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U. S. Nuclear Regulatory Commission
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Washington, D.C. 20555

Quad Cities Nuclear Power Station, Unit 1
Facility Operating License No. DPR-29
NRC Docket Number 50-254

Subject: Core Operating Limits Report for Quad Cities Unit 1 Cycle 18A (Revision 1)

Reference: Letter from Timothy J. Tulon (Exelon Generation Company, LLC) to U. S. NRC, "Core Operating Limits Report for Quad Cities Unit 1 Cycle 18A," dated May 29, 2003.

In accordance with Technical Specifications Section 5.6.5.d, enclosed is Revision 1 of the Core Operating Limits Report (COLR) for Quad Cities Unit 1 Cycle 18A.

Revision 1 reflects the results of further licensing analyses that were recently performed for Unit 1 Cycle 18A. Specifically, a statistical Rod Withdrawal Error (RWE) analysis was performed that resulted in updated operating limits for Minimum Critical Power Ratio when cycle exposure is greater than 2200 MWD/MT. This revision to the COLR is applicable until the end of Cycle 18A, which is scheduled to conclude in March 2005.

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

Respectfully,

T J Tulon

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

Attachment A: Core Operating Limits Report for Quad Cities Unit 1 Cycle 18A (Revision 1)

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

A001

Attachment A

Core Operating Limits Report

for

Quad Cities Unit 1 Cycle 18A

(Revision 1)

Exelon Nuclear

Core Operating Limits Report (COLR)

for

Quad Cities Unit 1 Cycle 18A

Revision 1

Issuances of Changes Summary

Affected Section	Affected Pages	Summary of Changes	Revision	Issue Date
All	All	• Original Issue for Cycle 18A	0	5/2003
References Section 2 Section 3 Section 5	2, 4, 10, 11, 12, 16, 17, 19	• Update MCPR section with results from statistical RWE analysis. • Remove distinction between "BASE CASE" and "FWHOOS/FFWTR" cases (DLO and SLO) such that the "BASE CASE" now includes coverage for FWHOOS/FFWTR. • Update Table 5-1 with recalculated PLUOOS administrative limits.	1	8/2003

Table of Contents

References

1. Exelon Generation Company, LLC and MidAmerican Energy Company, Docket No. 50-254, Quad Cities Nuclear Power Station, Unit 1 Facility Operating License, License No. DPR-29.
2. Generic Letter 88-16, Letter from D. M. Crutchfield to All Power Reactor Licensees and Applicants, Concerning the Removal of Cycle-Specific Parameter Limits from Tech Specs, October 3, 1988.
3. Global Nuclear Fuel, 0000-0014-8357-SRLR, Rev. 0, "Supplemental Reload Licensing Report for Quad Cities 1 Q1M16 Cycle 18A," May 2003.
4. GE-NE-J11-03912-00-01-R1, "Dresden 2 and 3 Quad Cities 1 and 2 Equipment Out-Of-Service and Legacy Fuel Transient Analysis," November 2001.
5. BNDQ:02-026, Revision 0, "Determination of Q1C18 MICROBURN GE14 LHGR Limits," July 10, 2002.
6. GE DRF C51-00217-01, "Instrument Setpoint Calculation Nuclear Instrumentation, Rod Block Monitor, Commonwealth Edison Company, Quad Cities 1 & 2," December 14, 1999.
7. QDC-03-08, "Unit One OPL-3 for Q1C18A," April 1, 2003.
8. QDC-02-18, "OPL-3 for Quad Cities Unit 1 Cycle 18," April 25, 2002.
9. 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.
10. BNDG:02-001, Revision 0, "Determination of Generic $MCPR_F$ Limits," May 17, 2002.
11. NEDE-24011-P-A-14, General Electric Standard Application for Reactor Fuel (GESTAR II) and US Supplement, June 2000.
12. NF0300028, Revision 0, "Quad Cities 1 Cycle 18A FRED Form," March 26, 2003.
13. NF-MW:02-0413, "Approval of GE Evaluation of Dresden and Quad Cities Pressure Regulator Out of Service Analysis," October 22, 2002.
14. NFM-MW:02-0274, "Approval of GE Evaluation of MSIV out of Service for Dresden and Quad Cities", August 2, 2002.
15. BNDQ:03-022, Revision 0, "Quad Cities Unit 1 Cycle 18A Composite LHGR Curve Generation for Bundle 2647," May 2003.
16. BNDQ:03-024, Revision 0, "Quad Cities Unit 1 Cycle 18A Generation of the Revision 0 Core Operating Limits Report (COLR)," May 23, 2003.
17. GE-NE-0000-0018-5044-R0, "Statistically Based Rod Withdrawal Error Analysis For Dresden and Quad Cities," July 2003.
18. BNDQ:03-052, Revision 0, "Q1C18A Core Operating Limits Report (COLR) Revision 1 Creation," August 2003.

