

Core Operating Limits Report

For

Dresden Unit 2 Cycle 25

Revision 1

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Record of Dresden 2 Cycle 25 COLR Revisions

<u>Revision</u>	<u>Description</u>
0	Initial issuance for D2C25
1	Update Section 5, Section 8 Note 1, and associated references for transition to POWERPLEX-XD on-line core monitoring system and revise the Table 5-13 LHGRFAC(P) values at 80% for PLUOOS and TCV Slow Closure to be no greater than the Base Case limits.

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1. Terms and Definitions

2TBVOOS	Turbine bypass valve #8 and a second turbine bypass valve out of service
APLHGR	Average planar linear heat generation rate
ASD	Adjustable speed drive
CPR	Critical power ratio
DLO	Dual loop operation
EFPH	Effective full power hour
EOC	End of cycle
EOFPL	End of full power life
EOOS	Equipment out of service
FWT	Feedwater temperature
FWTR	Feedwater temperature reduction
GWd/MTU	Gigawatt days per metric ton Uranium
ICF	Increased core flow
ISS	Intermediate scram speed
LHGR	Linear heat generation rate
LHGRFAC(F)	Flow dependent linear heat generation rate multiplier
LHGRFAC(P)	Power dependent linear heat generation rate multiplier
LPRM	Local power range monitor
MAPLHGR	Maximum average planar linear heat generation rate
MCFL	Max combined flow limiter
MCPR	Minimum critical power ratio
MCPR(F)	Flow dependent minimum critical power ratio
MCPR(P)	Power dependent minimum critical power ratio
MELLLA	Maximum extended load line limit analysis
MSIV	Main steam isolation valve
MWd/MTU	Megawatt days per metric ton Uranium
NFWT	Nominal feedwater temperature
NRC	Nuclear Regulatory Commission
NSS	Nominal scram speed
OLMCPR	Operating limit minimum critical power ratio
OOS	Out of service
OPRM	Oscillation power range monitor
PBDA	Period based detection algorithm
PLUOOS	Power load unbalance out of service
PCOOS	Pressure controller out of service
RFWT	Reduced feedwater temperature
RWE	Rod withdrawal error
SER	Safety evaluation report
SLMCPR	Safety limit minimum critical power ratio
SLO	Single loop operation
TBVOOS	Turbine bypass valves out of service
TBV	Turbine bypass valve
TCV	Turbine control valve
TIP	Traversing in-core probe
TMOL	Thermal mechanical operating limit
TSSS	Technical Specification scram speed
TSV	Turbine stop valve

2. 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.

Licensed rated thermal power is 2957 MWth. Rated core flow is 98 Mlb/hr. Operation up to 108% rated flow (ICF) is fully evaluated for this cycle; however, flow cannot exceed 103.4% rated flow due to unit specific limitations. For allowed operating regions, see applicable power/flow map.

The licensing analysis supports full power operation to EOFPL + 25 days (16182 MWD/MTU) and coastdown to a power of 70% given all burnup limits are satisfied (Reference 22).

Coastdown is defined as any cycle exposure beyond the full power, licensed increased core flow, and all rods out condition with the plant power gradually reducing as available core reactivity diminishes.

MCPR(P) and MCPR(F) values are independent of scram speed. MCPR(F) is independent of FWT.

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

All thermal limits are analyzed to NSS, ISS, and TSSS, except for the special case 2TBVOOS, which is only analyzed for NSS and NFWT (Reference 22). Only MCPR operating limits vary with scram speed.

For thermal limit monitoring above 100% rated power or 108% rated core flow, the 100% rated power or the 108% core flow thermal limit values, respectively, can be used unless otherwise indicated in the applicable table.

3. Average Planar Linear Heat Generation Rate

Technical Specifications Sections 3.2.1 and 3.4.1

For natural uranium lattices, DLO and SLO MAPLHGR values are provided in Table 3-1. For all other lattices, lattice-specific MAPLHGR values for DLO are provided in Tables 3-2 through 3-56. During SLO, these limits are multiplied by the SLO multiplier listed in Table 3-57.

Table 3-1: MAPLHGR for Lattices 81 and 89

(Reference 9, 15, 16 and 17)

All Bundles Lattice 81: Opt2-B0.71 89: Opt2-T0.71	
Average Planar Exposure (MWd/MTU)	DLO and SLO MAPLHGR (kW/ft)
0	7.50
75000	7.50

Table 3-2: MAPLHGR for Lattice 113

(References 9, 10, and 11)

Bundle Opt2-4.05-18GZ8.00-14GZ5.50 Lattice 113 : Opt2-B4.45-18G8.00	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	8.67
2500	8.86
5000	8.97
7500	9.04
10000	9.07
12000	9.11
15000	9.26
17000	9.38
20000	9.54
22000	9.69
24000	9.75
30000	9.68
36000	9.64
42000	9.62
50000	9.67
60000	9.66
72000	9.88

Table 3-3: MAPLHGR for Lattice 114
(References 9, 10 and 11)

Bundle Opt2-4.05-18GZ8.00-14GZ5.50 Lattice 114: Opt2-BE4.54-18G8.00	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	8.70
2500	8.88
5000	9.02
7500	9.08
10000	9.13
12000	9.18
15000	9.35
17000	9.47
20000	9.65
22000	9.80
24000	9.83
30000	9.76
36000	9.72
42000	9.70
50000	9.70
60000	9.70
72000	9.92

Table 3-4: MAPLHGR Lattice 115
(References 9, 10, and 11)

Bundle Opt2-4.05-18GZ8.00-14GZ5.50 Lattice 115: Opt2-M4.54-18G8.00	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	8.68
2500	8.85
5000	9.01
7500	9.10
10000	9.14
12000	9.21
15000	9.36
17000	9.49
20000	9.66
22000	9.82
24000	9.83
30000	9.76
36000	9.71
42000	9.70
50000	9.68
60000	9.68
72000	9.93

Table 3-5: MAPLHGR for Lattice 116
(References 9, 10, and 11)

Bundle Opt2-4.05-18GZ8.00-14GZ5.50 Lattice 116: Opt2-ME4.50-18G8.00	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	8.81
2500	9.00
5000	9.14
7500	9.25
10000	9.28
12000	9.36
15000	9.53
17000	9.68
20000	9.99
22000	10.03
24000	10.01
30000	9.97
36000	9.91
42000	9.90
50000	9.82
60000	9.85
72000	10.19

Table 3-6: MAPLHGR for Lattice 117
(References 9, 10, and 11)

Bundle Opt2-4.05-18GZ8.00-14GZ5.50 Lattice 117: Opt2-T4.50-18G8.00	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	8.85
2500	9.03
5000	9.17
7500	9.22
10000	9.22
12000	9.28
15000	9.46
17000	9.64
20000	10.00
22000	10.00
24000	10.00
30000	9.95
36000	9.89
42000	9.87
50000	9.79
60000	9.82
72000	10.19

Table 3-7: MAPLHGR for Lattice 118

(References 9, 10, and 11)

Bundle Opt2-4.05-18GZ8.00-14GZ5.50 Lattice 118: Opt2-T4.52-14G5.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	9.66
2500	9.77
5000	9.79
7500	9.71
10000	9.64
12000	9.66
15000	9.95
17000	10.15
20000	10.17
22000	10.16
24000	10.14
30000	10.07
36000	10.01
42000	9.95
50000	9.85
60000	9.90
72000	10.26

Table 3-8: MAPLHGR for Lattice 119

(References 9, 10, and 11)

