Dresden Unit 3 Cycle 24A

Core Operating Limits Report

Revision 1

Table of Contents

Page

1. Terms and Definitions 6
2. General Information 7
3. Average Planar Linear Heat Generation Rate 8
4. Operating Limit Minimum Critical Power Ratio 62
   4.1. Manual Flow Control MCPR Limits 62
      4.1.1. Power-Dependent MCPR 62
      4.1.2. Flow-Dependent MCPR 62
   4.2. Scram Time 63
   4.3. Recirculation Pump ASD Settings 63
5. Linear Heat Generation Rate 70
6. Control Rod Block Setpoints 76
7. Stability Protection Setpoints 77
8. Modes of Operation 78
9. Methodology 80
10. References 81

List of Tables

Page

Table 3-1: MAPLHGR SLO multiplier 8
Table 3-2: MAPLHGR for Lattices 081 and 089 8
Table 3-3: MAPLHGR for Lattice 114 9
Table 3-4: MAPLHGR for Lattice 115 10
Table 3-5: MAPLHGR for Lattice 116 11
Table 3-6: MAPLHGR for Lattice 117 12
Table 3-7: MAPLHGR for Lattice 118 13
Table 3-8: MAPLHGR for Lattice 119 14
Table 3-9: MAPLHGR for Lattice 120 15
Table 3-10: MAPLHGR for Lattice 121 16
Table 3-11: MAPLHGR for Lattice 122 17
Table 3-12: MAPLHGR for Lattice 123 18
Table 3-13: MAPLHGR for Lattice 124 19
Table 3-14: MAPLHGR for Lattice 125 20
Table 3-15: MAPLHGR for Lattice 126 21
Table 3-16: MAPLHGR for Lattice 127 22
Table 3-17: MAPLHGR for Lattice 128 23
Table 3-18: MAPLHGR for Lattice 129 24
Table 3-19: MAPLHGR for Lattice 130 25
Table 3-20: MAPLHGR for Lattice 131 26
Table 3-21: MAPLHGR for Lattice 132 27
Table 3-22: MAPLHGR for Lattice 133 28
Table 3-23: MAPLHGR for Lattice 134 29
Table 3-24: MAPLHGR for Lattice 135 30
Table 3-25: MAPLHGR for Lattice 136 31
Table 3-26: MAPLHGR for Lattice 137 32
Table 3-27: MAPLHGR for Lattice 138 33
Table 3-28: MAPLHGR for Lattice 139 34
Table 3-29: MAPLHGR for Lattice 140 35
Table 3-30: MAPLHGR for Lattice 141 36
Table 3-31: MAPLHGR for Lattice 142 37
Table 3-32: MAPLHGR for Lattice 143 38
Table 3-33: MAPLHGR for Lattice 144 39
Table 3-34: MAPLHGR for Lattice 145 40
Table 3-35: MAPLHGR for Lattice 146 41
Table 3-36: MAPLHGR for Lattice 147 42
Table 3-37: MAPLHGR for Lattice 148 43
Table 3-38: MAPLHGR for Lattice 149 44
Table 3-39: MAPLHGR for Lattice 150 45
Table 3-40: MAPLHGR for Lattice 151 46
Table 3-41: MAPLHGR for Lattice 152 47
Table 3-42: MAPLHGR for Lattice 153 48
Table 3-43: MAPLHGR for Lattice 154 49
Table 3-44: MAPLHGR for Lattice 155 50
Table 3-45: MAPLHGR for Lattice 156 51
Table 3-46: MAPLHGR for Lattice 157 52
Table 3-47: MAPLHGR for Lattice 158 53
Table 3-48: MAPLHGR for Lattice 159 54
Table 3-49: MAPLHGR for Lattice 160 55
Table 3-50: MAPLHGR for Lattice 161 56
Table 3-51: MAPLHGR for Lattice 162 57
Table 3-52: MAPLHGR for Lattice 163 58

Table 3-53: MAPLHGR for Lattice 164 59
Table 3-54: MAPLHGR for Lattice 165 60
Table 3-55: MAPLHGR for Lattice 166 61
Table 4-1: Scram Times 63
Table 4-2 MCPR TSSS Based Operating Limits – NFWT 64
Table 4-3 MCPR TSSS Based Operating Limits – FWTR 64
Table 4-4 MCPR ISS Based Operating Limits – NFWT 65
Table 4-5 MCPR ISS Based Operating Limits – FWTR 65
Table 4-6 MCPR NSS Based Operating Limits – NFWT 66
Table 4-7 MCPR NSS Based Operating Limits – FWTR 66
Table 4-8 MCPR(P) – NFWT 67
Table 4-9 MCPR(P) – FWTR 68
Table 4-10 MCPR(F) 69
Table 5-1 LHGR Limits for Lattices 116, 118, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 137, 138, 139, 143, 144, 145, 146, 147, 148, 155, 156, 157, 161, 162, 163, 164, 165, 166 70
Table 5-2 LHGR Limits for Lattices 114, 115 70
Table 5-3 LHGR Limits for Lattice 117 71
Table 5-4 LHGR Limits for Lattice 119 71
Table 5-5 LHGR Limits for Lattices 135, 141 72
Table 5-6 LHGR Limits for Lattices 131, 132, 133, 136, 140, 142 72
Table 5-7 LHGR Limits for Lattice 134 72
Table 5-8 LHGR Limits for Lattices 153, 159 73
Table 5-9 LHGR Limits for Lattices 149, 150, 151, 154, 158, 160 73
Table 5-10 LHGR Limits for Lattice 152 73
Table 5-11 LHGR Limits for Lattices 81, 89 74
Table 5-12: LHGRFAC(P) Multipliers 75
Table 5-13: LHGRFAC(F) Multipliers 75
Table 6-1 Rod Block Monitor Upscale Instrumentation Setpoints 76
Table 7-1 OPRM PBDA Trip Settings 77
Table 8-1 Modes of Operation 78
Table 8-2 Core Thermal Power Restriction for OOS Conditions 79

Record of Dresden 3 Cycle 24A COLR Revisions

Revision	Description
0	Initial issuance for D3C24A
1	Update Section 5, Section 8 Note 1, and associated references for transition to POWERPLEX-XD on-line core monitoring system. Update Section 2, Section 8 Note 1 to support a coastdown to a power level of 55%.

