43						
TCV Stuck Closed	≤ 60	3.14	2.56	2.25	1.32	1.28	1.15			1.00
	> 60	3.74	2.96	2.54						
TCV Stuck Closed SLO	≤ 60	3.15	2.57	2.26	1.32	1.28	1.15			1.00
	> 60	3.75	2.97	2.55						

[1] - values are applicable to cases for both with and without FFTR.

Table 5-4 MCPR(F) Limits for GE and FANP Fuel
DLO or SLO Operation
(Reference 10)

Flow (% rated)	MCPR(F) Limit
110.0	1.22
100.0	1.22
0.0	1.86

Table 5-5 MCPR(F) Limits for GE and FANP Fuel with TCV Stuck Closed
DLO or SLO Operation
(Reference 10)

Flow (% rated)	MCPR(F) Limit
110.0	1.27
108.9	1.27
0.00	1.97

6. Linear Heat Generation Rate

The maximum LHGR shall not exceed the zero exposure limit of 13.4 (kW/ft) for the following fuel bundles (Reference 14):

GE14-P10DNAB409-15GZ-100T-145-T6-2507
GE14-P10DNAB406-16GZ-100T-145-T6-2508
GE14-P10DNAB418-16GZ-100T-145-T6-2646
GE14-P10DNAB389-18GZ-100T-145-T6-2650

The linear heat generation rate (LHGR) limit is the product of the exposure dependent LHGR limit from Tables 6-1 through 6-17 and the minimum of: the power dependent LHGR factor, LHGRFAC(P), the flow dependent LHGR factor, LHGRFAC(F), or the single loop operation (SLO) multiplication factor where applicable. The LHGRFAC(P) is determined from Table 6-18. The LHGRFAC(F) is determined from Table 6-19 or 6-20. The SLO multiplication factor can be found in Table 6-21.

Table 6-1: LHGR Limit for GE14-P10DNAB418-16GZ-100T-145-T6-2646
(Reference 9)

Lattices 5963, 5970, 5971, 5974 and 5975 Composite Limit kW/ft	
5963: P10DNAL071-NOG-100T-T6-5963 5970: P10DNAL465-16G7.0-100T-T6-5970 5971: P10DNAL465-13G7.0/3G6.0-100T-T6-5971 5974: P10DNAL071-NOG-100T-V-T6-5974 5975: P10DNAL071-16GE-100T-V-T6-5975	
UO2 Pellet Burnup (GWd/MTU)	**Composite 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-P10DNAB418-16GZ-100T-145-T6-2646, Lattice 5972
(Reference 9)

Lattice 5972 Composite Limit kW/ft P10DNAL461-12G7.0/3G6.0-100T-E-T6-5972	
UO2 Pellet Burnup (GWd/MTU)	**Composite Limit (kW/ft)**
0.0000	13.4000
15.9515	13.4000
17.2857	13.2538
18.1089	13.1602
19.4140	13.0119
20.7050	12.8651
23.2463	12.5762
26.9800	12.1517
33.0780	11.4585
39.0585	10.7786
44.9195	10.0506
50.6634	9.3499
56.3043	8.7427
61.8691	8.1854
67.3941	6.2027
70.0000	5.0000

Table 6-3: LHGR Limit for: GE14-P10DNAB418-16GZ-100T-145-T6-2646, Lattice 5973
(Reference 9)

Lattice 5973 Composite Limit kW/ft P10DNAL461-12G7.0/3G6.0-100T-V-T6-5973	
UO2 Pellet Burnup (GWd/MTU)	**Composite Limit (kW/ft)**
0.0000	13.4000
14.6537	13.4000
16.0077	13.3991
17.3409	13.2476
18.1982	13.1501
19.5019	13.0019
20.7905	12.8554
23.3251	12.5672
27.0482	12.1440
33.1306	11.4525
39.0945	10.7607
44.9367	9.9688
50.6595	9.2608
56.2772	8.6476
61.8172	8.1267
67.3169	6.2384
70.0000	5.0000

Table 6-4: LHGR Limit for GE14-P10DNAB389-18GZ-100T-145-T6-2650
(Reference 9)