Bundle Opt2-4.05-16GZ8.00-14GZ5.50 Lattice 119: Opt2-B4.46-16G8.00	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	8.96
2500	9.11
5000	9.19
7500	9.21
10000	9.21
12000	9.23
15000	9.33
17000	9.41
20000	9.54
22000	9.67
24000	9.77
30000	9.72
36000	9.68
42000	9.66
50000	9.67
60000	9.65
72000	9.88

Table 3-9: MAPLHGR for Lattice 120

(References 9, 10, and 11)

Bundle Opt2-4.05-16GZ8.00-14GZ5.50 Lattice 120: Opt2-BE4.55-16G8.00	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	9.00
2500	9.15
5000	9.25
7500	9.28
10000	9.28
12000	9.30
15000	9.41
17000	9.50
20000	9.64
22000	9.78
24000	9.86
30000	9.81
36000	9.76
42000	9.75
50000	9.69
60000	9.69
72000	9.93

Table 3-10: MAPLHGR for Lattice 121

(References 9, 10, and 11)

Bundle Opt2-4.05-16GZ8.00-14GZ5.50 Lattice 121: Opt2-M4.55-16G8.00	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	8.99
2500	9.12
5000	9.24
7500	9.29
10000	9.28
12000	9.32
15000	9.42
17000	9.52
20000	9.65
22000	9.79
24000	9.85
30000	9.80
36000	9.76
42000	9.75
50000	9.67
60000	9.67
72000	9.93

Table 3-11: MAPLHGR for Lattice 122

(References 9, 10, and 11)

Bundle Opt2-4.05-16GZ8.00-14GZ5.50 Lattice 122: Opt2-ME4.51-16G8.00	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	9.14
2500	9.30
5000	9.40
7500	9.46
10000	9.44
12000	9.48
15000	9.60
17000	9.71
20000	9.96
22000	10.05
24000	10.05
30000	10.01
36000	9.96
42000	9.89
50000	9.80
60000	9.84
72000	10.19

Table 3-12: MAPLHGR for Lattice 123

(References 9, 10, and 11)

Bundle Opt2-4.05-16GZ8.00-14GZ5.50 Lattice 123: Opt2-T4.51-16G8.00	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	9.18
2500	9.33
5000	9.42
7500	9.43
10000	9.39
12000	9.42
15000	9.54
17000	9.67
20000	9.97
22000	10.03
24000	10.03
30000	10.00
36000	9.94
42000	9.85
50000	9.77
60000	9.81
72000	10.20

Table 3-13: MAPLHGR for Lattice 124

(References 9, 10, and 11)

Bundle Opt2-4.05-16GZ8.00-14GZ5.50 Lattice 124: Opt2-T4.52-14G5.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	9.66
2500	9.77
5000	9.79
7500	9.71
10000	9.64
12000	9.66
15000	9.95
17000	10.15
20000	10.17
22000	10.16
24000	10.14
30000	10.07
36000	10.01
42000	9.95
50000	9.85
60000	9.90
72000	10.26

Table 3-14: MAPLHGR for Lattice 125

(References 9, 10, and 11)

Bundle Opt2-4.10-14GZ5.50-2GZ5.50 Lattice 125: Opt2-B4.50-16G5.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	8.91
2500	9.07
5000	9.20
7500	9.26
10000	9.28
12000	9.31
15000	9.47
17000	9.65
20000	9.82
22000	9.87
24000	9.86
30000	9.79
36000	9.73
42000	9.71
50000	9.75
60000	9.73
72000	9.93

Table 3-15: MAPLHGR for Lattice 126

(References 9, 10, and 11)

Bundle Opt2-4.10-14GZ5.50-2GZ5.50 Lattice 126: Opt2-BE4.60-16G5.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	8.95
2500	9.11
5000	9.26
7500	9.32
10000	9.34
12000	9.39
15000	9.57
17000	9.76
20000	9.93
22000	9.97
24000	9.95
30000	9.88
36000	9.83
42000	9.80
50000	9.79
60000	9.77
72000	9.98

Table 3-16: MAPLHGR for Lattice 127

(References 9, 10, and 11)

Bundle Opt2-4.10-14GZ5.50-2GZ5.50 Lattice 127: Opt2-M4.60-16G5.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	8.94
2500	9.10
5000	9.25
7500	9.33
10000	9.36
12000	9.40
15000	9.58
17000	9.77
20000	9.95
22000	9.97
24000	9.95
30000	9.88
36000	9.82
42000	9.79
50000	9.77
60000	9.75
72000	9.98

Table 3-17: MAPLHGR for Lattice 128

(References 9, 10, and 11)

Bundle Opt2-4.10-14GZ5.50-2GZ5.50 Lattice 128: Opt2-ME4.56-16G5.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	9.10
2500	9.26
5000	9.42
7500	9.52
10000	9.52
12000	9.60
15000	9.87
17000	10.10
20000	10.20
22000	10.19
24000	10.17
30000	10.09
36000	10.03
42000	10.01
50000	9.92
60000	9.93
72000	10.25

Table 3-18: MAPLHGR for Lattice 129

(References 9, 10, and 11)

Bundle Opt2-4.10-14GZ5.50-2GZ5.50 Lattice 129: Opt2-T4.56-16G5.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	9.14
2500	9.31
5000	9.44
7500	9.46
10000	9.46
12000	9.53
15000	9.88
17000	10.11
20000	10.19
22000	10.17
24000	10.15
30000	10.08
36000	10.01
42000	9.99
50000	9.88
60000	9.91
72000	10.25

Table 3-19: MAPLHGR for Lattice 130

(References 9, 10, and 11)

Bundle Opt2-4.10-14GZ5.50-2GZ5.50 Lattice 130: Opt2-T4.57-14G5.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	9.50
2500	9.63
5000	9.71
7500	9.68
10000	9.61
12000	9.62
15000	9.88
17000	10.09
20000	10.21
22000	10.19
24000	10.18
30000	10.10
36000	10.04
42000	9.98
50000	9.87
60000	9.90
72000	10.25

Table 3-20: MAPLHGR for Lattice 131

(References 3 and 15)

Bundle Opt2-4.04-18GZ7.50-14GZ5.50 Lattice 131: Opt2-B4.44-18G7.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	9.21
2500	9.53
5000	9.45
7500	9.38
10000	9.49
12000	9.50
15000	9.55
17000	9.61
20000	9.80
22000	9.89
24000	9.83
30000	9.77
36000	9.71
42000	9.67
50000	9.70
60000	9.81
72000	10.07
75000	10.07

Table 3-21: MAPLHGR for Lattice 132

(References 3 and 15)

Bundle Opt2-4.04-18GZ7.50-14GZ5.50 Lattice 132: Opt2-BE4.54-18G7.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	9.34
2500	9.62
5000	9.51
7500	9.43
10000	9.55
12000	9.57
15000	9.64
17000	9.73
20000	9.89
22000	10.02
24000	9.94
30000	9.86
36000	9.81
42000	9.74
50000	9.77
60000	9.80
72000	10.10
75000	10.10

Table 3-22: MAPLHGR for Lattice 133

(References 3 and 15)

Bundle Opt2-4.04-18GZ7.50-14GZ5.50 Lattice 133: Opt2-M4.54-18G7.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	9.33
2500	9.62
5000	9.57
7500	9.43
10000	9.56
12000	9.62
15000	9.67
17000	9.75
20000	9.98
22000	9.99
24000	9.93
30000	9.85
36000	9.81
42000	9.74
50000	9.75
60000	9.78
72000	9.90
75000	9.90

Table 3-23: MAPLHGR for Lattice 134

(References 3 and 15)

Bundle Opt2-4.04-18GZ7.50-14GZ5.50 Lattice 134: Opt2-ME4.50-18G7.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	9.46
2500	9.77
5000	9.62
7500	9.52
10000	9.72
12000	9.73
15000	9.83
17000	9.93
20000	10.19
22000	10.19
24000	10.11
30000	10.04
36000	9.97
42000	9.92
50000	9.85
60000	9.88
72000	10.39
75000	10.39