1. Average Planar Linear Heat Generation Rate

1.1 Technical Specification Reference

Sections 3.2.1 and 3.4.1

1.2 Description

Tables 1-1 and 1-2 are used to determine the maximum average planar linear heat generation rate (MAPLHGR) limit for each fuel type. Limits listed in Tables 1-1 and 1-2 are for dual reactor recirculation loop operation (DLO).

For single reactor recirculation loop operation (SLO), the MAPLHGR limits given in Tables 1-1 and 1-2 must be multiplied by a SLO MAPLHGR multiplier. The SLO MAPLHGR multipliers are given in Table 1-3 by fuel type.

Table 1-1: Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) for FANP (formerly SPC) ATRIUM-9B Fuel	
Applicable to the following fuel bundle types: Bundle Type 5, ATRM9-P9DATB348-11G6.5-SPC100T-9WR-144-T6-2444 Bundle Type 7, ATRM9-P9DATB360-11G6.5-SPC100T-9WR-144-T6-2445	
Applicable Reference Number(s): 3	
Planar Average Exposure (GWD/MT)	MAPLHGR Limit (kW/ft)
0.00	13.52
17.25	13.52
70.00	7.84

Table 1-2: Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) for GNF GE14 Fuel	
Applicable to the following fuel bundle types: Bundle Type 16, GE14-P10DNAB411-14GZ-100T-145-T6-2564 Bundle Type 17, GE14-P10DNAB409-15GZ-100T-145-T6-2565 Bundle Type 1, GE14-P10DNAB194-4G7.0-100T-145-T6-2647	
Applicable Reference Number(s): 3	
Planar Average Exposure (GWD/MT)	MAPLHGR Limit (kW/ft)
0.00	11.68
16.00	11.68
44.09	9.16
55.12	8.09
63.50	6.97
70.00	4.36

Table 1-3: Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) SLO Multipliers for All Fuel Types	
Applicable Reference Number(s): 3	
Fuel Product Line	**SLO MAPLHGR Multiplier**
ATRIUM-9B	0.84
GE14	0.77

2. Minimum Critical Power Ratio

2.1 *Technical Specification Reference*

Sections 3.2.2, 3.4.1, and 3.7.7.

2.2 *Description*

The MCPR limit for a specific fuel type/condition is determined by choosing the maximum CPR limit from the pool of applicable limits. The sections below provide the method for determining the applicable MCPR limit in any case. Linear interpolation is to be used to determine values from the following tables for flow/power conditions not specifically listed: 2-3, 2-4, 2-5, and 2-7. Rated core thermal power is 2957 MWth and rated core flow is 98 Mlb/hr.

2.2.1 Manual Flow Control (MFC) MCPR Limits

The operating limit MCPR (OLMCPR) for operation in the manual flow control mode is determined from either Section 2.2.1.1 or 2.2.1.2, whichever is greater at the given power and flow condition.

2.2.1.1 MFC Power-Dependent MCPR ($MCPR_P$)

For operation at less than 38.5% of rated core thermal power, the OLMCPR as a function of core thermal power ($MCPR_P$) is shown in Table 2-3. For operation at greater than 38.5% of rated core thermal power, the OLMCPR as a function of core thermal power is determined by multiplying the applicable EOOS condition limit as shown in Table 2-1 or 2-2 (see Section 2.2.3) by the applicable MCPR multiplier, K_P, given in Table 2-3. For operation at exactly 38.5% of rated core thermal power, the OLMCPR as a function of core thermal power is the maximum of either of the two aforementioned methods evaluated at 38.5% of rated core thermal power.

2.2.1.2 MFC Flow-Dependent MCPR ($MCPR_F$)

The OLMCPR as a function of flow ($MCPR_F$) is determined from either Table 2-4 or Table 2-5 depending on the EOOS condition. The $MCPR_F$ limit is independent of the flow control mode of the reactor.

2.2.2 Automatic Flow Control (AFC) MCPR Limits

The operating limit MCPR (OLMCPR) in the automatic flow control mode is to be determined from either Section 2.2.2.1 or 2.2.2.2, whichever is greater at the given power and flow condition.