Lattices 5963, 5994, 5995, 5998 and 5999 Composite Limit kW/ft 5963: P10DNAL071-NOG-100T-T6-5963 5994: P10DNAL430-17G8.0/1G3.0-100T-T6-5994 5995: P10DNAL431-9G8.0/8G6.0/1G3.0-100T-T6-5995 5998: P10DNAL071-NOG-100T-V-T6-5998 5999: P10DNAL071-18GE-100T-V-T6-5999	
UO2 Pellet Burnup (GWd/MTU)	Composite Limit (kW/ft)
0.0	13.4
16.0	13.4
63.5	8.0
70.0	5.0

Table 6-5: LHGR Limit for GE14-P10DNAB389-18GZ-100T-145-T6-2650, Lattice 5996
(Reference 9)

Lattice 5996 Composite Limit kW/ft P10DNAL430-7G8.0/8G6.0-100T-E-T6-5996	
UO2 Pellet Burnup (GWd/MTU)	Composite Limit (kW/ft)
0.0000	13.4000
14.8906	13.4000
16.2580	13.3707
17.6015	13.2179
18.9215	13.0679
19.4423	13.0087
20.7453	12.8605
23.3142	12.5685
27.0881	12.1395
33.2434	11.4389
39.2913	10.5936
45.2308	9.8060
51.0564	9.1014
56.7750	8.4943
61.9432	8.0319
67.9800	5.9323
70.0000	5.0000

Table 6-6: LHGR Limit for GE14-P10DNAB389-18GZ-100T-145-T6-2650, Lattice 5997
(Reference 9)

Lattice 5997 Composite Limit kW/ft P10DNAL430-7G8.0/8G6.0-100T-V-T6-5997	
UO2 Pellet Burnup (GWd/MTU)	**Composite Limit (kW/ft)**
0.0000	13.4000
14.9485	13.4000
16.3156	13.3641
17.6577	13.1592
18.9752	12.9330
19.3601	12.9427
20.6567	12.8235
23.2117	12.5211
26.9637	12.0810
33.0874	11.3527
39.1088	10.5071
45.0238	9.6894
50.6192	8.9710
56.3453	8.3308
62.0012	7.7843
67.6125	6.1019
70.0000	5.0000

Table 6-7: LHGR Limit for GE14-P10DNAB409-15GZ-100T-145-T6-2507
(References 7 and 9)

Lattices 5254, 5259, and 5260 Composite Limit kW/ft 5254: P10DNAL071-NOG-100T-T6-5254 5259: P10DNAL071-NOG-100T-V-T6-5259 5260: P10DNAL071-15GE-100T-V-T6-5260	
UO2 Pellet Burnup (GWd/MTU)	Composite Limit (kW/ft)
0.0	13.4
16.0	13.4
63.5	8.0
70.0	5.0

Table 6-8: LHGR Limit for GE14-P10DNAB409-15GZ-100T-145-T6-2507, Lattice 5255
(Reference 7)

Lattice 5255 Composite Limit kW/ft P10DNAL457-10G7.0/5G6.0-100T-T6-5255	
UO2 Pellet Burnup (GWd/MTU)	Composite Limit (kW/ft)
0.0000	13.4000
16.0000	13.4000
26.5600	12.1995
32.4838	11.3566
38.2923	10.5548
42.6374	10.0194
48.4082	9.4042
54.1266	8.8227
59.7952	8.2658
66.1221	6.7898
70.0000	5.0000

Table 6-9: LHGR Limit for GE14-P10DNAB409-15GZ-100T-145-T6-2507, Lattice 5256
(Reference 7)

Lattice 5256 Composite Limit kW/ft P10DNAL457-10G7.0/4G6.0-100T-T6-5256	
UO2 Pellet Burnup (GWd/MTU)	Composite Limit (kW/ft)
0.0000	13.4000
16.0000	13.4000
26.4377	12.2134
32.3724	11.3683
38.1915	10.5646
42.5345	10.0279
48.3153	9.4117
54.0433	8.8293
59.7208	8.2716
66.0634	6.8169
70.0000	5.0000