1. Terms and Definitions

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
EOOS	Equipment out of service
FWTR	Feedwater temperature reduction
FWHOOS	Feedwater heater out of service
ICF	Increased core flow
ISS	Intermediate scram speed
LHGR	Linear heat generation rate
LHGRFAC(F)	Flow dependent LHGR multiplier
LHGRFAC(P)	Power dependent LHGR multiplier
LPRM	Local power range monitor
MAPLHGR	Maximum average planar linear heat generation rate
MCPR	Minimum critical power ratio
MCPR(F)	Flow dependent MCPR
MCPR(P)	Power dependent MCPR
MELLLA	Maximum extended load line limit analysis
MSIV	Main steam isolation valve
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
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 incore probe
TMOL	Thermal mechanical operating limit
TSSS	Technical Specification scram speed
TSV	Turbine stop valve

2. General Information

Licensed rated thermal power is 2957 MWth. Rated core flow is 98 Mlb/hr. Operation up to 108% rated flow is licensed for this cycle. For allowed operating regions, see applicable power/flow map.

The licensing analysis supports full power operation to EOFPL+25 EFPD (7357 MWd/MTU) and coastdown to a power level of 55%, given all burnup limits are satisfied (References 6 and 25). The combined exposure of D3C24 and D3C24A full power operation to EOFPL+25 EFPD is 16117 MWd/MTU (Reference 3).

Power and flow dependent limits are listed for various power and flow levels. Linear interpolation is to be used to find intermediate values.

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.

The power-dependent OLMCPR and OLMCPR multiplier, K(P), values in Tables 4-8 and 4-9 are independent of scram speed. The MCPR(F) values are independent of scram speed.

Only MCPR operating limits vary with scram speed. All other thermal limits are analyzed to NSS, ISS, and TSSS.

For thermal limit monitoring above 100% rated power or 108% rated core flow, the 100% rated power and the 108% core flow thermal limit values, respectively, shall be used.

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

3. Average Planar Linear Heat Generation Rate

Technical Specification Sections 3.2.1 and 3.4.1

For natural uranium lattices, DLO and SLO MAPLHGR values are provided in Table 3-2.

For all other lattices, lattice-specific MAPLHGR values for DLO and all EOOS conditions are provided in Tables 3-3 through 3-55. During single loop operation, these limits are multiplied by the EOOS SLO multiplier listed in Table 3-1.

Table 3-1: MAPLHGR SLO multiplier
(References 5, 8, and 11)

EOOS Condition	Multiplier
SLO	0.86

Table 3-2: MAPLHGR for Lattices 081 and 089
(References 4, 5, 7, and 10)

All Bundles Lattice 081: Opt2-B0.71 089: Opt2-T0.71	
Average Planar Exposure (MWd/MTU)	**DLO and SLO MAPLHGR (kW/ft)**
0	7.50
75000	7.50

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

Bundle Opt2-4.02-18GZ8.00-14GZ5.50 Lattice 114: Opt2-B4.43-18G8.00	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	8.67
2500	8.85
5000	8.99
7500	9.07
10000	9.11
12000	9.15
15000	9.27
17000	9.40
20000	9.57
22000	9.71
24000	9.76
30000	9.67
36000	9.62
42000	9.48
50000	9.55
60000	9.53
62000	9.57
72000	9.88

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

Bundle Opt2-4.02-18GZ8.00-14GZ5.50 Lattice 115: Opt2-BE4.52-18G8.00	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	8.71
2500	8.87
5000	9.03
7500	9.12
10000	9.17
12000	9.22
15000	9.35
17000	9.49
20000	9.67
22000	9.82
24000	9.84
30000	9.75
36000	9.70
42000	9.56
50000	9.60
60000	9.56
62000	9.60
72000	9.93

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

Bundle Opt2-4.02-18GZ8.00-14GZ5.50 Lattice 116: Opt2-M4.52-18G8.00	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	8.68
2500	8.86
5000	9.01
7500	9.12
10000	9.18
12000	9.23
15000	9.36
17000	9.51
20000	9.69
22000	9.84
24000	9.84
30000	9.74
36000	9.69
42000	9.56
50000	9.58
60000	9.54
62000	9.59
72000	9.93

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

Bundle Opt2-4.02-18GZ8.00-14GZ5.50 Lattice 117: Opt2-ME4.47-18G8.00	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	8.80
2500	8.99
5000	9.14
7500	9.26
10000	9.30
12000	9.38
15000	9.51
17000	9.69
20000	10.00
22000	10.03
24000	10.02
30000	9.94
36000	9.88
42000	9.75
50000	9.70
60000	9.71
62000	9.76
72000	10.19

Table 3-7: MAPLHGR for Lattice 118
(References 10 and 11)

Bundle Opt2-4.02-18GZ8.00-14GZ5.50 Lattice 118: Opt2-T4.47-18G8.00	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	8.85
2500	9.03
5000	9.16
7500	9.23
10000	9.25
12000	9.31
15000	9.45
17000	9.66
20000	10.02
22000	10.01
24000	10.00
30000	9.92
36000	9.87
42000	9.72
50000	9.66
60000	9.68
62000	9.88
72000	10.19

Table 3-8: MAPLHGR for Lattice 119
(References 10 and 11)

Bundles Opt2-4.02-18GZ8.00-14GZ5.50 Opt2-4.03-16GZ8.00-14GZ5.50 Lattice 119: Opt2-T4.50-14G5.50	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	9.64
2500	9.77
5000	9.81
7500	9.74
10000	9.67
12000	9.70
15000	9.95
17000	10.14
20000	10.16
22000	10.15
24000	10.13
30000	10.03
36000	9.97
42000	9.81
50000	9.75
60000	9.76
62000	9.96
72000	10.26