2.2.2.1 AFC Power-Dependent MCPR

For operation at less than 38.5% of rated core thermal power, the OLMCPR as a function of core thermal power ($MCPR_P$) is shown in Table 2-7. For operation at greater than 38.5% of rated core thermal power, the OLMCPR as a function of core thermal power is determined by multiplying the applicable EOOS condition limit as shown in Table 2-6 by the applicable MCPR multiplier, K_P, given in Table 2-7. For operation at exactly 38.5% of rated core thermal power, the OLMCPR as a function of core thermal power is the maximum of either of the two aforementioned methods evaluated at 38.5% of rated core thermal power.

2.2.2.2 AFC Flow-Dependent MCPR

The OLMCPR as a function of flow ($MCPR_F$) is determined from either Table 2-4 or Table 2-5 depending on the EOOS condition. The $MCPR_F$ limit is independent of the flow control mode of the reactor.

2.2.3 Option A and Option B

OLMCPR values have been determined based upon two assumed core average scram times – Option A which assumes the Technical Specification 20% insertion core average scram time and Option B which assumes a core average 20% insertion scram time equal to 0.694 seconds.

Option A OLMCPR values may be utilized if the core average 20% insertion scram time is less than or equal to the Technical Specification required time. Reload analyses performed by Global Nuclear Fuel (GNF) for cycle 18A Option A MCPR limits utilized a 20% core average insertion time of 0.900 seconds (References 7 and 8).

Option B OLMCPR values may be utilized if the core average 20% insertion scram time is less than or equal to 0.694 seconds (References 7 and 8).

If the core average scram insertion time does not meet the Option B criteria, but is less than the Option A criteria, the appropriate OLMCPR value may be determined from a linear interpolation between the Option A and Option 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, which is the 20% insertion time utilized by GNF in the reload analyses. For manual flow control operation, Option A based OLMCPRs are found in Table 2-1 while Option B based OLMCPRs are contained in Table 2-2. For automatic flow control operation only Option A based OLMCPRs are available and are given in Table 2-6 (no adjustment for core average scram time is available for AFC mode).

2.2.4 Recirculation Pump Motor Generator Settings

Quad Cities Unit 1 Cycle 18A was analyzed with a maximum core flow runout of 110% of rated core flow. Therefore, the recirculation pump motor generator scoop tube mechanical and electrical stops must be set to maintain core flow less than 110% of rated core flow, which is equivalent to 107.8 Mlb/hr (1.10 * 98.0 Mlb/hr), for all runout events (Reference 12). A maximum core flow runout of 110% of rated core flow is consistent with what was used in the analysis presented in Reference 4.

Table 2-1: Option A Scram Time Based OLMCPRs for Manual Flow Control Operation

Applicable Reference Number(s): 3, 4, 17

EOOS Combination[4]	Fuel Type	Cycle Exposure Range: <2200 MWD/MT	≥2200 MWD/MT & <EOR[1]-2128 MWD/MT	≥EOR[1]-2128 MWD/MT & <EOR	≥EOR[1] (Coastdown)
Base Case	GE14	1.55	1.55	1.63	1.63
	ATRIUM-9B	1.52	1.52	1.61	1.61
Base Case SLO	GE14	1.56	1.56	1.64	1.64
	ATRIUM-9B	1.53	1.53	1.62	1.62
TBPOOS[2]	GE14	1.72	1.72	1.72	1.74[3]
	ATRIUM-9B	1.68	1.68	1.68	1.70[3]
TBPOOS SLO[2]	GE14	1.73	1.73	1.73	1.75[3]
	ATRIUM-9B	1.69	1.69	1.69	1.71[3]
TCV Slow Closure	GE14	1.61	1.61	1.63	1.63
	ATRIUM-9B	1.55	1.55	1.61	1.61
TCV Slow Closure SLO	GE14	1.62	1.62	1.64	1.64
	ATRIUM-9B	1.56	1.56	1.62	1.62
PLUOOS	GE14	1.64	1.64	1.64	1.64
	ATRIUM-9B	1.58	1.58	1.61	1.61
PLUOOS SLO	GE14	1.65	1.65	1.65	1.65
	ATRIUM-9B	1.59	1.59	1.62	1.62
TCV Stuck Closed	GE14	1.55	1.55	1.63	1.63
	ATRIUM-9B	1.52	1.52	1.61	1.61
TCV Stuck Closed SLO	GE14	1.56	1.56	1.64	1.64
	ATRIUM-9B	1.53	1.53	1.62	1.62

Notes for Table 2-1:

1. EOR refers to the end of rated power operation – the all-rods-out condition at 100% rated power and 100% rated flow.
2. TBPOOS cases include a +0.03 OLMCPR penalty for operation below analysis basis dome pressure per page 24 of Reference 4.
3. TBPOOS cases which cover operation in coast down conditions include a +0.02 OLMCPR penalty per page 22 of Reference 4.
4. All EOOS combinations presented here, including the BASE CASE and BASE CASE SLO, account for both normal feedwater temperature operation and operation with FFWTR/FHOOS.