Table 3-24: MAPLHGR for Lattice 135

(References 3 and 15)

Bundle Opt2-4.04-18GZ7.50-14GZ5.50 Lattice 135: Opt2-T4.50-18G7.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	9.48
2500	9.76
5000	9.56
7500	9.45
10000	9.55
12000	9.72
15000	9.78
17000	9.94
20000	10.19
22000	10.16
24000	10.11
30000	10.05
36000	9.97
42000	9.93
50000	9.81
60000	9.84
72000	10.25
75000	10.25

Table 3-25: MAPLHGR for Lattice 136

(References 3 and 15)

Bundle Opt2-4.04-18GZ7.50-14GZ5.50 Lattice 136: Opt2-T4.52-14G5.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	10.21
2500	10.47
5000	10.28
7500	10.05
10000	10.09
12000	10.11
15000	10.22
17000	10.27
20000	10.26
22000	10.29
24000	10.22
30000	10.16
36000	10.09
42000	10.00
50000	9.87
60000	9.90
72000	10.26
75000	10.26

Table 3-26: MAPLHGR for Lattice 137

(References 3 and 15)

Bundle Opt2-4.01-16GZ7.50-14GZ5.50 Lattice 137: Opt2-B4.41-16G7.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	9.47
2500	9.76
5000	9.66
7500	9.57
10000	9.64
12000	9.54
15000	9.57
17000	9.60
20000	9.76
22000	9.90
24000	9.84
30000	9.79
36000	9.75
42000	9.70
50000	9.70
60000	9.79
72000	10.07
75000	10.07

Table 3-27: MAPLHGR for Lattice 138
(References 3 and 15)

Bundle Opt2-4.01-16GZ7.50-14GZ5.50 Lattice 138: Opt2-BE4.51-16G7.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	9.63
2500	9.85
5000	9.81
7500	9.63
10000	9.70
12000	9.70
15000	9.70
17000	9.75
20000	9.89
22000	10.00
24000	9.95
30000	9.89
36000	9.85
42000	9.77
50000	9.70
60000	9.69
72000	10.02
75000	10.02

Table 3-28: MAPLHGR for Lattice 139
(References 3 and 15)

Bundle Opt2-4.01-16GZ7.50-14GZ5.50 Lattice 139: Opt2-M4.51-16G7.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	9.62
2500	9.87
5000	9.91
7500	9.63
10000	9.72
12000	9.74
15000	9.73
17000	9.77
20000	9.91
22000	10.00
24000	9.95
30000	9.88
36000	9.85
42000	9.77
50000	9.68
60000	9.68
72000	10.06
75000	10.06

Table 3-29: MAPLHGR for Lattice 140

(References 3 and 15)

Bundle Opt2-4.01-16GZ7.50-14GZ5.50 Lattice 140: Opt2-ME4.46-16G7.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	9.78
2500	10.04
5000	9.96
7500	9.80
10000	9.89
12000	9.89
15000	9.89
17000	9.94
20000	10.17
22000	10.19
24000	10.14
30000	10.08
36000	10.01
42000	9.92
50000	9.80
60000	9.84
72000	10.25
75000	10.25

Table 3-30: MAPLHGR for Lattice 141

(References 3 and 15)

Bundle Opt2-4.01-16GZ7.50-14GZ5.50 Lattice 141: Opt2-T4.46-16G7.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	9.80
2500	10.02
5000	9.87
7500	9.76
10000	9.84
12000	9.84
15000	9.83
17000	9.95
20000	10.16
22000	10.15
24000	10.13
30000	10.08
36000	10.00
42000	9.88
50000	9.77
60000	9.71
72000	9.91
75000	9.91

Table 3-31: MAPLHGR for Lattice 142

(References 3 and 15)

Bundle Opt2-4.01-16GZ7.50-14GZ5.50 Lattice 142: Opt2-T4.47-14G5.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	10.22
2500	10.45
5000	10.32
7500	10.07
10000	10.01
12000	10.11
15000	10.23
17000	10.25
20000	10.23
22000	10.23
24000	10.19
30000	10.14
36000	10.07
42000	9.96
50000	9.84
60000	9.87
72000	10.26
75000	10.26

Table 3-32: MAPLHGR for Lattice 143

(References 3 and 15)

Bundle Opt2-4.04-14G5.50-2GZ5.50 Lattice 143: Opt2-B4.44-16G5.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	9.48
2500	9.78
5000	9.79
7500	9.59
10000	9.69
12000	9.63
15000	9.75
17000	9.83
20000	10.01
22000	9.95
24000	9.90
30000	9.84
36000	9.79
42000	9.74
50000	9.72
60000	9.77
72000	9.85
75000	9.79

Table 3-33: MAPLHGR for Lattice 144

(References 3 and 15)

Bundle Opt2-4.04-14G5.50-2GZ5.50 Lattice 144: Opt2-BE4.54-16G5.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	9.55
2500	9.87
5000	10.02
7500	9.74
10000	9.78
12000	9.76
15000	9.89
17000	10.00
20000	10.15
22000	10.07
24000	10.02
30000	9.94
36000	9.91
42000	9.87
50000	9.84
60000	9.94
72000	10.19
75000	10.19

Table 3-34: MAPLHGR for Lattice 145

(References 3 and 15)

Bundle Opt2-4.04-14G5.50-2GZ5.50 Lattice 145: Opt2-M4.54-16G5.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	9.54
2500	9.87
5000	10.06
7500	9.85
10000	9.80
12000	9.80
15000	9.91
17000	10.04
20000	10.13
22000	10.07
24000	10.02
30000	9.94
36000	9.91
42000	9.87
50000	9.82
60000	9.94
72000	10.19
75000	10.19

Table 3-35: MAPLHGR for Lattice 146

(References 3 and 15)

Bundle Opt2-4.04-14G5.50-2GZ5.50 Lattice 146: Opt2-ME4.50-16G5.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	9.70
2500	10.04
5000	10.15
7500	9.87
10000	9.96
12000	9.96
15000	10.18
17000	10.32
20000	10.34
22000	10.26
24000	10.23
30000	10.15
36000	10.09
42000	10.04
50000	9.88
60000	9.88
72000	10.30
75000	10.30

Table 3-36: MAPLHGR for Lattice 147

(References 3 and 15)

Bundle Opt2-4.04-14G5.50-2GZ5.50 Lattice 147: Opt2-T4.50-16G5.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	9.74
2500	10.06
5000	10.08
7500	9.84
10000	9.92
12000	9.93
15000	10.14
17000	10.31
20000	10.25
22000	10.24
24000	10.20
30000	10.14
36000	10.07
42000	10.00
50000	9.85
60000	9.87
72000	10.25
75000	10.25

Table 3-37: MAPLHGR for Lattice 148

(References 3 and 15)

Bundle Opt2-4.04-14G5.50-2GZ5.50 Lattice 148: Opt2-T4.51-14G5.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	10.14
2500	10.42
5000	10.48
7500	10.06
10000	10.08
12000	10.07
15000	10.15
17000	10.27
20000	10.26
22000	10.30
24000	10.23
30000	10.17
36000	10.10
42000	9.98
50000	9.84
60000	9.77
72000	10.39
75000	10.39

Table 3-38: MAPLHGR for Lattice 149

(References 16 and 17)

Bundle Opt2-4.02-18GZ7.50-14GZ5.50 Lattice 149: Opt2-B4.31-18G7.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	9.51
2500	9.85
5000	9.92
7500	9.84
10000	10.09
12000	10.18
15000	10.32
17000	10.37
20000	10.43
22000	10.39
24000	10.41
30000	10.24
36000	10.12
42000	9.99
50000	9.89
75000	9.89

