AmerGen Energy Company, LLC
200 Exelon Way
Kennett Square, PA 19348

www.exeloncorp.com

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TS 6.9.1.f.4

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

Oyster Creek Generating Station
Facility Operating License No. DPR-16
NRC Docket No. 50-219

Subject: Issuance of the Oyster Creek Core Operating Limits Report
For Cycle 21 (Document No. COLR Oyster Creek 1 Rev. 2)

Enclosed is a copy of the Core Operating Limits Report (COLR) for Oyster Creek Generating Station, Cycle 21 (Document No. COLR Oyster Creek 1 Rev. 2). This report incorporates the revised cycle specific parameters resulting from the new core configuration implemented during the Oyster Creek Generating Station refueling outage.

This COLR is being submitted to the NRC in accordance with Oyster Creek Generating Station Technical Specifications (TS) Section 6.9.1.f.4.

If you have any questions, please contact Tom Loomis (610-765-5510).

Very truly yours,

D. P. Helker

David P. Helker
Manager - Licensing and Regulatory Affairs

Enclosure

cc: S. J. Collins, Regional Administrator, Region I, USNRC
M. S. Ferdas, USNRC Senior Resident Inspector
G. E. Miller, Project Manager, USNRC
File No. 06033

Cycle 21 Core Operating Limits Report (COLR) – Oyster Creek

(this is a complete re-write)

Reviewed: Richard J Mompton 10/12/06
SQR Date
Reactor Engineering

Approved: 10/05/06
GNF - BWR Design Manager Date

Table of Contents

1. List of Tables

2. References

1. GNF Document, NEDE-31152P, Reference 8, "General Electric Fuel Bundle Designs," April 2001.

2. GNF Document, 0000-0056-4117-SRLR, Revision 0, "Supplemental Reload Licensing Report for Oyster Creek Reload 21 Cycle 21," September 2006.

3. GNF Document, 0000-0056-4117-FBIR, Revision 0, "Fuel Bundle Information Report for Oyster Creek Reload 21 Cycle 21," September 2006.

4. Deleted.

5. Deleted.

6. GENE Letter, NSA02-247, "Oyster Creek APRM Flow-Biased Setpoint Margin Between Scram and Rod Block for Stability Option II Adjustment", January 2002.

7. GPU Document, "Technical Evaluation of GE9B Fuel for Oyster Creek", TDR 1132, March 1994.

8. Passport EC 351249 (CAP O2004-2511)

9. EDMS Document, VM-PX-2469, Framatome ANP Document, "POWERPLEX-III Core Monitoring Software Specification", EMF-2469(P) Rev. 1.

10. AMERGEN ENERGY COMPANY, LLC OYSTER CREEK GENERATING STATION DOCKET NO. 50-219, License No. DPR-16

11. Exelon Document, C-1302-226-E620-447, Rev. 0, "Cycle 21 Core Loading Plan – Oyster Creek."

3. Terms and Definitions

APLHGR	Average Planar Linear Heat Generation Rate
ARTS	APRM, Rod Block Monitor, and Technical Specification (Improvement)
APRM	Average Power Range Monitor
BOC	Beginning of Cycle
BWROG	Boiling Water Reactor Owner's Group
Coastdown	Coastown occurs when full power is not achievable with all rods out, maximum allowable core flow and feedwater temperature reduction, and equilibrium xenon
ELLLA	Extended Load Line Limit Analysis
EOC	End of Cycle
EOR	End of Rated Conditions (i.e., cycle exposure at 100% power, 100% flow, all-rods-out, all feedwater heaters in service and equilibrium xenon)
GNF	Global Nuclear Fuel
ICF	Increased Core Flow
ISOLATED	The recirculation loop suction, discharge and discharge bypass valves are in the closed position
K(f)	MCPR flow dependent multiplier (i.e., adjustment to the CPR limit when at core flows less than rated)
LHGR	Linear Heat Generation Rate
LPRM	Local Power Range Monitor
MAPLHGR	Maximum Average Planar Linear Heat Generation Rate
MCPR	Minimum Critical Power Ratio
OOS	Out of Service
Option A	Option A refers to the Technical Specifications core average scram time speed that when applied results in a more restrictive MCPR limit
Option B	Option B refers to a specific core average scram time speed that when met allows the use of a lower MCPR limit
TIP	Traversing In Core Probe

4. General Information

Oyster Creek is a non-ARTS plant. Therefore, there are no ARTS-based power or flow biased APLHGR, LHGR or CPR operating limits. There are, however, Oyster Creek specific flow biased CPR operating limits for operation at less than rated flow. The flow-biased limits are discussed in Section 6.1. Rated core flow is 61 Mlb/hr and operation up to 110.7% of rated is licensed for this cycle. Additionally, Oyster Creek utilizes an ELLLA operating domain which has expanded the power/flow map to allow for greater operational flexibility.