Table 2-2: Option B Scram Time Based OLMCPRs for Manual Flow Control Operation					
Applicable Reference Number(s): 3, 4, 17					
EOOS Combination[4]	Fuel Type	Cycle Exposure Range			
		<2200 MWD/MT	≥2200 MWD/MT & <EOR[1]-2128 MWD/MT	≥EOR[1]-2128 MWD/MT & <EOR	≥EOR[1] (Coastdown)
Base Case	GE14	1.44	1.47	1.47	1.47
	ATRIUM-9B	1.44	1.47	1.47	1.47
Base Case SLO	GE14	1.45	1.48	1.48	1.48
	ATRIUM-9B	1.45	1.48	1.48	1.48
TBPOOS[2]	GE14	1.55	1.55	1.55	1.57[3]
	ATRIUM-9B	1.51	1.51	1.51	1.53[3]
TBPOOS SLO[2]	GE14	1.56	1.56	1.56	1.58[3]
	ATRIUM-9B	1.52	1.52	1.52	1.54[3]
TCV Slow Closure	GE14	1.44	1.47	1.47	1.47
	ATRIUM-9B	1.44	1.47	1.47	1.47
TCV Slow Closure SLO	GE14	1.45	1.48	1.48	1.48
	ATRIUM-9B	1.45	1.48	1.48	1.48
PLUOOS	GE14	1.47	1.47	1.47	1.47
	ATRIUM-9B	1.44	1.47	1.47	1.47
PLUOOS SLO	GE14	1.48	1.48	1.48	1.48
	ATRIUM-9B	1.45	1.48	1.48	1.48
TCV Stuck Closed	GE14	1.44	1.47	1.47	1.47
	ATRIUM-9B	1.44	1.47	1.47	1.47
TCV Stuck Closed SLO	GE14	1.45	1.48	1.48	1.48
	ATRIUM-9B	1.45	1.48	1.48	1.48

Notes for Table 2-2:
1. EOR refers to the end of rated power operation – the all-rods-out condition at 100% rated power and 100% rated flow.
2. TBPOOS cases include a +0.03 OLMCPR penalty for operation below analysis basis dome pressure per page 24 of Reference 4.
3. TBPOOS cases which cover operation in coast down conditions include a +0.02 OLMCPR penalty per page 22 of Reference 4.
4. All EOOS combinations presented here, including the BASE CASE and BASE CASE SLO, account for both normal feedwater temperature operation and operation with FFWTR/FHOOS.

Table 2-3: MCPR$_P$ for All Fuel Types for Manual Flow Control Operation										
Applicable Reference Number(s): 4, 3										
EOOS Combination	Core Flow (% Rated)	Core Thermal Power (% Rated)								
		0	25	38.5	38.5	45	60	70	70	≥100
		Operating Limit MCPR[1]			Operating Limit MCPR Multiplier, K_P[1]					
Base Case	≤60	3.16	2.58	2.27	1.32	1.28	1.15	N/A	N/A	1.00
	>60	3.77	2.99	2.56						
Base Case SLO	≤60	3.17	2.59	2.28	1.32	1.28	1.15	N/A	N/A	1.00
	>60	3.78	3.00	2.57						
TBPOOS	≤60	5.55	3.77	2.82	1.37	1.28	1.15	N/A	N/A	1.00
	>60	6.79	4.62	3.45						
TBPOOS SLO	≤60	5.56	3.78	2.83	1.37	1.28	1.15	N/A	N/A	1.00
	>60	6.80	4.63	3.46						
TCV Slow Closure	≤60	5.55	3.77	2.82	1.64	N/A	1.45	1.26	1.11	1.00
	>60	6.79	4.62	3.45						
TCV Slow Closure SLO	≤60	5.56	3.78	2.83	1.64	N/A	1.45	1.26	1.11	1.00
	>60	6.80	4.63	3.46						
PLUOOS	≤60	5.55	3.77	2.82	1.64	N/A	1.45	1.26	1.11	1.00
	>60	6.79	4.62	3.45						
PLUOOS SLO	≤60	5.56	3.78	2.83	1.64	N/A	1.45	1.26	1.11	1.00
	>60	6.80	4.63	3.46						
TCV Stuck Closed	≤60	3.16	2.58	2.27	1.32	1.28	1.15	N/A	N/A	1.00
	>60	3.77	2.99	2.56						
TCV Stuck Closed SLO	≤60	3.17	2.59	2.28	1.32	1.28	1.15	N/A	N/A	1.00
	>60	3.78	3.00	2.57						