Table 3-39: MAPLHGR for Lattice 150

(References 16 and 17)

Bundle Opt2-4.02-18GZ7.50-14GZ5.50 Lattice 150: Opt2-B4.44-18G7.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	9.42
2500	9.75
5000	9.65
7500	9.57
10000	9.69
12000	9.72
15000	9.77
17000	9.84
20000	10.04
22000	10.14
24000	10.08
30000	10.02
36000	9.97
42000	9.93
50000	9.97
75000	9.97

Table 3-40: MAPLHGR for Lattice 151

(References 16 and 17)

Bundle Opt2-4.02-18GZ7.50-14GZ5.50 Lattice 151: Opt2-BE4.54-18G7.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	9.55
2500	9.83
5000	9.72
7500	9.62
10000	9.75
12000	9.78
15000	9.87
17000	9.96
20000	10.12
22000	10.26
24000	10.19
30000	10.11
36000	10.07
42000	10.01
50000	10.04
75000	10.04

Table 3-41: MAPLHGR for Lattice 152

(References 16 and 17)

Bundle Opt2-4.02-18GZ7.50-14GZ5.50 Lattice 152: Opt2-M4.54-18G7.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	9.54
2500	9.84
5000	9.79
7500	9.62
10000	9.75
12000	9.82
15000	9.90
17000	9.98
20000	10.20
22000	10.24
24000	10.17
30000	10.10
36000	10.06
42000	10.00
50000	10.02
75000	10.02

Table 3-42: MAPLHGR for Lattice 153

(References 16 and 17)

Bundle Opt2-4.02-18GZ7.50-14GZ5.50 Lattice 153: Opt2-ME4.50-18G7.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	9.67
2500	10.00
5000	9.83
7500	9.72
10000	9.92
12000	9.94
15000	10.05
17000	10.16
20000	10.45
22000	10.43
24000	10.36
30000	10.30
36000	10.23
42000	10.19
50000	10.13
75000	10.13

Table 3-43: MAPLHGR for Lattice 154

(References 16 and 17)

Bundle Opt2-4.02-18GZ7.50-14GZ5.50 Lattice 154: Opt2-T4.50-18G7.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	9.70
2500	9.98
5000	9.77
7500	9.64
10000	9.75
12000	9.93
15000	10.00
17000	10.16
20000	10.43
22000	10.40
24000	10.35
30000	10.30
36000	10.23
42000	10.19
50000	10.09
75000	10.09

Table 3-44: MAPLHGR for Lattice 155

(References 16 and 17)

Bundle Opt2-4.02-18GZ7.50-14GZ5.50 Lattice 155: Opt2-T4.52-14G5.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	10.40
2500	10.71
5000	10.55
7500	10.25
10000	10.30
12000	10.32
15000	10.45
17000	10.52
20000	10.51
22000	10.52
24000	10.47
30000	10.41
36000	10.35
42000	10.27
50000	10.16
75000	10.16

Table 3-45: MAPLHGR for Lattice 156

(References 16 and 17)

Bundle Opt2-3.98-16GZ7.50-14GZ5.50 Lattice 156: Opt2-B4.27-16G7.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	9.78
2500	10.09
5000	10.14
7500	10.04
10000	10.20
12000	10.25
15000	10.34
17000	10.38
20000	10.41
22000	10.44
24000	10.45
30000	10.19
36000	10.07
42000	9.94
50000	9.84
75000	9.84

Table 3-46: MAPLHGR for Lattice 157

(References 16 and 17)

Bundle Opt2-3.98-16GZ7.50-14GZ5.50 Lattice 157: Opt2-B4.41-16G7.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	9.69
2500	9.99
5000	9.88
7500	9.76
10000	9.83
12000	9.76
15000	9.79
17000	9.83
20000	10.00
22000	10.13
24000	10.09
30000	10.04
36000	10.00
42000	9.95
50000	9.95
75000	9.95

Table 3-47: MAPLHGR for Lattice 158

(References 16 and 17)

Bundle Opt2-3.98-16GZ7.50-14GZ5.50 Lattice 158: Opt2-BE4.51-16G7.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	9.84
2500	10.08
5000	10.02
7500	9.82
10000	9.90
12000	9.92
15000	9.92
17000	9.98
20000	10.13
22000	10.24
24000	10.20
30000	10.14
36000	10.10
42000	10.04
50000	9.71
75000	9.71

Table 3-48: MAPLHGR for Lattice 159

(References 16 and 17)

Bundle Opt2-3.98-16GZ7.50-14GZ5.50 Lattice 159: Opt2-M4.51-16G7.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	9.84
2500	10.09
5000	10.12
7500	9.83
10000	9.91
12000	9.96
15000	9.95
17000	10.00
20000	10.14
22000	10.24
24000	10.19
30000	10.13
36000	10.10
42000	10.03
50000	9.93
75000	9.93

Table 3-49: MAPLHGR for Lattice 160

(References 16 and 17)

Bundle Opt2-3.98-16GZ7.50-14GZ5.50 Lattice 160: Opt2-ME4.46-16G7.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	10.01
2500	10.27
5000	10.19
7500	10.00
10000	10.10
12000	10.11
15000	10.11
17000	10.17
20000	10.42
22000	10.42
24000	10.39
30000	10.33
36000	10.27
42000	10.19
50000	10.08
75000	10.08

Table 3-50: MAPLHGR for Lattice 161

(References 16 and 17)

Bundle Opt2-3.98-16GZ7.50-14GZ5.50 Lattice 161: Opt2-T4.46-16G7.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	10.03
2500	10.26
5000	10.09
7500	9.97
10000	10.04
12000	10.05
15000	10.06
17000	10.18
20000	10.40
22000	10.40
24000	10.37
30000	10.33
36000	10.26
42000	10.15
50000	10.00
75000	10.00

Table 3-51: MAPLHGR for Lattice 162

(References 16 and 17)

Bundle Opt2-3.98-16GZ7.50-14GZ5.50 Lattice 162: Opt2-T4.47-14G5.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	10.41
2500	10.69
5000	10.54
7500	10.28
10000	10.20
12000	10.32
15000	10.46
17000	10.49
20000	10.48
22000	10.47
24000	10.44
30000	10.39
36000	10.33
42000	10.22
50000	10.12
75000	10.12

Table 3-52: MAPLHGR for Lattice 163

(References 16 and 17)

Bundle Opt2-4.10-14G5.50-2GZ5.50 Lattice 163: Opt2-B4.50-16G5.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	9.47
2500	9.81
5000	9.71
7500	9.58
10000	9.68
12000	9.73
15000	9.89
17000	10.00
20000	10.18
22000	10.21
24000	10.18
30000	10.12
36000	10.07
42000	10.00
50000	10.02
75000	10.02

Table 3-53: MAPLHGR for Lattice 164

(References 16 and 17)

Bundle Opt2-4.10-14G5.50-2GZ5.50 Lattice 164: Opt2-BE4.60-16G5.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	9.53
2500	9.89
5000	9.85
7500	9.83
10000	9.76
12000	9.82
15000	10.01
17000	10.16
20000	10.33
22000	10.34
24000	10.31
30000	10.23
36000	10.18
42000	10.14
50000	10.09
75000	10.09

Table 3-54: MAPLHGR for Lattice 165

(References 16 and 17)

Bundle Opt2-4.10-14G5.50-2GZ5.50 Lattice 165: Opt2-M4.60-16G5.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	9.51
2500	9.91
5000	9.89
7500	9.85
10000	9.78
12000	9.85
15000	10.02
17000	10.18
20000	10.36
22000	10.36
24000	10.31
30000	10.23
36000	10.18
42000	10.14
50000	10.09
75000	10.09