Table 3-9: MAPLHGR for Lattice 120
(References 10 and 11)

Bundle Opt2-4.03-16GZ8.00-14GZ5.50 Lattice 120: Opt2-B4.44-16G8.00	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	8.96
2500	9.11
5000	9.21
7500	9.25
10000	9.25
12000	9.26
15000	9.33
17000	9.44
20000	9.56
22000	9.69
24000	9.78
30000	9.70
36000	9.65
42000	9.52
50000	9.56
60000	9.52
62000	9.70
72000	9.89

Table 3-10: MAPLHGR for Lattice 121
(References 10 and 11)

Bundle Opt2-4.03-16GZ8.00-14GZ5.50 Lattice 121: Opt2-BE4.53-16G8.00	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	9.01
2500	9.15
5000	9.26
7500	9.31
10000	9.31
12000	9.34
15000	9.41
17000	9.53
20000	9.66
22000	9.80
24000	9.86
30000	9.79
36000	9.74
42000	9.60
50000	9.61
60000	9.56
62000	9.74
72000	9.93

Table 3-11: MAPLHGR for Lattice 122
(References 10 and 11)

Bundle Opt2-4.03-16GZ8.00-14GZ5.50 Lattice 122: Opt2-M4.53-16G8.00	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	8.99
2500	9.13
5000	9.25
7500	9.32
10000	9.32
12000	9.35
15000	9.42
17000	9.54
20000	9.67
22000	9.81
24000	9.86
30000	9.78
36000	9.73
42000	9.59
50000	9.57
60000	9.54
62000	9.59
72000	9.94

Table 3-12: MAPLHGR for Lattice 123
(References 10 and 11)

Bundle Opt2-4.03-16GZ8.00-14GZ5.50 Lattice 123: Opt2-ME4.49-16G8.00	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	9.14
2500	9.29
5000	9.40
7500	9.48
10000	9.47
12000	9.52
15000	9.58
17000	9.72
20000	9.98
22000	10.05
24000	10.04
30000	9.98
36000	9.92
42000	9.74
50000	9.69
60000	9.70
62000	9.76
72000	10.19

Table 3-13: MAPLHGR for Lattice 124
(References 10 and 11)

Bundle Opt2-4.03-16GZ8.00-14GZ5.50 Lattice 124: Opt2-T4.49-16G8.00	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	9.18
2500	9.33
5000	9.43
7500	9.45
10000	9.42
12000	9.45
15000	9.52
17000	9.69
20000	9.99
22000	10.03
24000	10.03
30000	9.97
36000	9.91
42000	9.71
50000	9.65
60000	9.67
62000	9.74
72000	10.20

Table 3-14: MAPLHGR for Lattice 125
(References 10 and 11)

Bundle Opt2-4.07-14G5.50-2GZ5.50 Lattice 125: Opt2-B4.48-16G5.50	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	8.92
2500	9.08
5000	9.22
7500	9.30
10000	9.33
12000	9.36
15000	9.48
17000	9.68
20000	9.84
22000	9.89
24000	9.87
30000	9.77
36000	9.71
42000	9.57
50000	9.62
60000	9.60
62000	9.77
72000	9.94

Table 3-15: MAPLHGR for Lattice 126
(References 10 and 11)

Bundle Opt2-4.07-14G5.50-2GZ5.50 Lattice 126: Opt2-BE4.57-16G5.50	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	8.96
2500	9.12
5000	9.28
7500	9.36
10000	9.40
12000	9.44
15000	9.58
17000	9.79
20000	9.96
22000	9.98
24000	9.96
30000	9.86
36000	9.80
42000	9.65
50000	9.70
60000	9.64
62000	9.81
72000	9.99

Table 3-16: MAPLHGR for Lattice 127
(References 10 and 11)

Bundle Opt2-4.07-14G5.50-2GZ5.50 Lattice 127: Opt2-M4.57-16G5.50	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	8.95
2500	9.11
5000	9.27
7500	9.37
10000	9.40
12000	9.45
15000	9.59
17000	9.81
20000	9.97
22000	9.98
24000	9.96
30000	9.86
36000	9.79
42000	9.65
50000	9.67
60000	9.62
62000	9.80
72000	9.99

Table 3-17: MAPLHGR for Lattice 128
(References 10 and 11)

Bundle Opt2-4.07-14G5.50-2GZ5.50 Lattice 128: Opt2-ME4.54-16G5.50	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	9.10
2500	9.27
5000	9.43
7500	9.54
10000	9.55
12000	9.63
15000	9.88
17000	10.13
20000	10.20
22000	10.19
24000	10.16
30000	10.06
36000	9.99
42000	9.85
50000	9.82
60000	9.79
62000	9.99
72000	10.25

Table 3-18: MAPLHGR for Lattice 129
(References 10 and 11)

Bundle Opt2-4.07-14G5.50-2GZ5.50 Lattice 129: Opt2-T4.54-16G5.50	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	9.14
2500	9.30
5000	9.45
7500	9.49
10000	9.51
12000	9.57
15000	9.88
17000	10.14
20000	10.19
22000	10.17
24000	10.15
30000	10.05
36000	9.98
42000	9.84
50000	9.78
60000	9.77
62000	9.96
72000	10.25

Table 3-19: MAPLHGR for Lattice 130
(References 10 and 11)

Bundle Opt2-4.07-14G5.50-2GZ5.50 Lattice 130: Opt2-T4.55-14G5.50	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	9.50
2500	9.62
5000	9.72
7500	9.70
10000	9.65
12000	9.66
15000	9.89
17000	10.12
20000	10.20
22000	10.19
24000	10.17
30000	10.06
36000	10.00
42000	9.84
50000	9.78
60000	9.77
62000	9.97
72000	10.26

Table 3-20: MAPLHGR for Lattice 131
(References 7 and 8)