Notes for Table 2-3:
1. Values are to be linearly interpolated between listed core thermal power values.

Table 2-4: Flow Dependent OLMCPR (MCPR$_F$) for All Fuel Types and All Operating Conditions Except TCV Stuck Closed[1,2]	
Applicable Reference Number(s): 10, 3, 4	
Core Flow (% Rated)	MCPR$_F$[3]
110.0	1.22
100.0	1.22
0.0	1.86

Notes for Table 2-4:
1. This table is not applicable to TCV Stuck Closed operating conditions.
2. This table is applicable to both Manual Flow Control and Automatic Flow Control operation.
3. Values are to be linearly interpolated between listed core flow values.

Table 2-5: Flow Dependent OLMCPR (MCPR$_F$) for All Fuel Types and TCV Stuck Closed Operating Conditions[1,2]	
Applicable Reference Number(s): 10, 3, 4	
Core Flow (% Rated)	MCPR$_F$[3]
110.0	1.27
108.9	1.27
0.0	1.97

Notes for Table 2-5:
1. This table is applicable to TCV Stuck Closed operating conditions only.
2. This table is applicable to both Manual Flow Control and Automatic Flow Control operation.
3. Values are to be linearly interpolated between listed core flow values.

Table 2-6: Option A Scram Time Based OLMCPRs for Automatic Flow Control Operation					
Applicable Reference Number(s): 3, 4					
EOOS Combination[2,3]	Fuel Type	Cycle Exposure Range			
		<2200 MWD/MT	≥2200 MWD/MT & <EOR[1]-2128 MWD/MT	≥EOR[1]-2128 MWD/MT & <EOR	≥EOR[1] (Coastdown)
Base Case	GE14	1.73	1.86	1.86	1.86
	ATRIUM-9B	1.70	1.86	1.86	1.86

Notes for Table 2-6:
1. EOR refers to the end of rated power operation – the all-rods-out condition at 100% rated power and 100% rated flow.
2. Operation in Automatic Flow Control mode with TCV Slow Closure, TCV Stuck Closed, or PLUOOS is not an allowed condition.
3. Operation in Automatic Flow Control mode with an MSIVOOS or a pressure regulator OOS is not an allowed condition.

Table 2-7: MCPR$_P$ for All Fuel Types for Automatic Flow Control Operation								
Applicable Reference Number(s): 4, 3								
EOOS Combination[1,3]	Core Flow (% Rated)	Core Thermal Power (% Rated)						
		0	25	38.5	38.5	45	60	≥100
		Operating Limit MCPR			Operating Limit MCPR Multiplier, K$_P$[2]			
Base Case	≤60	3.16	2.58	2.27	1.32	1.28	1.15	1.00
	>60	3.77	2.99	2.56				

Notes for Table 2-7:
1. Operation in Automatic Flow Control mode with TCV Slow Closure, TCV Stuck Closed, or PLUOOS is not an allowed condition.
2. Values are to be linearly interpolated between listed core thermal power values.
3. Operation in Automatic Flow Control mode with an MSIVOOS or a pressure regulator OOS is not an allowed condition.

3. Linear Heat Generation Rate

3.1 *Technical Specification Reference*

Section 3.2.3.

3.2 *Description*

The linear heat generation rate (LHGR) limit is the product of the LHGR limit from Tables 3-1, 3-2, 3-3 or 3-4 (depending of the fuel type) and the minimum of either the power dependent LHGR multiplication factor, $LHGRFAC_P$, the flow dependent LHGR multiplication factor, $LHGRFAC_F$ or the single loop operation (SLO) multiplication factor. The applicable $LHGRFAC_P$ limit is to be determined from Table 3-5 or Table 3-8 depending on the flow control mode in use. The applicable $LHGRFAC_F$ limit is to be determined from Table 3-6 or 3-7, depending on the EOOS status. The SLO multiplication factor can be found in Table 3-9.