Table 3-55: MAPLHGR for Lattice 166

(References 16 and 17)

Bundle Opt2-4.10-14G5.50-2GZ5.50 Lattice 166: Opt2-ME4.57-16G5.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	9.68
2500	10.09
5000	10.04
7500	9.93
10000	9.95
12000	10.03
15000	10.31
17000	10.47
20000	10.62
22000	10.56
24000	10.51
30000	10.44
36000	10.37
42000	10.28
50000	10.22
75000	10.22

Table 3-56: MAPLHGR for Lattice 167

(References 16 and 17)

Bundle Opt2-4.10-14G5.50-2GZ5.50 Lattice 167: Opt2-T4.58-14G5.50	
Average Planar Exposure (MWd/MTU)	DLO MAPLHGR (kW/ft)
0	10.13
2500	10.45
5000	10.44
7500	10.17
10000	10.08
12000	10.10
15000	10.29
17000	10.44
20000	10.56
22000	10.56
24000	10.52
30000	10.46
36000	10.39
42000	10.31
50000	10.17
75000	10.17

Table 3-57: MAPLHGR SLO Multiplier
(References 3, 11, and 16)

EOOS Condition	Multiplier
SLO	0.86

4. Operating Limit Minimum Critical Power Ratio

Technical Specification Sections 3.2.2, 3.4.1, and 3.7.7

The OLMCPRs for D2C25 were established to protect the SLMCPR for abnormal operational occurrences. The SLMCPR values for DLO and SLO for D2C25 were determined to be 1.12 and 1.14 (Reference 22), respectively, which are unchanged from the NRC-approved values for the previous operating cycle (D2C24).

4.1. 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.

4.1.1. Power-Dependent MCPR

For operation at less than or equal to 38.5% core thermal power, the power dependent OLMCPR is shown in Tables 4-8 and 4-9. For operation at greater than 38.5% core thermal power, the power dependent OLMCPR is determined by multiplying the applicable rated condition OLMCPR limit shown in Tables 4-2 through 4-7 by the applicable OLMCPR multiplier given in Tables 4-8 and 4-9.

4.1.2. Flow-Dependent MCPR

Table 4-10 gives the MCPR(F) limit as a function of the flow based on the applicable plant condition. The flow-dependent OLMCPR values are applicable to all base case and EOOS combinations.

4.2. Scram Time

TSSS, ISS, and NSS refer to scram speeds. The scram time values associated with these speeds are shown in Table 4-1. The TSSS scram times shown in Table 4-1 are the same as those specified in the Technical Specifications (Reference 5). Reference 22 indicates that the TSSS control rod insertion times that were actually used in the transient analysis are conservative with respect to the scram times specified in the Technical Specifications.

To utilize the OLMCPR limits for NSS in Tables 4-6 and 4-7, the average control rod insertion time at each control rod insertion fraction must be equal to or less than the NSS time shown in Table 4-1 below.

To utilize the OLMCPR limits for ISS in Tables 4-4 and 4-5, the average control rod insertion time at each control rod insertion fraction must be equal to or less than the ISS time shown in Table 4-1 below.

To utilize the OLMCPR limits for TSSS in Tables 4-2 and 4-3, the average control rod insertion time at each control rod insertion fraction must be equal to or less than the TSSS time shown in Table 4-1 below.

The "Average Control Rod Insertion Time" is defined as the sum of the control rod insertion times of all operable control rods divided by the number of operable control rods. The time for inoperable drives fully inserted (notch 00) can be conservatively included for calculation of core average scram speed. (Reference 22)

Table 4-1: Scram Times
(References 5 and 22)

Control Rod Insertion Fraction (%)	TSSS (seconds)	ISS (seconds)	NSS (seconds)
5	0.48	0.360	0.324
20	0.89	0.720	0.700
50	1.98	1.580	1.510
90	3.44	2.740	2.635

4.3. Recirculation Pump ASD Settings

Technical Requirements Manual 2.1.a.1

Cycle 25 was analyzed with a maximum core flow runout of 110%; therefore the recirculation pump ASD must be set to maintain core flow less than 110% (107.8 Mlb/hr) for all runout events (Reference 13). This value is consistent with the analyses in Reference 22.

Table 4-2: MCPR TSSS Based Operating Limits – NFWT
(Reference 22)

EOOS Combination	Cycle Exposure	
	≤ 14500 MWd/MTU	> 14500 MWd/MTU
Base	1.64	1.71
Base SLO	1.67	1.75
PLUOOS	1.70	1.76
PLUOOS SLO	1.74	1.80
TBVOOS	1.77	1.80
TBVOOS SLO	1.81	1.84
TCV Slow Closure	1.74	1.80
TCV Slow Closure SLO	1.78	1.84
TCV Stuck Closed	1.64	1.71
TCV Stuck Closed SLO	1.67	1.75

Table 4-3: MCPR TSSS Based Operating Limits – RFWT
(Reference 22)

EOOS Combination	Cycle Exposure	
	≤ 14500 MWd/MTU	> 14500 MWd/MTU
Base	1.64	1.71
Base SLO	1.67	1.75
PLUOOS	1.70	1.76
PLUOOS SLO	1.74	1.80
TBVOOS	1.79	1.82
TBVOOS SLO	1.83	1.86
TCV Slow Closure	1.74	1.80
TCV Slow Closure SLO	1.78	1.84
TCV Stuck Closed	1.64	1.71
TCV Stuck Closed SLO	1.67	1.75

Table 4-4: MCPR ISS Based Operating Limits – NFWT
(Reference 22)

EOOS Combination	Cycle Exposure	
	≤ 14500 MWd/MTU	> 14500 MWd/MTU
Base	1.46	1.48
Base SLO	1.49	1.51
PLUOOS	1.50	1.55
PLUOOS SLO	1.53	1.58
TBVOOS	1.55	1.60
TBVOOS SLO	1.58	1.63
TCV Slow Closure	1.52	1.57
TCV Slow Closure SLO	1.55	1.60
TCV Stuck Closed	1.46	1.48
TCV Stuck Closed SLO	1.49	1.51

Table 4-5: MCPR ISS Based Operating Limits – RFWT
(Reference 22)

EOOS Combination	Cycle Exposure	
	≤ 14500 MWd/MTU	> 14500 MWd/MTU
Base	1.50	1.51
Base SLO	1.53	1.54
PLUOOS	1.50	1.55
PLUOOS SLO	1.53	1.58
TBVOOS	1.59	1.63
TBVOOS SLO	1.62	1.66
TCV Slow Closure	1.52	1.57
TCV Slow Closure SLO	1.55	1.60
TCV Stuck Closed	1.50	1.51
TCV Stuck Closed SLO	1.53	1.54

Table 4-6: MCPR NSS Based Operating Limits – NFWT
(Reference 22)

EOOS Combination	Cycle Exposure	
	≤ 14500 MWd/MTU	> 14500 MWd/MTU
Base	1.46	1.46
Base SLO	1.49	1.49
2TBVOOS*	1.46	1.47
2TBVOOS SLO*	1.49	1.50
PLUOOS	1.49	1.53
PLUOOS SLO	1.52	1.56
TBVOOS	1.54	1.58
TBVOOS SLO	1.57	1.61
TCV Slow Closure	1.50	1.55
TCV Slow Closure SLO	1.53	1.58
TCV Stuck Closed	1.46	1.46
TCV Stuck Closed SLO	1.49	1.49

*The 2TBVOOS EOOS option for DLO and SLO is only available for NSS at NFWT.