Table 6-10: LHGR Limit for GE14-P10DNAB409-15GZ-100T-145-T6-2507, Lattice 5257
(Reference 7)

Lattice 5257 Composite Limit kW/ft P10DNAL446-10G7.0/4G6.0-100T-E-T6-5257	
UO2 Pellet Burnup (GWd/MTU)	Composite Limit (kW/ft)
0.0000	13.4000
16.0000	13.4000
22.4684	12.6646
25.9797	12.2498
31.8383	11.5023
36.4126	10.9965
42.2318	10.3946
48.0000	9.7621
63.5000	8.0000
70.0000	5.0000

Table 6-11: LHGR Limit for GE14-P10DNAB409-15GZ-100T-145-T6-2507, Lattice 5258
(Reference 7)

Lattice 5258 Composite Limit kW/ft P10DNAL446-10G7.0/4G6.0-100T-V-T6-5258	
UO2 Pellet Burnup (GWd/MTU)	**Composite Limit (kW/ft)**
0.0000	13.4000
16.0000	13.4000
17.7371	13.2025
18.9898	13.0548
20.2266	12.9195
22.6600	12.6287
26.2497	12.1583
32.1571	11.4142
37.9780	10.6863
42.3297	10.1829
48.0873	9.5889
53.7859	9.0048
59.4266	8.4220
65.0184	7.2992
70.0000	5.0000

Table 6-12: LHGR Limit for GE14-P10DNAB406-16GZ-100T-145-T6-2508
(References 7 and 9)

Lattices 5254, 5259, and 5265 Composite Limit kW/ft 5254: P10DNAL071-NOG-100T-T6-5254 5259: P10DNAL071-NOG-100T-V-T6-5259 5265: P10DNAL071-16GE-100T-V-T6-5265	
UO2 Pellet Burnup (GWd/MTU)	Composite Limit (kW/ft)
0.0	13.4
16.0	13.4
63.5	8.0
70.0	5.0

Table 6-13: LHGR Limit for GE14-P10DNAB406-16GZ-100T-145-T6-2508, Lattice 5261
(Reference 7)

Lattice 5261 Composite Limit kW/ft P10DNAL452-12G7.0/4G6.0-100T-T6-5261	
UO2 Pellet Burnup (GWd/MTU)	Composite Limit (kW/ft)
0.0000	13.4000
16.0000	13.4000
26.5529	12.2003
32.5158	11.3596
38.3655	10.5487
42.8529	9.9603
48.6317	9.3489
54.3587	8.7722
60.0364	8.1569
66.3477	6.6857
70.0000	5.0000

Table 6-14: LHGR Limit for GE14-P10DNAB406-16GZ-100T-145-T6-2508, Lattice 5262
(Reference 7)

Lattice 5262 Composite Limit kW/ft P10DNAL452-12G7.0/2G6.0-100T-T6-5262	
UO2 Pellet Burnup (GWd/MTU)	**Composite Limit (kW/ft)**
0.0000	13.4000
16.0000	13.4000
26.3186	12.2269
32.3063	11.3814
38.1786	10.5659
42.6528	9.9762
48.4524	9.3633
54.1986	8.7853
59.8932	8.1683
66.2385	6.7361
70.0000	5.0000

Table 6-15: LHGR Limit for GE14-P10DNAB406-16GZ-100T-145-T6-2508, Lattice 5263
(Reference 7)

Lattice 5263 Composite Limit kW/ft P10DNAL444-12G7.0/2G6.0-100T-E-T6-5263	
UO2 Pellet Burnup (GWd/MTU)	**Composite Limit (kW/ft)**
0.0000	13.4000
16.0000	13.4000
22.2147	12.6935
25.7994	12.2602
31.6822	11.4670
36.3906	10.8097
42.2210	10.0473
48.0018	9.3234
53.7263	8.6493
59.3943	8.0286
65.0127	7.3018
70.0000	5.0000

Table 6-16: LHGR Limit for GE14-P10DNAB406-16GZ-100T-145-T6-2508, Lattice 5264
(Reference 7)