Table 3-1: LHGR Limits for Bundle Type GE14-P10DNAB411-14GZ-100T-145-T6-2564 (Type 16)

Applicable Reference Number(s): 5

Nodal Exposure (GWD/MT)	LHGR Limit (kW/ft)[1]
0.00	13.40
12.50	13.40
15.20	13.05
24.00	11.95
47.00	9.10
56.25	8.00
62.85	5.00

Notes for Table 3-1:
1. Values are to be linearly interpolated between listed nodal exposure values.

Table 3-2: LHGR Limits for Bundle Type GE14-P10DNAB409-15GZ-100T-145-T6-2565 (Type 17)

Applicable Reference Number(s): 5

Nodal Exposure (GWD/MT)	LHGR Limit (kW/ft)[1]
0.00	13.40
12.50	13.40
15.00	13.05
18.70	12.60
27.50	11.50
56.00	8.00
62.50	5.00

Notes for Table 3-2:
1. Values are to be linearly interpolated between listed nodal exposure values.

Table 3-3: LHGR Limits for Bundle Type GE14-P10DNAB194-4G7.0-100T-145-T6-2647 (Type 1)	
Applicable Reference Number(s): 15	
Nodal Exposure (GWD/MT)	LHGR Limit (kW/ft)[1]
0.00	13.40
11.02	13.40
13.22	12.91
16.53	12.91
55.11	8.20
60.62	5.62
61.71	5.00

Notes for Table 3-3:
1. Values are to be linearly interpolated between listed nodal exposure values.

Table 3-4: LHGR Limits for Bundle Types ATRM9-P9DATB348-11G6.5-SPC100T-9WR-144-T6-2444 (Type 5) and ATRM9-P9DATB360-11G6.5-SPC100T-9WR-144-T6-2445 (Type 7)	
Applicable Reference Number(s): 9	
Nodal Exposure (GWD/MT)	LHGR Limit (kW/ft)[1]
0.00	14.40
15.00	14.40
64.30	7.90

Notes for Table 3-4:
1. Values are to be linearly interpolated between listed nodal exposure values.

Table 3-5: LHGRFAC$_P$ for All Fuel Types for Manual Flow Control Operation

Applicable Reference Number(s): 4, 3

EOOS Combination	Core Flow (% Rated)	Core Thermal Power (% Rated)							
		0	25	38.5	38.5	70	70	80	≥100
		LHGRFAC$_P$ Multiplier[1,2]							
Base Case	All	0.50	0.56	0.59	0.68	N/A	N/A	0.86	1.00
Base Case SLO	All	0.50	0.56	0.59	0.68	N/A	N/A	0.86	1.00
TBPOOS	≤60	0.22	0.39	0.48	0.54	N/A	N/A	N/A	1.00
	>60	0.33	0.39	0.42					
TBPOOS SLO	≤60	0.22	0.39	0.48	0.54	N/A	N/A	N/A	1.00
	>60	0.33	0.39	0.42					
TCV Slow Closure	≤60	0.22	0.39	0.48	0.54	0.73	0.78	N/A	1.00
	>60	0.33	0.39	0.42					
TCV Slow Closure SLO	≤60	0.22	0.39	0.48	0.54	0.73	0.78	N/A	1.00
	>60	0.33	0.39	0.42					
PLUOOS	≤60	0.22	0.39	0.48	0.54	0.73	0.78	N/A	1.00
	>60	0.33	0.39	0.42					
PLUOOS SLO	≤60	0.22	0.39	0.48	0.54	0.73	0.78	N/A	1.00
	>60	0.33	0.39	0.42					
TCV Stuck Closed	All	0.50	0.56	0.59	0.68	N/A	N/A	0.86	1.00
TCV Stuck Closed SLO	All	0.50	0.56	0.59	0.68	N/A	N/A	0.86	1.00

Notes for Table 3-5:
1. Values are to be linearly interpolated between listed core power values.
2. The LHGR multiplier for any core power/flow condition is the limiting of the LHGRFAC$_P$, LHGRFAC$_F$, and SLO Multiplier (if applicable).