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	9.12
2500	9.44
5000	9.40
7500	9.33
10000	9.46
12000	9.49
15000	9.54
17000	9.61
20000	9.81
22000	9.89
24000	9.84
30000	9.77
36000	9.72
42000	9.68
50000	9.71
60000	9.82
62000	9.82
64000	9.82
72000	9.93

Table 3-21: MAPLHGR for Lattice 132
(References 7 and 8)

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	9.28
2500	9.56
5000	9.47
7500	9.38
10000	9.53
12000	9.55
15000	9.64
17000	9.73
20000	9.89
22000	10.01
24000	9.94
30000	9.86
36000	9.82
42000	9.75
50000	9.78
60000	9.81
62000	9.87
64000	9.92
72000	9.92

Table 3-22: MAPLHGR for Lattice 133
(References 7 and 8)

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	9.26
2500	9.56
5000	9.53
7500	9.39
10000	9.53
12000	9.59
15000	9.66
17000	9.75
20000	9.97
22000	9.98
24000	9.93
30000	9.86
36000	9.81
42000	9.75
50000	9.76
60000	9.79
62000	9.83
64000	9.86
72000	9.87

Table 3-23: MAPLHGR for Lattice 134
(References 7 and 8)

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	9.39
2500	9.70
5000	9.57
7500	9.50
10000	9.68
12000	9.70
15000	9.81
17000	9.92
20000	10.17
22000	10.16
24000	10.09
30000	10.03
36000	9.96
42000	9.92
50000	9.85
60000	9.88
62000	9.99
64000	10.12
72000	10.29

Table 3-24: MAPLHGR for Lattice 135
(References 7 and 8)

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	9.42
2500	9.68
5000	9.51
7500	9.41
10000	9.51
12000	9.69
15000	9.75
17000	9.93
20000	10.17
22000	10.14
24000	10.09
30000	10.04
36000	9.96
42000	9.92
50000	9.81
60000	9.84
62000	9.96
64000	10.09
72000	10.32

Table 3-25: MAPLHGR for Lattice 136
(References 7 and 8)

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	10.15
2500	10.39
5000	10.24
7500	10.00
10000	10.05
12000	10.08
15000	10.20
17000	10.25
20000	10.24
22000	10.26
24000	10.20
30000	10.14
36000	10.08
42000	9.98
50000	9.87
60000	9.89
62000	10.01
64000	10.14
72000	10.25

Table 3-26: MAPLHGR for Lattice 137
(References 7 and 8)

Bundle Opt2-4.05-16GZ7.50-14GZ5.50 Lattice 137: Opt2-B4.45-16G7.50	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	9.44
2500	9.72
5000	9.70
7500	9.50
10000	9.60
12000	9.64
15000	9.60
17000	9.65
20000	9.79
22000	9.93
24000	9.87
30000	9.81
36000	9.76
42000	9.72
50000	9.74
60000	9.81
62000	9.81
64000	9.80
72000	9.93

Table 3-27: MAPLHGR for Lattice 138
(References 7 and 8)

Bundle Opt2-4.05-16GZ7.50-14GZ5.50 Lattice 138: Opt2-BE4.55-16G7.50	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	9.59
2500	9.82
5000	9.76
7500	9.57
10000	9.66
12000	9.69
15000	9.70
17000	9.75
20000	9.88
22000	10.02
24000	9.97
30000	9.90
36000	9.86
42000	9.79
50000	9.76
60000	9.80
62000	9.86
64000	9.91
72000	9.99

Table 3-28: MAPLHGR for Lattice 139
(References 7 and 8)

Bundle Opt2-4.05-16GZ7.50-14GZ5.50 Lattice 139: Opt2-M4.55-16G7.50	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	9.58
2500	9.83
5000	9.74
7500	9.58
10000	9.68
12000	9.72
15000	9.73
17000	9.77
20000	9.91
22000	10.01
24000	9.96
30000	9.90
36000	9.85
42000	9.78
50000	9.74
60000	9.78
62000	9.82
64000	9.85
72000	9.87

Table 3-29: MAPLHGR for Lattice 140
(References 7 and 8)

Bundle Opt2-4.05-16GZ7.50-14GZ5.50 Lattice 140: Opt2-ME4.51-16G7.50	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	9.73
2500	9.99
5000	9.90
7500	9.75
10000	9.84
12000	9.86
15000	9.87
17000	9.93
20000	10.18
22000	10.18
24000	10.13
30000	10.07
36000	10.02
42000	9.95
50000	9.85
60000	9.86
62000	9.98
64000	10.11
72000	10.27

Table 3-30: MAPLHGR for Lattice 141
(References 7 and 8)

Bundle Opt2-4.05-16GZ7.50-14GZ5.50 Lattice 141: Opt2-T4.51-16G7.50	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	9.76
2500	9.97
5000	9.81
7500	9.70
10000	9.79
12000	9.81
15000	9.83
17000	9.93
20000	10.17
22000	10.16
24000	10.13
30000	10.08
36000	10.00
42000	9.91
50000	9.80
60000	9.82
62000	9.95
64000	10.07
72000	10.35

Table 3-31: MAPLHGR for Lattice 142
(References 7 and 8)

Bundle Opt2-4.05-16GZ7.50-14GZ5.50 Lattice 142: Opt2-T4.52-14G5.50	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	10.15
2500	10.39
5000	10.24
7500	10.01
10000	10.05
12000	10.08
15000	10.20
17000	10.25
20000	10.24
22000	10.26
24000	10.20
30000	10.14
36000	10.08
42000	9.98
50000	9.87
60000	9.89
62000	10.01
64000	10.14
72000	10.25

Table 3-32: MAPLHGR for Lattice 143
(References 7 and 8)

Bundle Opt2-4.10-14G5.50-2GZ5.50 Lattice 143: Opt2-B4.50-16G5.50	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	9.24
2500	9.54
5000	9.47
7500	9.37
10000	9.47
12000	9.52
15000	9.67
17000	9.78
20000	9.95
22000	9.98
24000	9.94
30000	9.85
36000	9.81
42000	9.75
50000	9.77
60000	9.86
62000	9.85
64000	9.83
72000	9.86