Table 4-7: MCPR NSS Based Operating Limits – RFWT
(Reference 22)

EOOS Combination	Cycle Exposure	
	≤ 14500 MWd/MTU	> 14500 MWd/MTU
Base	1.50	1.51
Base SLO	1.53	1.54
PLUOOS	1.50	1.53
PLUOOS SLO	1.53	1.56
TBVOOS	1.58	1.61
TBVOOS SLO	1.61	1.64
TCV Slow Closure	1.50	1.55
TCV Slow Closure SLO	1.53	1.58
TCV Stuck Closed	1.50	1.51
TCV Stuck Closed SLO	1.53	1.54

Table 4-8: MCPR(P) – NFWT
(Reference 22)

EOOS Combination	Core Flow (% of rated)	Core Thermal Power (% of rated)							
		0	25	≤ 38.5	>38.5	50	60	80	100
		Operating Limit MCPR			Operating Limit MCPR Multiplier				
Base	≤ 60	3.02	2.46	2.16	1.35	1.21	1.14	1.06	1.00
	> 60	3.21	2.71	2.44					
Base SLO	≤ 60	3.08	2.51	2.20					
	> 60	3.27	2.76	2.49					
2TBVOOS*	≤ 60	3.02	2.46	2.22	1.35	1.21	1.14	1.06	1.00
	> 60	3.21	2.71	2.44					
2TBVOOS SLO*	≤ 60	3.08	2.51	2.26					
	> 60	3.27	2.76	2.49					
PLUOOS	≤ 60	3.02	2.46	2.16	1.60	1.48	1.28	1.06	1.00
	> 60	3.21	2.71	2.44					
PLUOOS SLO	≤ 60	3.08	2.51	2.20					
	> 60	3.27	2.76	2.49					
TBVOOS	≤ 60	4.47	3.19	2.50	1.35	1.21	1.14	1.06	1.00
	> 60	4.47	3.35	2.88					
TBVOOS SLO	≤ 60	4.55	3.25	2.55					
	> 60	4.55	3.41	2.94					
TCV Slow Closure	≤ 60	3.02	2.46	2.16	1.60	1.48	1.28	1.06	1.00
	> 60	3.21	2.71	2.44					
TCV Slow Closure SLO	≤ 60	3.08	2.51	2.20					
	> 60	3.27	2.76	2.49					
TCV Stuck Closed	≤ 60	3.02	2.46	2.16	1.35	1.21	1.14	1.06	1.00
	> 60	3.21	2.71	2.44					
TCV Stuck Closed SLO	≤ 60	3.08	2.51	2.20					
	> 60	3.27	2.76	2.49					

*The 2TBVOOS EOOS option for DLO and SLO is only available for NSS at NFWT.

Table 4-9: MCPR(P) – RFWT
(Reference 22)

EOOS Combination	Core Flow (% of rated)	Core Thermal Power (% of rated)							
		0	25	≤ 38.5	>38.5	50	60	80	100
		Operating Limit MCPR			Operating Limit MCPR Multiplier				
Base	≤ 60	3.02	2.46	2.16	1.40	1.24	1.16	1.06	1.00
	> 60	3.21	2.71	2.44					
Base SLO	≤ 60	3.08	2.51	2.20					
	> 60	3.27	2.76	2.49					
PLUOOS	≤ 60	3.02	2.46	2.16	1.60	1.48	1.28	1.06	1.00
	> 60	3.21	2.71	2.44					
PLUOOS SLO	≤ 60	3.08	2.51	2.20					
	> 60	3.27	2.76	2.49					
TBVOOS	≤ 60	4.78	3.37	2.61	1.40	1.24	1.16	1.06	1.00
	> 60	4.78	3.37	2.95					
TBVOOS SLO	≤ 60	4.87	3.44	2.66					
	> 60	4.87	3.44	3.01					
TCV Slow Closure	≤ 60	3.02	2.46	2.16	1.60	1.48	1.28	1.06	1.00
	> 60	3.21	2.71	2.44					
TCV Slow Closure SLO	≤ 60	3.08	2.51	2.20					
	> 60	3.27	2.76	2.49					
TCV Stuck Closed	≤ 60	3.02	2.46	2.16	1.40	1.24	1.16	1.06	1.00
	> 60	3.21	2.71	2.44					
TCV Stuck Closed SLO	≤ 60	3.08	2.51	2.20					
	> 60	3.27	2.76	2.49					

Table 4-10: MCPR(F)
(Reference 22)

Flow (% of 98 Mlb/hr)	DLO	SLO
0	1.98	2.02
100	1.38	1.41
108	1.38	1.41

5. Linear Heat Generation Rate

Technical Specification Sections 3.2.3 and 3.4.1

The TMOL at rated conditions is established in terms of the maximum LHGR as a function of rod nodal exposure. The limits in Table 5-5 apply to bundle lattices that do not require Gadolinia set down penalties. The limits in Table 5-12 apply to the natural Uranium blankets at the top and bottom of all fuel types. The limits in all other tables apply to bundle lattices that require Gadolinia set down penalties.

The LHGR limit is the product of the exposure dependent LHGR limit from Table 5-1 through Table 5-12 as appropriate and the minimum of the power dependent LHGR Factor, LHGRFAC(P), and the flow dependent LHGR Factor, LHGRFAC(F). The LHGRFAC(P) is determined from Table 5-13. The LHGRFAC(F) is determined from Table 5-14, and is applicable for DLO, SLO, and all Base Case and EOOS conditions.

Table 5-1: LHGR Limit for Lattices 113, 114, 115, 118, 122
(References 9 and 22)

Rod Nodal Exposure (GWd/MTU)	LHGR Limit (kW/ft)
0.000	13.72
14.000	13.11
14.001	12.72
23.000	11.85
46.000	9.66
46.001	9.95
57.000	8.87
62.000	8.38
75.000	3.43

Table 5-2: LHGR Limit for Lattice 116
(References 9 and 22)

Rod Nodal Exposure (GWd/MTU)	LHGR Limit (kW/ft)
0.000	13.72
14.000	13.11
14.001	12.65
23.000	11.79
35.000	10.65
35.001	11.04
57.000	8.87
62.000	8.38
75.000	3.43

Table 5-3: LHGR Limit for Lattices 117, 123, 124
(References 9 and 22)

Rod Nodal Exposure (GWd/MTU)	LHGR Limit (kW/ft)
0.000	13.72
14.000	13.11
18.000	12.71
18.001	12.46
23.000	11.98
46.000	9.75
46.001	9.95
57.000	8.87
62.000	8.38
75.000	3.43

Table 5-4: LHGR Limit for Lattices 119, 120, 121
(References 9 and 22)

Rod Nodal Exposure (GWd/MTU)	LHGR Limit (kW/ft)
0.000	13.72
14.000	13.11
22.000	12.32
22.001	12.20
23.000	12.10
26.000	11.81
26.001	11.92
57.000	8.87
62.000	8.38
75.000	3.43

Table 5-5: LHGR Limit for Lattices 125*, 126*, 127*, 128*, 129*, 130*, 137, 138, 139, 143, 144, 145, 146, 147, 148, 156, 157, 158, 159, 163, 164, 165, 166, 167
(References 9, 15, 17, 20, 21, and 22)

Rod Nodal Exposure (GWd/MTU)	LHGR Limit (kW/ft)
0.000	13.72
14.000	13.11
23.000	12.22
57.000	8.87
62.000	8.38
75.000	3.43

* Limits for Lattice 125, 126, 127, 128, 129, and 130 from Reference 22.