5. Average Planar Linear Heat Generation Rate

The MAPLHGR limits are discussed in Technical Specifications Section 3.10.A. The MAPLHGR limits for the lattices in each fuel type as a function of average planar exposure are given in Tables 5-1 through 5-13 for operation with zero ISOLATED RECIRCULATION LOOPS (Reference 2 and Reference 11). For operation with one ISOLATED RECIRCULATION LOOP, multiply the limits in Tables 5-1 through 5-13 by the ISOLATED Loop multiplier listed in Table 5-14 (Reference 2). All lattices are defined in Reference 11.

Table 5-1 MAPLHGR for bundle: GE9B-P8DWB348-12GZ-80U-145-T6
PPLX Lattice #18, #23, #24, #25, #26, #27
GNF Lattice #3792, #3791, #3790, #3789, #3118

Avg. Planar Exposure (GWd/MT)	MAPLHGR (kW/ft)
0.0	10.88
0.2	10.88
1.1	10.98
5.5	11.30
8.8	11.28
11.0	11.19
13.8	11.11
16.5	10.79
19.3	9.99
22.0	9.89
27.6	9.86
38.6	9.63
49.6	9.69
60.6	9.59
71.7	9.61

Table 5-2 MAPLHGR for bundle: GE11-P9HUB374-13GZ-100T-145-T6-2559
PPLX Lattice #36, #35, #33, #31
GNF Lattice #5542, #5540, #5544, #5545

Avg. Planar Exposure (GWd/MT)	MAPLHGR (kW/ft)
0.0	9.64
0.2	9.64
1.1	9.75
5.5	9.65
11.0	9.49
16.5	9.47
22.0	9.03
27.6	8.44
38.6	8.24
49.6	8.20
60.6	8.36
71.7	8.40

Table 5-3 MAPLHGR for bundle: GE11-P9HUB374-13GZ-100T-145-T6-2559
PPLX Lattices #32, #34
GNF Lattices #5541, #5543

Avg. Planar Exposure (GWd/MT)	MAPLHGR (kW/ft)
0.0	9.83
0.2	9.83
1.1	9.75
5.5	9.65
11.0	9.60
16.5	9.44
22.0	9.04
27.6	8.45
38.6	8.22
49.6	8.18
60.6	8.35
71.7	8.39

Table 5-4 MAPLHGR for bundle: GE11-P9HUB369-12GZ-100T-145-T6-2560
PPLX Lattices #43, #41, #45, #46
GNF Lattices #5547, #5540, #5544, #5549

Avg. Planar Exposure (GWd/MT)	MAPLHGR (kW/ft)
0.0	10.10
0.2	10.10
1.1	10.07
5.5	9.89
11.0	9.71
16.5	9.61
22.0	9.06
27.6	8.50
38.6	8.32
49.6	8.30
60.6	8.48
71.7	8.53

Table 5-5 MAPLHGR for bundle: GE11-P9HUB369-12GZ-100T-145-T6-2560
PPLX Lattices #42, #44
GNF Lattices #5546, #5548

Avg. Planar Exposure (GWd/MT)	MAPLHGR (kW/ft)
0.0	10.07
0.2	10.07
1.1	10.02
5.5	9.96
11.0	9.76
16.5	9.63
22.0	9.09
27.6	8.52
38.6	8.33
49.6	8.31
60.6	8.49
71.7	8.55

Table 5-6 MAPLHGR for bundle: GE11-P9HUB363-12GZ-100T-145-T6-2817
PPLX Lattices #3, #1
GNF Lattices #6783, #6785

Avg. Planar Exposure (GWd/MT)	MAPLHGR (kW/ft)
0.0	9.98
0.2	9.98
1.1	10.11
5.5	10.00
11.0	9.79
16.5	9.69
22.0	9.07
27.6	8.49
38.6	8.34
49.6	8.33
60.6	8.51
71.7	8.58

Table 5-7 MAPLHGR for bundle: GE11-P9HUB363-12GZ-100T-145-T6-2817
PPLX Lattices #2, #8, #9, #10
GNF Lattices #6784, #6782, #6786, #6787