Table 3-33: MAPLHGR for Lattice 144
(References 7 and 8)

Bundle Opt2-4.10-14G5.50-2GZ5.50 Lattice 144: Opt2-BE4.60-16G5.50	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	9.29
2500	9.64
5000	9.61
7500	9.61
10000	9.55
12000	9.61
15000	9.79
17000	9.93
20000	10.10
22000	10.10
24000	10.05
30000	9.97
36000	9.92
42000	9.88
50000	9.83
60000	9.86
62000	9.90
64000	9.92
72000	9.82

Table 3-34: MAPLHGR for Lattice 145
(References 7 and 8)

Bundle Opt2-4.10-14G5.50-2GZ5.50 Lattice 145: Opt2-M4.60-16G5.50	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	9.28
2500	9.65
5000	9.65
7500	9.62
10000	9.57
12000	9.63
15000	9.81
17000	9.96
20000	10.13
22000	10.10
24000	10.05
30000	9.97
36000	9.92
42000	9.89
50000	9.81
60000	9.84
62000	9.87
64000	9.90
72000	9.83

Table 3-35: MAPLHGR for Lattice 146
(References 7 and 8)

Bundle Opt2-4.10-14G5.50-2GZ5.50 Lattice 146: Opt2-ME4.57-16G5.50	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	9.44
2500	9.82
5000	9.79
7500	9.70
10000	9.73
12000	9.81
15000	10.08
17000	10.23
20000	10.34
22000	10.28
24000	10.23
30000	10.16
36000	10.10
42000	10.00
50000	9.94
60000	9.93
62000	10.03
64000	10.18
72000	10.31

Table 3-36: MAPLHGR for Lattice 147
(References 7 and 8)

Bundle Opt2-4.10-14G5.50-2GZ5.50 Lattice 147: Opt2-T4.57-16G5.50	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	9.48
2500	9.83
5000	9.80
7500	9.59
10000	9.69
12000	9.77
15000	10.03
17000	10.22
20000	10.27
22000	10.26
24000	10.21
30000	10.15
36000	10.08
42000	10.02
50000	9.90
60000	9.89
62000	10.02
64000	10.12
72000	10.39

Table 3-37: MAPLHGR for Lattice 148
(References 7 and 8)

Bundle Opt2-4.10-14G5.50-2GZ5.50 Lattice 148: Opt2-T4.58-14G5.50	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	9.86
2500	10.16
5000	10.16
7500	9.92
10000	9.87
12000	9.87
15000	10.05
17000	10.19
20000	10.28
22000	10.30
24000	10.24
30000	10.18
36000	10.11
42000	10.02
50000	9.90
60000	9.89
62000	10.01
64000	10.12
72000	10.41

Table 3-38: MAPLHGR for Lattice 149
(References 4 and 5)

Bundle Opt2-4.04-18GZ7.50-14GZ5.50 Lattice 149: Opt2-B4.44-18G7.50	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	9.14
2500	9.45
5000	9.41
7500	9.35
10000	9.48
12000	9.50
15000	9.55
17000	9.62
20000	9.82
22000	9.90
24000	9.85
30000	9.78
36000	9.72
42000	9.68
50000	9.70
60000	9.80
62000	9.85
64000	9.92
72000	10.05
75000	10.05

Table 3-39: MAPLHGR for Lattice 150
(References 4 and 5)

Bundle Opt2-4.04-18GZ7.50-14GZ5.50 Lattice 150: Opt2-BE4.54-18G7.50	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	9.29
2500	9.57
5000	9.48
7500	9.39
10000	9.54
12000	9.56
15000	9.65
17000	9.74
20000	9.90
22000	10.02
24000	9.95
30000	9.86
36000	9.82
42000	9.75
50000	9.77
60000	9.80
62000	9.89
64000	9.95
72000	10.10
75000	10.10

Table 3-40: MAPLHGR for Lattice 151
(References 4 and 5)

Bundle Opt2-4.04-18GZ7.50-14GZ5.50 Lattice 151: Opt2-M4.54-18G7.50	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	9.28
2500	9.57
5000	9.55
7500	9.41
10000	9.54
12000	9.60
15000	9.68
17000	9.76
20000	10.00
22000	9.99
24000	9.93
30000	9.86
36000	9.82
42000	9.74
50000	9.75
60000	9.78
62000	9.87
64000	9.94
72000	10.10
75000	10.10

Table 3-41: MAPLHGR for Lattice 152
(References 4 and 5)

Bundle Opt2-4.04-18GZ7.50-14GZ5.50 Lattice 152: Opt2-ME4.50-18G7.50	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	9.40
2500	9.72
5000	9.58
7500	9.49
10000	9.70
12000	9.72
15000	9.82
17000	9.93
20000	10.19
22000	10.17
24000	10.11
30000	10.03
36000	9.98
42000	9.91
50000	9.83
60000	9.89
62000	9.98
64000	10.11
72000	10.34
75000	10.34

Table 3-42: MAPLHGR for Lattice 153
(References 4 and 5)

Bundle Opt2-4.04-18GZ7.50-14GZ5.50 Lattice 153: Opt2-T4.50-18G7.50	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	9.43
2500	9.70
5000	9.52
7500	9.42
10000	9.52
12000	9.70
15000	9.77
17000	9.94
20000	10.18
22000	10.15
24000	10.10
30000	10.04
36000	9.97
42000	9.92
50000	9.80
60000	9.85
62000	9.95
64000	10.09
72000	10.34
75000	10.34

Table 3-43: MAPLHGR for Lattice 154
(References 4 and 5)

Bundle Opt2-4.04-18GZ7.50-14GZ5.50 Lattice 154: Opt2-T4.52-14G5.50	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	10.17
2500	10.41
5000	10.26
7500	10.02
10000	10.06
12000	10.09
15000	10.22
17000	10.26
20000	10.26
22000	10.28
24000	10.22
30000	10.15
36000	10.09
42000	9.98
50000	9.86
60000	9.91
62000	10.01
64000	10.15
72000	10.40
75000	10.40