Table 5-6: LHGR Limit for Lattices 135, 141
(References 15 and 20)

Rod Nodal Exposure (GWd/MTU)	LHGR Limit (kW/ft)
0.000	13.72
14.000	13.11
22.000	12.32
22.001	12.20
23.000	12.10
35.000	10.93
35.001	11.04
57.000	8.87
62.000	8.38
75.000	3.43

Table 5-7: LHGR Limit for Lattices 131, 132, 133, 136, 140, 142
(References 15 and 20)

Rod Nodal Exposure (GWd/MTU)	LHGR Limit (kW/ft)
0.000	13.72
14.000	13.11
14.001	12.85
23.000	11.98
46.000	9.75
46.001	9.95
57.000	8.87
62.000	8.38
75.000	3.43

Table 5-8: LHGR Limit for Lattice 134
(References 15 and 20)

Rod Nodal Exposure (GWd/MTU)	LHGR Limit (kW/ft)
0.000	13.72
14.000	13.11
14.001	12.72
23.000	11.85
35.000	10.71
35.001	11.04
57.000	8.87
62.000	8.38
75.000	3.43

Table 5-9: LHGR Limit for Lattices 154, 161
(References 17 and 21)

Rod Nodal Exposure (GWd/MTU)	LHGR Limit (kW/ft)
0.000	13.72
14.000	13.11
23.000	12.22
23.001	12.10
33.000	11.12
33.001	11.23
57.000	8.87
62.000	8.38
75.000	3.43

Table 5-10: LHGR Limit for Lattices 150, 151, 152, 155, 160, 162
(References 17 and 21)

Rod Nodal Exposure (GWd/MTU)	LHGR Limit (kW/ft)
0.000	13.72
14.000	13.11
14.001	12.85
23.000	11.98
46.000	9.75
46.001	9.95
57.000	8.87
62.000	8.38
75.000	3.43

Table 5-11: LHGR Limit for Lattices 149, 153
(References 17 and 21)

Rod Nodal Exposure (GWd/MTU)	LHGR Limit (kW/ft)
0.000	13.72
14.000	13.11
15.000	13.01
15.001	12.62
23.000	11.85
33.000	10.90
33.001	11.23
57.000	8.87
62.000	8.38
75.000	3.43

Table 5-12: LHGR Limit for Lattices 81, 89
(Reference 22)

Rod Nodal Exposure (GWd/MTU)	LHGR Limit (kW/ft)
0.000	11.96
14.000	11.43
23.000	10.66
57.000	8.87
62.000	8.38
75.000	3.43

Table 5-13: LHGRFAC(P) Multipliers
(Reference 22)

EOOS Combination	Core Thermal Power (% of rated)							
	0	25	≤ 38.5	> 38.5	50	60	80	100
Base	0.54	0.64	0.69	0.73	0.80	0.84	0.90	1.00
Base SLO								
2TBVOOS*	0.54	0.64	0.69	0.73	0.80	0.84	0.90	1.00
2TBVOOS SLO*								
PLUOOS	0.54	0.64	0.69	0.69	0.73	0.82	0.90	1.00
PLUOOS SLO								
TBVOOS	0.33	0.46	0.53	0.69	0.75	0.78	0.84	1.00
TBVOOS SLO								
TCV Slow Closure	0.54	0.64	0.69	0.69	0.73	0.82	0.90	1.00
TCV Slow Closure SLO								
TCV Stuck Closed	0.54	0.64	0.69	0.73	0.80	0.84	0.90	1.00
TCV Stuck Closed SLO								

*The 2TBVOOS EOOS Option for DLO and SLO are only available for NSS at NFWT.

Table 5-14: LHGRFAC(F) Multipliers
(Reference 22)

EOOS Condition	Flow (% of 98 Mlb/hr)						
	0	20	40	60	80	100	108
Base Case and all EOOS Conditions	0.27	0.43	0.60	0.80	1.00	1.00	1.00

6. Control Rod Block Setpoints

Technical Specification Sections 3.3.2.1 and 3.4.1

The Rod Block Monitor Upscale Instrumentation Setpoints are determined from the relationships shown below:

Table 6-1: Rod Block Monitor Upscale Instrumentation Setpoints
(Reference 6)

Rod Block Monitor Upscale Trip Function	Allowable Value
Two Recirculation Loop Operation	$0.65 W_d + 55\%$
Single Recirculation Loop Operation	$0.65 W_d + 51\%$

W_d – percent of recirculation loop drive flow required to produce a rated core flow of 98.0 Mlb/hr.

The setpoint may be lower/higher and will still comply with the RWE analysis because RWE is analyzed unblocked (Reference 22).

7. Stability Protection Setpoints

Technical Specification Section 3.3.1.3

The OPRM PBDA Trip Settings are provided in Table 7-1.

Table 7-1: OPRM PBDA Trip Settings
(Reference 22)

PBDA Trip Amplitude Setpoint (Sp)	Corresponding Maximum Confirmation Count Setpoint (Np)
1.15	16

The PBDA is the only OPRM setting credited in the safety analysis as documented in the licensing basis for the OPRM system (Methodology 2).

The OPRM PBDA trip settings are based, in part, on the cycle specific OLMCPR and the power/flow dependent MCPR limits. Any change to the OLMCPR values and/or the power/flow 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.

8. Modes of Operation

The allowed modes of operation with combinations of EOOS are as described below:

Table 8-1: Modes of Operation
(Reference 22)

EOOS Options	Thermal Limit Sets
Base	Base (DLO or SLO)
TBV #8 and any one additional TBV OOS with NSS and NFWT Only	2TBVOOS (DLO or SLO)
TBV #8 and any one additional TBV OOS in a condition other than NSS and NFWT	TBVOOS (DLO or SLO)
PLUOOS	PLUOOS (DLO or SLO)
TBVOOS	TBVOOS (DLO or SLO)
TCV Slow Closure	TCV Slow Closure (DLO or SLO)
TCV Stuck Closed* **	Base Case (DLO or SLO) ➤ See Table 8-2 for power restrictions
PCOOS	PLUOOS (DLO or SLO)
PCOOS and PLUOOS	PLUOOS (DLO or SLO)
PCOOS and TCV Slow Closure	TCV Slow Closure (DLO or SLO)
PCOOS and one TCV Stuck Closed*	PLUOOS (DLO or SLO) ➤ See Table 8-2 for power restrictions
PLUOOS and one TCV Stuck Closed*	PLUOOS (DLO or SLO) ➤ See Table 8-2 for power restrictions

*Also applicable to one TSV Closed and the combination of one TCV and one TSV stuck closed in the same line.

**EOOS condition has identical thermal limits as the Base Case. Therefore, this condition will use the Base Case thermal limit set.

Common Notes – Applicable to both Base Case and all EOOS Combinations for DLO/SLO:

1. All modes are allowed for operation at MELLLA, ICF (up to 108% rated core flow but subject to the restrictions in Section 2), and coastdown (subject to restrictions in Table 8-2). Either EOC must be reached or coastdown must begin prior to reaching 16182 MWd/MTU. The licensing analysis remains valid down to a coastdown power level of 70% given all burnup limits are satisfied per Methodology 6. Each OOS Option may be combined with each of the following conditions:
 - a. Up to 16 TIP channel traces and 2 common channel traces may be substituted using the SUBTIP methodology (Reference 12) provided the requirements for utilizing SUBTIP methodology are met as clarified in Reference 18.
 - b. Up to 50% of the LPRMs OOS (Reference 12)
 - c. An LPRM calibration frequency of up to 2500 EFPH (2000 EFPH + 25%) (Reference 12)
2. Nominal FWT results are valid for application within a +10°F/-30°F temperature band around the nominal FWT curve and operating steam dome pressure region bounded by the maximum value of 1020 psia and the minimum pressure curve (Reference 8). The FWTR results are valid for the minimum FWT curve (Reference 22). For operation outside of NFWT, a FWTR of between 30°F and 120°F is supported for Base Case and all EOOS DLO/SLO conditions, except for 2TBVOOS, for cycle operation through EOC subject to the restriction in Reference 4 for feedwater temperature reductions of greater than 100°F. The restriction requires that, for a FWT reduction greater than 100°F, operation needs to be restricted to less than the 100% load line.
3. All analyses support the fastest Turbine Bypass Valve (assumed to be #1) OOS, with the remaining 8 TBVs meeting the assumed opening profile in Reference 7. The analyses also support Turbine Bypass flow of 3.456 Mlb/hr of vessel rated steam flow, equivalent to one TBV OOS (or partially closed TBVs equivalent to one closed TBV), if the assumed opening profile (Reference 7) for the remaining TBVs is met. If the opening profile is **NOT** met, or if the TBV system cannot pass an equivalent of 3.456 Mlb/hr of vessel rated steam flow and the 2TBVOOS EOOS option is not being used, utilize the TBVOOS condition (Reference 22).
4. The 2TBVOOS with NSS and NFWT analysis supports Turbine Bypass Valve #8 and any one additional Turbine Bypass Valve OOS, with the remaining 7 TBV meeting the assumed opening profile in Reference 7. If operating with more than one TBV OOS with RFWT, ISS, or TSSS, utilize the TBVOOS condition (Reference 22).
5. If any TBVs are OOS in the pressure control mode, the maximum steam flow removal capacity for pressure control needs to be evaluated to ensure that at least the equivalent of two TBVs are capable of being opened for pressure control within the limits of the MCFL (Reference 22).
6. A single MSIV may be taken OOS (shut) under all OOS Options, as long as core thermal power is maintained $\leq 75\%$ of 2957 MWth (Reference 22).

Table 8-2: Core Thermal Power Restriction for OOS Conditions
(Reference 22)

EOOS Condition	Core Thermal Power (% of Rated Power)
One TCV Stuck Closed * PCOOS and One TCV Stuck Closed* PLUOOS and One TCV Stuck Closed*	$\leq 75^{**}$

* Also applicable to one TSV Closed and the combination of one TCV and one TSV stuck closed in the same line. (Reference 22).

** Operation above 75% rated power is included as part of the reload analysis. However, operation above 75% power may require raising the MCFL setpoint to increase the available total reactor vessel steam flow capability. Information regarding the steam flow capability necessary to satisfy the reload analysis for operation above 75% power is reported in Reference 22.

9. 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. GE Topical Report NEDE-24011-P-A, Revision 15, "General Electric Standard Application for Reactor Fuel (GESTAR)," September 2005.
2. GE Topical Report NEDO-32465-A, Revision 0, "Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology for Reload Applications," August 1996.
3. Westinghouse Report WCAP-15682-P-A, Revision 0, "Westinghouse BWR ECCS Evaluation Model: Supplement 2 to Code Description, Qualification and Application," April 2003.
4. Westinghouse Report WCAP-16078-P-A, Revision 0, "Westinghouse BWR ECCS Evaluation Model: Supplement 3 to Code Description, Qualification and Application to SVEA-96 Optima2 Fuel," November 2004.
5. Westinghouse Report WCAP-16081-P-A, Revision 0, "10x10 SVEA Fuel Critical Power Experiments and CPR Correlation: SVEA-96 Optima2," March 2005.
6. Westinghouse Topical Report CENPD-300-P-A, Revision 0, "Reference Safety Report for Boiling Water Reactor Reload Fuel," July 1996.
7. Westinghouse Topical Report CENPD-390-P-A, Revision 0, "The Advanced PHOENIX and POLCA Codes for Nuclear Design of Boiling Water Reactors," December 2000.
8. Westinghouse Topical Report WCAP-15836-P-A, Revision 0, "Fuel Rod Design Methods for Boiling Water Reactors – Supplement 1," April 2006.
9. Westinghouse Topical Report WCAP-15942-P-A, Revision 0, "Fuel Assembly Mechanical Design Methodology for Boiling Water Reactors, Supplement 1 to CENPD-287," March 2006.
10. Westinghouse Report WCAP-16865-P-A, Revision 1, "Westinghouse BWR ECCS Evaluation Model Updates: Supplement 4 to Code Description, Qualification and Application," October 2011.

10. References

1. Exelon Generation Company, LLC, Docket No. 50-237, Dresden Nuclear Power Station, Unit 2 Renewed Facility Operating License, License No. DPR-19.
2. Removed.
3. Westinghouse Document NF-BEX-13-111-NP, Revision 0, "Dresden Nuclear Power Station Unit 2 Cycle 24 MAPLHGR Report," September 2013.
4. 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.
5. Exelon Technical Specifications for Dresden 2 and 3, Table 3.1.4-1, "Control Rod Scram Times."
6. GE DRF C51-00217-01, "Instrument Setpoint Calculation Nuclear Instrumentation, Rod Block Monitor, Commonwealth Edison Company, Dresden 2 & 3," December 15, 1999.
7. Exelon TODI OPS Ltr: 15-13, Revision 0, "OPL-W Parameters for Dresden Unit 2 Cycle 25 Transient Analysis," March 9, 2015.
8. Exelon TODI ES1500006, Revision 0, "Licensing Generic Inputs Report (LGIR)," March 10, 2015.
9. Westinghouse Document NF-BEX-11-58, Revision 0, "Bundle Design Report for Dresden 2 Cycle 23," April 19, 2011.
10. Westinghouse Document NF-BEX-11-101-NP, Revision 0, "Dresden Nuclear Power Station Unit 2 Cycle 23 MAPLHGR Report," August 2011.
11. Westinghouse Document NF-BEX-11-101-NP, Revision 1, "Dresden Nuclear Power Station Unit 2 Cycle 23 MAPLHGR Report," September 2015.
12. Exelon Engineering Evaluation, EC 357691-000, "EVALUATION OF APPROPRIATE UNCERTAINTIES FOR USE BY WESTINGHOUSE IN SAFETY LIMIT MCPR ANALYSES," November 28, 2005.
13. Westinghouse Document NF-BEX-15-98, Revision 0, "Dresden Nuclear Power Station Unit 2 Cycle 25 Reload Engineering Report," September 2015.
14. Westinghouse Document NF-BEX-15-88, Revision 0, "Safety Limit MCPR for Dresden Unit 2 Cycle 25," June 2, 2015.
15. Westinghouse Document NF-BEX-13-66, Revision 0, "Bundle Design Report for Dresden 2 Cycle 24," May 3, 2013.
16. Westinghouse Document NF-BEX-15-101-NP, Revision 0, "Dresden Nuclear Power Station Unit 2 Cycle 25 MAPLHGR Report," September 2015.
17. Westinghouse Document NF-BEX-15-72, Revision 0, "Bundle Design Report for Dresden 2 Cycle 25," April 17, 2015.
18. FANP Letter, NJC:04:031/FAB04-496, "Startup with TIP Equipment Out of Service," April 20, 2004. (Exelon EC 348897-000)
19. Westinghouse Document BTD 09-0311, Revision 1, "Westinghouse CMS – Operation guidelines for Dresden and Quad Cities plants," July 20, 2009.
20. Westinghouse Letter NF-BEX-15-12, "Linear Heat Generation Rate Limits for Fresh and Once-Burned Fuel Loaded in Dresden Unit 2 Cycle 24," January 14, 2015.
21. Westinghouse Letter NF-BEX-15-157, "Linear Heat Generation Rate Limits for Fresh Fuel Loaded in Dresden Unit 2 Cycle 25," October 28, 28, 2015.
22. Westinghouse Document NF-BEX-15-105, Revision 1, "Dresden Nuclear Power Station Unit 2 Cycle 25 Reload Licensing Report," August 2016.