Lattice 5264 Composite Limit kW/ft P10DNAL444-12G7.0/2G6.0-100T-V-T6-5264	
UO2 Pellet Burnup (GWd/MTU)	Composite Limit (kW/ft)
0.0000	13.4000
16.0000	13.4000
17.3980	13.2411
18.6393	13.0830
19.8662	12.8680
22.2850	12.5549
25.8608	12.0511
31.7287	11.2541
36.4936	10.7218
42.3157	9.9690
48.0855	9.2457
53.7969	8.5723
59.4504	7.9532
65.0537	7.2829
70.0000	5.0000

Table 6-17: LHGR Limit for FANP ATRM-9 Fuel
ATRM9-P9DATB383-11GZ-SPC100T-9WR-144-T6-3918
ATRM9-P9DATB381-13GZ-SPC100T-9WR-144-T6-3919
(Reference 11)

Nodal Exposure (GWd/MTU)	LHGR Limit (kW/ft)
0.00	14.40
15.00	14.40
64.30	7.90

Table 6-18 LHGRFAC(P) for GE and FANP Fuel
(Reference 8)

EOOS Combination	Core Flow (% of rated)	Core Thermal Power (% of rated) 0	25	38.5	38.5	70	70	80	100
		LHGRFAC(P) Multiplier							
Base[1]	≤ 60	0.50	0.56	0.59	0.68			0.86	1.00
	> 60								
Base SLO	≤ 60	0.50	0.56	0.59	0.68			0.86	1.00
	> 60								
PLUOOS	≤ 60	0.22	0.39	0.48	0.54	0.73	0.78		1.00
	> 60	0.33		0.42					
PLUOOS SLO	≤ 60	0.22	0.39	0.48	0.54	0.73	0.78		1.00
	> 60	0.33		0.42					
TBPOOS	≤ 60	0.22	0.39	0.48	0.54				1.00
	> 60	0.33		0.42					
TBPOOS SLO	≤ 60	0.22	0.39	0.48	0.54				1.00
	> 60	0.33		0.42					
TCV Slow Closure	≤ 60	0.22	0.39	0.48	0.54	0.73	0.78		1.00
	> 60	0.33		0.42					
TCV Slow Closure SLO	≤ 60	0.22	0.39	0.48	0.54	0.73	0.78		1.00
	> 60	0.33		0.42					
TCV Stuck Closed	≤ 60	0.50	0.56	0.59	0.68			0.86	1.00
	> 60								
TCV Stuck Closed SLO	≤ 60	0.50	0.56	0.59	0.68			0.86	1.00
	> 60								

[1] - values are applicable to cases for both with and without FFTR.

Table 6-19 LHGRFAC(F) Multipliers, all cases except TCV Stuck Closed
(Reference 8)

Flow (% rated)	LHGRFAC(F) Multiplier
100.00	1.00
80.00	1.00
50.00	0.77
40.00	0.64
30.00	0.55
0.00	0.28

Table 6-20 LHGRFAC(F) Multipliers for TCV Stuck Closed
(Reference 8)

Flow (% rated)	LHGRFAC(F) Multiplier
100.00	1.00
98.30	1.00
80.00	0.86
50.00	0.63
40.00	0.50
30.00	0.41
0.00	0.14

Table 6-21 LHGR SLO multiplier for GE and FANP Fuel
(Reference 3)

Fuel Type	SLO Multiplier
ATRM9	0.84
GE14	0.77

7. Rod Block Monitor

The rod block monitor upscale instrumentation setpoints are determined from the relationships shown below (Reference 12):

ROD BLOCK MONITOR UPSCALE TRIP FUNCTION	ALLOWABLE VALUE
Two Recirculation Loop Operation	$0.65\ W_d + 56.1\%$
Single Recirculation Loop Operation	$0.65\ W_d + 51.4\%$

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 98 Mlb/hr.

8. Stability Protection Setpoints

The OPRM PBDA trip settings (Reference 18):

PBDA Trip Amplitude Setpoint (Sp)	Corresponding Maximum Confirmation Count Setpoint (Np)
1.12	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.