Table 3-44: MAPLHGR for Lattice 155
(References 4 and 5)

Bundle Opt2-4.01-16GZ7.50-14GZ5.50 Lattice 155: Opt2-B4.41-16G7.50	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	9.40
2500	9.68
5000	9.63
7500	9.53
10000	9.61
12000	9.54
15000	9.58
17000	9.61
20000	9.78
22000	9.90
24000	9.86
30000	9.81
36000	9.76
42000	9.70
50000	9.69
60000	9.71
62000	9.79
64000	9.88
72000	10.05
75000	10.05

Table 3-45: MAPLHGR for Lattice 156
(References 4 and 5)

Bundle Opt2-4.01-16GZ7.50-14GZ5.50 Lattice 156: Opt2-BE4.51-16G7.50	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	9.58
2500	9.81
5000	9.78
7500	9.60
10000	9.68
12000	9.70
15000	9.71
17000	9.76
20000	9.91
22000	10.00
24000	9.96
30000	9.90
36000	9.86
42000	9.78
50000	9.70
60000	9.70
62000	9.79
64000	9.91
72000	10.09
75000	10.09

Table 3-46: MAPLHGR for Lattice 157
(References 4 and 5)

Bundle Opt2-4.01-16GZ7.50-14GZ5.50 Lattice 157: Opt2-M4.51-16G7.50	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	9.57
2500	9.82
5000	9.87
7500	9.60
10000	9.70
12000	9.74
15000	9.73
17000	9.78
20000	9.92
22000	10.01
24000	9.96
30000	9.89
36000	9.85
42000	9.78
50000	9.68
60000	9.68
62000	9.77
64000	9.91
72000	10.09
75000	10.09

Table 3-47: MAPLHGR for Lattice 158
(References 4 and 5)

Bundle Opt2-4.01-16GZ7.50-14GZ5.50 Lattice 158: Opt2-ME4.46-16G7.50	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	9.72
2500	9.98
5000	9.92
7500	9.77
10000	9.86
12000	9.87
15000	9.88
17000	9.95
20000	10.17
22000	10.18
24000	10.13
30000	10.07
36000	10.01
42000	9.91
50000	9.79
60000	9.84
62000	9.95
64000	10.10
72000	10.34
75000	10.34

Table 3-48: MAPLHGR for Lattice 159
(References 4 and 5)

Bundle Opt2-4.01-16GZ7.50-14GZ5.50 Lattice 159: Opt2-T4.46-16G7.50	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	9.75
2500	9.96
5000	9.83
7500	9.73
10000	9.80
12000	9.80
15000	9.83
17000	9.95
20000	10.16
22000	10.15
24000	10.12
30000	10.08
36000	10.00
42000	9.87
50000	9.76
60000	9.73
62000	9.74
64000	9.79
72000	10.29
75000	10.29

Table 3-49: MAPLHGR for Lattice 160
(References 4 and 5)

Bundle Opt2-4.01-16GZ7.50-14GZ5.50 Lattice 160: Opt2-T4.47-14G5.50	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	10.18
2500	10.39
5000	10.27
7500	10.04
10000	10.01
12000	10.09
15000	10.23
17000	10.24
20000	10.23
22000	10.22
24000	10.19
30000	10.14
36000	10.07
42000	9.94
50000	9.82
60000	9.88
62000	9.99
64000	10.13
72000	10.40
75000	10.40

Table 3-50: MAPLHGR for Lattice 161
(References 4 and 5)

Bundle Opt2-4.10-14G5.50-2GZ5.50 Lattice 161: Opt2-B4.50-16G5.50	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	9.25
2500	9.56
5000	9.49
7500	9.38
10000	9.49
12000	9.53
15000	9.68
17000	9.79
20000	9.96
22000	9.99
24000	9.94
30000	9.87
36000	9.82
42000	9.74
50000	9.76
60000	9.85
62000	9.88
64000	9.97
72000	10.10
75000	10.10

Table 3-51: MAPLHGR for Lattice 162
(References 4 and 5)

Bundle Opt2-4.10-14G5.50-2GZ5.50 Lattice 162: Opt2-BE4.60-16G5.50	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	9.31
2500	9.66
5000	9.62
7500	9.62
10000	9.56
12000	9.62
15000	9.80
17000	9.94
20000	10.13
22000	10.11
24000	10.06
30000	9.98
36000	9.94
42000	9.88
50000	9.83
60000	9.85
62000	9.93
64000	9.99
72000	10.14
75000	10.14

Table 3-52: MAPLHGR for Lattice 163
(References 4 and 5)

Bundle Opt2-4.10-14G5.50-2GZ5.50 Lattice 163: Opt2-M4.60-16G5.50	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	9.30
2500	9.67
5000	9.66
7500	9.63
10000	9.58
12000	9.64
15000	9.82
17000	9.96
20000	10.17
22000	10.12
24000	10.06
30000	9.98
36000	9.94
42000	9.89
50000	9.80
60000	9.82
62000	9.92
64000	9.99
72000	10.15
75000	10.15

Table 3-53: MAPLHGR for Lattice 164
(References 4 and 5)

Bundle Opt2-4.10-14G5.50-2GZ5.50 Lattice 164: Opt2-ME4.57-16G5.50	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	9.46
2500	9.83
5000	9.80
7500	9.71
10000	9.74
12000	9.83
15000	10.09
17000	10.24
20000	10.41
22000	10.29
24000	10.24
30000	10.18
36000	10.11
42000	10.00
50000	9.93
60000	9.95
62000	10.04
64000	10.17
72000	10.39
75000	10.39

Table 3-54: MAPLHGR for Lattice 165
(References 4 and 5)