Table 3-6: LHGRFAC$_F$ Multipliers for All EOOS Conditions Except TCV Stuck Closed[1,2]	
Applicable Reference Number(s): 4, 3	
Core Flow (% Rated)	LHGRFAC$_F$[3,4]
0.0	0.28
30.0	0.55
40.0	0.64
50.0	0.77
80.0	1.00
≥100.0	1.00

Notes for Table 3-6:
1. This table is not applicable to TCV Stuck Closed operating conditions.
2. This table is applicable to both Manual Flow Control and Automatic Flow Control operation.
3. Values are to be linearly interpolated between listed core flow values.
4. The LHGR multiplier for any core power/flow condition is the limiting of the LHGRFAC$_P$, LHGRFAC$_F$, and SLO Multiplier (if applicable).

Table 3-7: LHGRFAC$_F$ Multipliers for TCV Stuck Closed Conditions[1,3]	
Applicable Reference Number(s): 4	
Core Flow (% Rated)	LHGRFAC$_F$[2,4]
0.0	0.14
30.0	0.41
40.0	0.50
50.0	0.63
80.0	0.86
98.3	1.00
≥100.0	1.00

Notes for Table 3-7:
1. This table is applicable to TCV Stuck Closed operating conditions only.
2. Values are to be linearly interpolated between listed core flow values.
3. This table is applicable to both Manual Flow Control and Automatic Flow Control operation.
4. The LHGR multiplier for any core power/flow condition is the limiting of the LHGRFAC$_P$, LHGRFAC$_F$, and SLO Multiplier (if applicable).

Table 3-8: LHGRFAC$_P$ Multipliers for Automatic Flow Control	
Applicable Reference Number(s): 4	
Core Thermal Power (% Rated)	LHGRFAC$_P$[1,2]
0.0	0.00
50.0	0.50
≥100.0	1.00

Notes for Table 3-8:
1. Values are to be linearly interpolated between listed core thermal power values.
2. The LHGR multiplier for any core power/flow condition is the limiting of the LHGRFAC$_P$, LHGRFAC$_F$, and SLO Multiplier (if applicable).

Table 3-9: Linear Heat Generation Rate (LHGR) SLO Multipliers for All Fuel Types	
Applicable Reference Number(s): 3	
Fuel Product Line	SLO LHGR Multiplier[1]
ATRIUM-9B	0.84
GE14	0.77

Notes for Table 3-9:
1. The LHGR multiplier for any core power/flow condition is the limiting of the LHGRFAC$_P$, LHGRFAC$_F$, and SLO Multiplier (if applicable).

4. Control Rod Withdrawal Block Instrumentation

4.1 Technical Specification Reference

Table 3.3.2.1-1

4.2 Description

The rod block monitor upscale instrumentation setpoints are determined from the relationships shown below (Reference 6).

Table 4-1: Rod Block Monitor Upscale Instrumentation Setpoints[3]	
Applicable Reference Number(s): 6	
Rod Block Monitor Upscale Trip Function	Allowable Value[1,2]
Two Recirculation Loop Operation	$0.65\ W_d + 56.1\%$
Single Recirculation Loop Operation	$0.65\ W_d + 51.4\%$

Notes for Table 4-1:
1. Wd – percent of recirculation loop drive flow required to produce a rated core flow of 98.0 Mlb/hr.
2. The setpoint may be lower or higher and still comply with the rod withdrawal event (RWE) licensing analysis because the RWE is analyzed for unblocked conditions.
3. The allowable value is clamped with a maximum value not to exceed the allowable value for a recirculation loop drive flow of 100%.

5. Allowed Modes of Operation

5.1 *Technical Specification Reference*

Bases Sections 3.2.2, 3.2.3, and 3.7.7

5.2 *Description*

The Allowed Modes of Operation with combinations of Equipment Out-of-Service are as described below:

Table 5-1: Allowed Modes of Operation

Applicable Reference Number(s): 3, 4, 7, 8, 11, 13, 14

EOOS Combinations[1,2,3]	Operating Region			
	Standard	ICF[5]	MELLLA	Coastdown[4]
Base Case	Yes	Yes	Yes	Yes
Base Case SLO	Yes	Yes	Yes	Yes
TBPOOS	Yes	Yes	Yes	Yes
TBPOOS SLO	Yes	Yes	Yes	Yes
TCV Slow Closure[6]	Yes	Yes	Yes	Yes
TCV Slow Closure[6] SLO	Yes	Yes	Yes	Yes
PLUOOS[7]	Yes	Yes	Yes	Yes
PLUOOS SLO	Yes	Yes	Yes	Yes
TCV Stuck Closed	Yes	Yes	Yes	Yes
TCV Stuck Closed SLO	Yes	Yes	Yes	Yes