9. Modes of Operation

The allowed Modes of Operation with the combinations of EOOS are as described below:

EOOS Options[1,2,7,8]	Operating Region			
	Standard	MELLLA	ICF[5]	Coastdown[3]
Base[10], Option A or B	Yes	Yes	Yes	Yes
Base SLO[10], Option A or B	Yes	Yes	No	Yes
TBPOOS, Option A or B	Yes	Yes	Yes	Yes
TBPOOS SLO, Option A or B	Yes	Yes	No	Yes
PLUOOS[4], Option A or B	Yes	Yes	Yes	Yes
PLUOOS SLO[4], Option A or B	Yes	Yes	No	Yes
TCV Slow Closure[6], Option A or B	Yes	Yes	Yes	Yes
TCV Slow Closure SLO[6], Option A or B	Yes	Yes	No	Yes
TCV Stuck Closed[9], Option A or B	Yes	Yes	Yes	Yes
TCV Stuck Closed SLO[9], Option A or B	Yes	Yes	No	Yes

[1] Each OOS Option may be combined with up to 18 TIP channels OOS provided the requirements (as clarified in Reference 20) for utilizing SUBTIP methodology are met and up to 50% of the LPRMs OOS with an LPRM calibration frequency of 2500 Effective Full Power Hours (EFPH) (2000 EFPH +25%). For operation under all limit sets with exception of the Base cases, a 120°F reduction in feedwater temperature throughout the cycle was analyzed and is subject to the restrictions in Reference 15 (Final Feedwater Temperature Reduction or Feedwater Heaters OOS).

[2] Each EOOS option except TBPOOS requires the opening profile for the turbine bypass valves provided in Reference 6 to be met. These conditions also support 1 Turbine Bypass Valve OOS if the assumed opening profile (Reference 6) for the remaining 8 Turbine Bypass Valves is met. If the opening profile is not met with 8 or 9 operating Turbine Bypass Valves, or if more than one Turbine Bypass Valve is OOS, utilize the TBPOOS condition.

[3] Coastdown operation is defined as any cycle exposure beyond the full power, all rods out condition with plant power slowly lowering to a lesser value while core flow is held constant. Up to a 15% overpower is analyzed per Reference 8 and supported by Reference 19.

[4] If the Base Case limit set (DLO only) is being used and the PLU is taken OOS for a surveillance and the surveillance is done at ≥80% rated reactor power and ≥80% rated reactor flow, an administrative limit of 0.99 on FDLRX/MFLPD and 0.95 on MFLCPR for scram time greater than Option B but less than or equal to Option A, or 0.99 on MFLCPR for scram times less than or equal to Option B limit can be used instead of the PLUOOS (DLO) thermal limit set. The MAPRAT limit is not impacted by PLUOOS and thus continue to monitor to 1.00 in this condition.

[5] Operation up to 108% rated core flow is licensed for this cycle.

[6] For operation with a pressure regulator out-of-service (PROOS), the TCV Slow Closure limits should be applied. For operation with a PROOS and TCV slow closure, the TCV slow closure limits are applicable. For operation with a PROOS and PLUOOS, the PLUOOS limits are applicable. (Reference 13 and 21)

[7] A single MSIV may be taken OOS (shut) under any and all OOS Options, so long as core thermal power is maintained ≤75% of 2957 MWth (Reference 3).

[8] The cycle specific stability analysis may impose restrictions on the Power-to-Flow map and/or restrict the applicable temperature for feedwater temperature reduction. See Reference 16.

[9] For operation with a Turbine Stop Valve out-of-service (TSV OOS), the TCV Stuck Closed limits should be applied (Reference 17). TSV OOS and TCV Stuck Closed is not an analyzed out-of-service combination.

[10] For Base and Base SLO cases, operations for both with and without a 120°F reduction in feedwater temperature was evaluated. For operation at nominal feedwater temperature, the OLMCPR limit is applicable to a variation of +/- 10°F in temperature. See Reference 22.