Bundle Opt2-4.10-14G5.50-2GZ5.50 Lattice 165: Opt2-T4.57-16G5.50	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	9.50
2500	9.85
5000	9.81
7500	9.60
10000	9.70
12000	9.78
15000	10.04
17000	10.24
20000	10.28
22000	10.27
24000	10.23
30000	10.16
36000	10.09
42000	10.02
50000	9.89
60000	9.91
62000	10.01
64000	10.16
72000	10.39
75000	10.39

Table 3-55: MAPLHGR for Lattice 166
(References 4 and 5)

Bundle Opt2-4.10-14G5.50-2GZ5.50 Lattice 166: Opt2-T4.58-14G5.50	
Average Planar Exposure (MWd/MTU)	**DLO MAPLHGR (kW/ft)**
0	9.88
2500	10.18
5000	10.18
7500	9.94
10000	9.87
12000	9.89
15000	10.06
17000	10.20
20000	10.29
22000	10.32
24000	10.26
30000	10.19
36000	10.12
42000	10.02
50000	9.88
60000	9.91
62000	10.01
64000	10.15
72000	10.39
75000	10.39

4. Operating Limit Minimum Critical Power Ratio

Technical Specification Sections 3.2.2, 3.4.1, and 3.7.7

The OLMCPRs for D3C24 were established to protect the SLMCPR during the anticipated operational occurrences. The SLMCPR values for DLO and SLO were determined to be 1.12 and 1.14, respectively (Reference 12).

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% of rated core thermal power, the OLMCPR as a function of core thermal power is shown in Tables 4-8 and 4-9. 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 rated condition OLMCPR limit shown in Tables 4-2 through 4-7 by the applicable OLMCPR multiplier, K(P) given in Tables 4-8 and 4-9.

4.1.2. Flow-Dependent MCPR

Table 4-10 gives the OLMCPR 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 15). Reference 3 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 Nominal Scram Speed 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 on Table 4-1 below.

To utilize the OLMCPR limits for Intermediate Scram Speed 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 on Table 4-1 below.

To utilize the OLMCPR limits for Technical Specification Scram Speed 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 on 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 conservatively be included for calculation of core average scram speed (Reference 3).

Table 4-1: Scram Times
(References 3 and 15)

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

4.3. Recirculation Pump ASD Settings

Technical Requirement Manual 2.1.a.1

Cycle 24 was analyzed with a maximum core flow runout of 110% (Reference 20); therefore the recirculation pump ASD must be set to maintain core flow less than 110% (107.8 Mlb/hr) for all runout events. This value is consistent with the analyses bases described in Reference 3.

Table 4-2 MCPR TSSS Based Operating Limits – NFWT
(References 3 and 6)

EOOS Combination	Cycle Exposure	
	≤ 5040 MWd/MTU	> 5040 MWd/MTU
BASE	1.76	1.79
BASE SLO	1.80	1.83
PLUOOS	1.78	1.82
PLUOOS SLO	1.82	1.86
TBVOOS	1.88	1.88
TBVOOS SLO	1.92	1.92
TCV SLOW CLOSURE	1.85	1.86
TCV SLOW CLOSURE SLO	1.89	1.90
TCV STUCK CLOSED	1.76	1.79
TCV STUCK CLOSED SLO	1.80	1.83

Table 4-3 MCPR TSSS Based Operating Limits – FWTR
(References 3 and 6)

EOOS Combination	Cycle Exposure	
	≤ 5040 MWd/MTU	> 5040 MWd/MTU
BASE	1.76	1.79
BASE SLO	1.80	1.83
PLUOOS	1.78	1.82
PLUOOS SLO	1.82	1.86
TBVOOS	1.90	1.90
TBVOOS SLO	1.94	1.94
TCV SLOW CLOSURE	1.85	1.86
TCV SLOW CLOSURE SLO	1.89	1.90
TCV STUCK CLOSED	1.76	1.79
TCV STUCK CLOSED SLO	1.80	1.83

Table 4-4 MCPR ISS Based Operating Limits – NFWT
(References 3 and 6)

EOOS Combination	Cycle Exposure	
	≤ 5040 MWd/MTU	> 5040 MWd/MTU
BASE	1.48	1.52
BASE SLO	1.51	1.55
PLUOOS	1.54	1.58
PLUOOS SLO	1.57	1.61
TBVOOS	1.59	1.64
TBVOOS SLO	1.62	1.67
TCV SLOW CLOSURE	1.57	1.60
TCV SLOW CLOSURE SLO	1.60	1.63
TCV STUCK CLOSED	1.48	1.52
TCV STUCK CLOSED SLO	1.51	1.55

Table 4-5 MCPR ISS Based Operating Limits – FWTR
(References 3 and 6)

EOOS Combination	Cycle Exposure	
	≤ 5040 MWd/MTU	> 5040 MWd/MTU
BASE	1.52	1.53
BASE SLO	1.55	1.56
PLUOOS	1.54	1.58
PLUOOS SLO	1.57	1.61
TBVOOS	1.64	1.67
TBVOOS SLO	1.67	1.70
TCV SLOW CLOSURE	1.57	1.60
TCV SLOW CLOSURE SLO	1.60	1.63
TCV STUCK CLOSED	1.52	1.53
TCV STUCK CLOSED SLO	1.55	1.56

Table 4-6 MCPR NSS Based Operating Limits – NFWT
(References 3 and 6)

EOOS Combination	Cycle Exposure	
	≤ 5040 MWd/MTU	> 5040 MWd/MTU
BASE	1.45	1.47
BASE SLO	1.48	1.50
PLUOOS	1.52	1.54
PLUOOS SLO	1.55	1.57
TBVOOS	1.58	1.60
TBVOOS SLO	1.61	1.63
TCV SLOW CLOSURE	1.54	1.57
TCV SLOW CLOSURE SLO	1.57	1.60
TCV STUCK CLOSED	1.45	1.47
TCV STUCK CLOSED SLO	1.48	1.50

Table 4-7 MCPR NSS Based Operating Limits – FWTR
(References 3 and 6)