Avg. Planar Exposure (GWd/MT)	MAPLHGR (kW/ft)
0.0	10.04
0.2	10.04
1.1	10.10
5.5	9.94
11.0	9.73
16.5	9.43
22.0	9.08
27.6	8.49
38.6	8.35
49.6	8.33
60.6	8.29
71.7	8.58

Table 5-8 MAPLHGR for bundle: GE11-P9HUB364-14GZ-100T-145-T6-2818
PPLX Lattices #7, #5
GNF Lattices #6788, #6790

Avg. Planar Exposure (GWd/MT)	MAPLHGR (kW/ft)
0.0	9.96
0.2	9.96
1.1	9.97
5.5	9.85
11.0	9.73
16.5	9.57
22.0	9.03
27.6	8.47
38.6	8.30
49.6	8.26
60.6	8.43
71.7	8.50

Table 5-9 MAPLHGR for bundle: GE11-P9HUB364-14GZ-100T-145-T6-2818
PPLX Lattices #6, #11, #12, #4
GNF Lattices #6789, #6782, #6791, #6792

Avg. Planar Exposure (GWd/MT)	MAPLHGR (kW/ft)
0.0	9.93
0.2	9.93
1.1	9.91
5.5	9.85
11.0	9.62
16.5	9.61
22.0	9.04
27.6	8.46
38.6	8.30
49.6	8.28
60.6	8.44
71.7	8.52

Table 5-10 MAPLHGR for bundle: GE11-P9DUB367-11GZ-100T-145-T6-2921
PPLX Lattices #13, #28
GNF Lattices #7311, #7312

Avg. Planar Exposure (GWd/MT)	MAPLHGR (kW/ft)
0.0	9.36
0.2	9.36
1.1	9.39
5.5	9.25
11.0	9.21
16.5	9.10
22.0	9.02
27.6	8.33
38.6	8.00
49.6	7.95
60.6	8.09
71.7	8.16

Table 5-11 MAPLHGR for bundle: GE11-P9DUB367-11GZ-100T-145-T6-2921
PPLX Lattices #14, #15, #16, #17
GNF Lattices #7313, #7314, #7315, #7316

Avg. Planar Exposure (GWd/MT)	MAPLHGR (kW/ft)
0.0	9.03
0.2	9.03
1.1	9.06
5.5	9.08
11.0	9.12
16.5	9.10
22.0	9.03
27.6	8.35
38.6	8.00
49.6	7.96
60.6	8.11
71.7	8.15

Table 5-12 MAPLHGR for bundle: GE11-P9DUB361-14GZ-100T-145-T6-2922
PPLX Lattices #29, #19
GNF Lattices #7311, #7317

Avg. Planar Exposure (GWd/MT)	MAPLHGR (kW/ft)
0.0	9.59
0.2	9.59
1.1	9.53
5.5	9.37
11.0	9.11
16.5	9.07
22.0	8.90
27.6	8.25
38.6	7.99
49.6	7.96
60.6	8.11
71.7	8.16

Table 5-13 MAPLHGR for bundle: GE11-P9DUB361-14GZ-100T-145-T6-2922
PPLX Lattices #20, #21, #22, #30
GNF Lattices #7318, #7319, #7315, #7320

Avg. Planar Exposure (GWd/MT)	MAPLHGR (kW/ft)
0.0	9.59
0.2	9.59
1.1	9.52
5.5	9.42
11.0	9.11
16.5	9.09
22.0	8.94
27.6	8.27
38.6	7.98
49.6	7.93
60.6	8.09
71.7	8.16

Table 5-14 MAPLHGR Multiplier with One ISOLATED Loop

Fuel Type	Isolated Loop Multiplier
GE9B	0.98
GE11	0.98

6. Minimum Critical Power Ratio

The MCPR limits are discussed in Technical Specifications Section 3.10.C.

6.1. Manual Flow Control MCPR Limits

The flow adjusted MCPR is determined by multiplying the applicable rated condition MCPR limit shown in Table 6-1 or 6-2 by the applicable MCPR multiplier, K(f), given in Table 6-3 or Table 6-4. . The MCPR values are documented in Reference 2 while the K(f) multipliers are documented in Reference 1. Table 6-1 and Table 6-2 limits are independent of APRM status changes since Reference 2 analyzes the Rod Withdrawal Error (RWE) as unblocked. The appropriate K(f) value may be determined by linear interpolation. A low flow correction factor is applied to the K(f) value for GE9 fuel (Table 6-3). The low flow correction factor applied to K(f) was obtained from Reference 7. Per Reference 1, a low flow correction factor does not apply to GE11 fuel (Table 6-4).