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. NEDE-24011-P-A-14 (Revision 14), "General Electric Standard Application for Reactor Fuel (GESTAR-II)," June 2000.
2. Commonwealth Edison Topical Report NFSR-0085, Revision 0, "Benchmark of BWR Nuclear Design Methods," November 1990.
3. Commonwealth Edison Topical Report NFSR-0085, Supplement 1 Revision 0, "Benchmark of BWR Nuclear Design Methods - Quad Cities Gamma Scan Comparisons," April 1991.
4. Commonwealth Edison Topical Report NFSR-0085, Supplement 2 Revision 0, "Benchmark of BWR Nuclear Design Methods – Neutronic Licensing Analyses," April 1991.
5. 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.
6. XN-NF-80-19(P)(A), Volume 1 Supplement 3, Supplement 3 Appendix F, and Supplement 4, "Advanced Nuclear Fuels Methodology for Boiling Water Reactors: Benchmark Results for CASMO-3G/MICROBURN-B Calculation Methodology," November 1990.
7. XN-NF-80-19(P)(A), Volumes 2, 2A, 2B, and 2C, "Exxon Nuclear Methodology for Boiling Water Reactors: EXEM BWR ECCS Evaluation Model," September 1982.
8. 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.
9. 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.
10. XN-NF-85-67(P)(A), Revision 1, "Generic Mechanical Design for Exxon Nuclear Jet Pump BWR Reload Fuel," September 1986.
11. XN-NF-82-06(P)(A), Revision 1 and Supplements 2, 4, and 5, "Qualification of Exxon Nuclear Fuel for Extended Burnup," October 1986.
12. XN-NF-82-06(P)(A), Supplement 1 Revision 2, "Qualification of Exxon Nuclear Fuel for Extended Burnup," Supplement 1, "Extended Burnup Qualification of ENC 9x9 BWR Fuel," May 1988.
13. ANF-89-14(P)(A), Revision 1 and Supplements 1 & 2, "Advanced Nuclear Fuels Corporation Generic Mechanical Design for Advanced Nuclear Fuels Corporation 9X9 – IX and 9x9 – 9X BWR Reload Fuel," October 1991.
14. ANF-89-98(P)(A), Revision 1 and Supplement 1, "Generic Mechanical Design Criteria for BWR Fuel Designs," May 1995.
15. XN-NF-79-71(P)(A), Revision 2 and Supplements 1, 2, and 3, "Exxon Nuclear Plant Transient Methodology for Boiling Water Reactors," March 1986.
16. ANF-1125(P)(A) and Supplements 1 and 2, "ANFB Critical Power Correlation," April 1990.

17. ANF-1125(P)(A), Supplement 1 Appendix E, "ANFB Critical Power Correlation Determination of ATRIUM-9B Additive Constant Uncertainties," September 1998.

18. ANF-524(P)(A), Revision 2 and Supplements 1 and 2, "ANF Critical Power Methodology for Boiling Water Reactors," November 1990.

19. ANF-913(P)(A), Volume 1 Revision 1 and Volume 1 Supplements 2, 3, and 4, "COTRANSA2: A Computer Program for Boiling Water Reactor Transient Analyses," August 1990.

20. ANF-91-048(P)(A), "Advanced Nuclear Fuels Corporation Methodology for Boiling Water Reactors EXEM BWR Evaluation Model," January 1993.

21. ANF-91-048(P)(A), Supplements 1 and 2, "BWR Jet Pump Model Revision for RELAX," October 1997.

22. Commonwealth Edison Company Topical Report NFSR-0091, "Benchmark of CASMO/MICROBURN BWR Nuclear Design Methods," Revision 0 and Supplements on Neutronics Licensing Analysis (Supplement 1) and La Salle County Unit 2 benchmarking (Supplement 2), December 1991, March 1992, and May 1992, respectively.

23. EMF-1125(P)(A), Supplement 1 Appendix C, "ANFB Critical Power Correlation Application for Co-Resident Fuel," August 1997.

24. EMF-85-74(P), Revision 0. Supplement 1 (P)(A) and Supplement 2 (P)(A), "RODEX2A (BWR) Fuel Rod Thermal-Mechanical Evaluation Model," Siemens Power Corporation, February 1998.

25. NEDC-32981P, Revision 0, "GEXL96 Correlation for ATRIUM-9B Fuel," September 2000.

26. NEDO-32465-A, "Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology for Reload Applications", August 1996.