Notes for Table 5-1:

1. Each OOS Option may be combined with up to 18 TIP channels OOS (provided the requirements for utilizing SUBTIP methodology are met) with all TIPS available at startup from a refuel outage 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 a 120°F reduction in feedwater temperature throughout the cycle was analyzed (Final Feedwater Temperature Reduction was analyzed for the entire cycle).
2. A single MSIV may be taken OOS (shut) under any and all OOS Options except Automatic Flow Control, so long as core thermal power is maintained ≤75% of 2957 MWth (References 14 and 3).
3. All OOS Options support 1 Turbine Bypass Valve OOS, if the OPL-3 assumed opening profile for the Turbine Bypass system is met. If the OPL-3 (References 7 and 8) opening profile is not met, or if more than one Turbine Bypass Valve is OOS, utilize the TBPOOS condition.
4. 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 (Reference 11 Section 4.3.1.2.8). Up to a 15% overpower is analyzed per Reference 4.
5. Increased Core Flow (ICF) is supported to 108% of rated core flow.
6. For operation with a pressure regulator out-of-service (PROOS), the TCV Slow Closure limits should be applied (Reference 13) and the operational notes from Reference 13 reviewed. PROOS in conjunction with TCV Slow Closure is not an analyzed out-of-service combination.
7. If the Base Case limit set is being used and the PLU is taken OOS for a surveillance and the reactor is maintained at ≥80% rated core thermal power and ≥80% of rated core flow during the PLUOOS period, an administrative limit on FDLRX/MFLPD and MFLCPR can be used instead of the PLUOOS thermal limit set. The FDLRX/MFLPD administrative limit to be used is 0.98 for all scram speeds. The MFLCPR administrative limit is 0.94 for Option A scram times, 0.97 for Option B scram times, and 0.97 for scram times less than or equal to 0.731 seconds but greater than the Option B time. (Reference 16).

6. Methodology References

The analytical methods used to determine the core operating limits shall be those previously reviewed and approved by the NRC (Technical Specification Section 5.6.5), specifically those described in the following documents:

1. ANF-1125 (P)(A) and Supplements 1 and 2, "Critical Power Correlation – ANFB," April 1990.
2. ANF-524 (P)(A) Revision 2 and Supplements 1 and 2, "ANF Critical Power Methodology for Boiling Water Reactors," November 1990.
3. XN-NF-79-71 (P)(A) Revision 2 and Supplements 1, 2 & 3, "Exxon Nuclear Plant Transient Methodology for Boiling Water Reactors," March 1986.
4. XN-NF-80-19 (P)(A) Volume 1 Supplements 1 and 2, "Exxon Nuclear Methodology for Boiling Water Reactors – Neutronic Methods for Design and Analysis," March 1993.
5. XN-NF-80-19 (P)(A) Volume 1 Supplement 3, Supplement 3 Appendix F, and Supplement 4, "Exxon Nuclear Methodology for Boiling Water Reactors," November 1990.
6. 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.
7. 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.
8. 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.
9. XN-NF-85-67 (P)(A) Revision 1, "Generic Mechanical Design for Exxon Nuclear Jet Pump BWR Reload Fuel," September 1986.
10. ANF-913 (P)(A) Volume 1 Revision 1, and Volume 1 Supplements 2, 3, 4, "COTRANSA2: A Computer Program for Boiling Water Reactor Transients Analysis," August 1990.
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), "Generic Mechanical Design Criteria for BWR Fuel Designs," Revision 1 and Revision 1 Supplement 1, May 1995.
15. ANF-91-048 (P)(A), "Advanced Nuclear Fuels Corporation Methodology for Boiling Water Reactors EXEM BWR ECCS Evaluation Model," January 1993.

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

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

18. NEDE-24011-P-A-14 Revision 14, "General Electric Standard Application for Reactor Fuel (GESTAR)," June 2000.

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

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

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

22. Commonwealth Edison Topical Report NFSR-0085, Revision 0, "Benchmark of BWR Nuclear Design Methods," November 1990.

23. Commonwealth Edison Topical Report NFSR-0085, Supplement 1 Revision 0, "Benchmark of BWR Nuclear Design Methods - Quad Cities Gamma Scan Comparisons," April 1991.

24. Commonwealth Edison Topical Report NFSR-0085, Supplement 2 Revision 0, "Benchmark of BWR Nuclear Design Methods – Neutronic Licensing Analyses," April 1991.