6.2. Scram Time

Core average scram insertion times are determined per Technical Specifications 3.2.B. Based on the results of the scram time surveillance testing and calculation of the core average insertion time, a MCPR limit is chosen from Table 6-1 or Table 6-2. If the core average scram insertion time does not meet the Option B criteria, but has met Option A criteria, then 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.

Table 6-1 MCPR Limit for Four or Five Recirculation Loops in Service

Option	Cycle Exposure	
	BOC to EOR-2425 MWD/MT	≥ EOR-2425 MWD/MT to EOC
A	1.46	1.51
B	1.35	1.40

Table 6-2 MCPR Limit for Three Recirculation Loops in Service

Option	Cycle Exposure	
	BOC to EOR-2425 MWD/MT	≥ EOR-2425 MWD/MT to EOC
A	1.48	1.53
B	1.37	1.42

Table 6-3 GE9B K(f) Multiplier[1]

Flow (% rated)	K(f)
120.0	1.00
100.0	1.00
90.0	1.00
80.0	1.05
70.0	1.09
60.0	1.13
50.0	1.18
40.0	1.22
30.0	1.33

Table 6-4 GE11 K(f) Multiplier[2]

Flow (% rated)	K(f)
120.0	1.00
100.0	1.00
90.0	1.00
80.0	1.05
70.0	1.09
60.0	1.13
50.0	1.18
40.0	1.22
30.0	1.28

[1] Table 6-3 incorporates a required low flow correction multiplier
[2] Table 6-4 does not require a low flow correction multiplier

7. Linear Heat Generation Rate

The LHGR limits are discussed in Technical Specifications Section 3.10.B. The maximum LHGR shall not exceed the LHGR limits as specified in Reference 3. The maximum values at beginning of life are a function of fuel type; these values are 13.4 (kW/ft) for GE9B fuel (Reference 3) and 12.0 (kW/ft) for GE11 fuel (Reference 3). The exposure dependent LHGR limits are contained in Reference 3 for both GE9B fuel and GE11 fuel.

8. Stability Protection Settings

The stability protection settings are discussed in Technical Specifications 2.3. Oyster Creek utilizes the BWROG Option II solution in the licensing stability calculations for Oyster Creek. Table 8-1 provides the analytical limit equations for APRM based stability protection settings and related Control Rod Block settings to support Option II implementation (Reference 2 and Reference 6).

Table 8-1 OPTION II Stability Protection Settings

Technical Specification 2.3.A.1 Neutron Flux, Scram - APRM

For $W \leq 27.5 \times 10^6$ lb / hr:

$S \leq (1.433 \times 10^{-5}) W + 24.8$

where:

S = setting in percent of rated power
W = recirculation flow (lb/hr)

Technical Specification 2.3.B Neutron Flux, Control Rod Block

For $W \leq 27.5 \times 10^6$ lb / hr:

$S \leq (1.433 \times 10^{-5}) W + 17.5$

where:

S = setting in percent of rated power
W = recirculation flow (lb/hr)

9. Modes of Operation

The allowed Modes of Operation are as described below:

	Operating Region		
Options[1,3]	**Standard**	**ELLLA**	**ICF**[2]
Five-loop Operation, Option A or B	Yes	Yes	Yes
Four-loop Operation, Option A or B	Yes	Yes	Yes
Three-loop Operation, Option A or B	Yes	Yes	Yes
Main Steam Line OOS[4]	Yes	Yes	Yes
TIP OOS[5]	Yes	Yes	Yes

[1] Each operational mode may be combined with up to a 100°F reduction in feedwater temperature (Final Feedwater Temperature Reduction or Feedwater Heaters OOS) at any point in the cycle (Reference 2).

[2] Operation up to 67.5 Mlb/hr core flow is licensed for this cycle (Reference 2).

[3] Each operational mode may be coincident with coastdown operation. The minimum coastdown power level is 40% per GESTAR.

[4] Reference 8 documents the Main Steam Line OOS condition.

[5] Reference 9 documents the allowance of TIP machines OOS.

10. Methodology

1. GNF Document, NEDC-31462P, "Oyster Creek NGS SAFER/CORECOOL/GESTR-LOCA Loss-of-Coolant Accident Analysis," August 1987.

2. GNF Document, NEDE-24011-P-A-15 and Supplement NEDE-24011-P-A-15-US, "General Electric Standard Application for Reload Fuel," September 2005.

3. GNF Document, NEDC-33065P, Rev. 0, "Application of Stability Long-Term Solution Option II to Oyster Creek," April 2002.