EOOS Combination	Cycle Exposure	
	≤ 5040 MWd/MTU	> 5040 MWd/MTU
BASE	1.51	1.52
BASE SLO	1.54	1.55
PLUOOS	1.52	1.54
PLUOOS SLO	1.55	1.57
TBVOOS	1.62	1.64
TBVOOS SLO	1.65	1.67
TCV SLOW CLOSURE	1.54	1.57
TCV SLOW CLOSURE SLO	1.57	1.60
TCV STUCK CLOSED	1.51	1.52
TCV STUCK CLOSED SLO	1.54	1.55

Table 4-8 MCPR(P) – NFWT
(Reference 3)

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	2.99	2.41	2.10	1.32	1.19	1.12	1.04	1.00
	> 60	3.22	2.72	2.45					
Base SLO	≤ 60	3.06	2.46	2.14	1.32	1.19	1.12	1.04	1.00
	> 60	3.27	2.77	2.50					
PLUOOS	≤ 60	2.99	2.41	2.10	1.56	1.45	1.31	1.06	1.00
	> 60	3.22	2.72	2.45					
PLUOOS SLO	≤ 60	3.06	2.46	2.14	1.56	1.45	1.31	1.06	1.00
	> 60	3.27	2.77	2.50					
TBVOOS	≤ 60	4.36	3.10	2.42	1.32	1.19	1.12	1.04	1.00
	> 60	4.44	3.42	2.87					
TBVOOS SLO	≤ 60	4.44	3.16	2.47	1.32	1.19	1.12	1.04	1.00
	> 60	4.53	3.49	2.93					
TCV Slow Closure	≤ 60	2.99	2.41	2.10	1.56	1.45	1.31	1.06	1.00
	> 60	3.22	2.72	2.45					
TCV Slow Closure SLO	≤ 60	3.06	2.46	2.14	1.56	1.45	1.31	1.06	1.00
	> 60	3.27	2.77	2.50					
TCV Stuck Closed	≤ 60	2.99	2.41	2.10	1.32	1.19	1.12	1.04	1.00
	> 60	3.22	2.72	2.45					
TCV Stuck Closed SLO	≤ 60	3.06	2.46	2.14	1.32	1.19	1.12	1.04	1.00
	> 60	3.27	2.77	2.50					

Table 4-9 MCPR(P) – FWTR
(Reference 3)

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	2.99	2.41	2.10	1.37	1.22	1.14	1.05	1.00
	> 60	3.22	2.72	2.45					
Base SLO	≤ 60	3.06	2.46	2.14	1.37	1.22	1.14	1.05	1.00
	> 60	3.27	2.77	2.50					
PLUOOS	≤ 60	2.99	2.41	2.10	1.56	1.45	1.31	1.06	1.00
	> 60	3.22	2.72	2.45					
PLUOOS SLO	≤ 60	3.06	2.46	2.14	1.56	1.45	1.31	1.06	1.00
	> 60	3.27	2.77	2.50					
TBVOOS	≤ 60	4.72	3.29	2.52	1.37	1.22	1.14	1.05	1.00
	> 60	4.44	3.42	2.96					
TBVOOS SLO	≤ 60	4.80	3.35	2.57	1.37	1.22	1.14	1.05	1.00
	> 60	4.53	3.49	3.02					
TCV Slow Closure	≤ 60	2.99	2.41	2.10	1.56	1.45	1.31	1.06	1.00
	> 60	3.22	2.72	2.45					
TCV Slow Closure SLO	≤ 60	3.06	2.46	2.14	1.56	1.45	1.31	1.06	1.00
	> 60	3.27	2.77	2.50					
TCV Stuck Closed	≤ 60	2.99	2.41	2.10	1.37	1.22	1.14	1.05	1.00
	> 60	3.22	2.72	2.45					
TCV Stuck Closed SLO	≤ 60	3.06	2.46	2.14	1.37	1.22	1.14	1.05	1.00
	> 60	3.27	2.77	2.50					

Table 4-10 MCPR(F)
(Reference 3)

Flow (% of 98 Mlb/hr)	DLO MCPR(F)	SLO MCPR(F)
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 for the Optima2 fuel is established in terms of the maximum LHGR as a function of rod nodal exposure. The limits in Table 5-1 apply to bundle lattices that do not require Gadolinia set down penalties. The limits in Tables 5-2 through 5-10 apply to bundle lattices that require Gadolinia set down penalties. The limits in Table 5-11 apply to natural U blankets in lattices 81 and 89.

The LHGR limit is the product of the exposure dependent LHGR limit from Table 5-1 through Table 5-11 as appropriate and the minimum of: the power dependent LHGR Factor (LHGRFAC(P), or the flow-dependent LHGR Factor, LHGRFAC(F). The LHGRFAC(P) is determined from Table 5-12. The LHGRFAC(F) is determined from Table 5-13, and is applicable for DLO and SLO and for all Base Case and EOOS conditions.

Table 5-1 LHGR Limits for Lattices 116, 118, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 137, 138, 139, 143, 144, 145, 146, 147, 148, 155, 156, 157, 161, 162, 163, 164, 165, 166
(Reference 4, 7, 10, 22, 23, 24)

Rod Nodal Exposure (GWd/MTU)	LHGR Limit (kW/ft)
0.00	13.72
14.00	13.11
23.00	12.22
57.00	8.87
62.00	8.38
75.00	3.43

Table 5-2 LHGR Limits for Lattices 114, 115
(References 10, 23)

Rod Nodal Exposure (GWd/MTU)	LHGR Limit (kW/ft)
0.000	13.72
14.000	13.11
21.000	12.41
21.001	12.29
23.000	12.09
24.000	12.00
24.001	12.12
57.000	8.87
62.000	8.38
75.000	3.43

Table 5-3 LHGR Limits for Lattice 117
(References 10, 23)

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	11.97
28.000	11.49
28.001	11.72
57.000	8.87
62.000	8.38
75.000	3.43

Table 5-4 LHGR Limits for Lattice 119
(References 10, 23)

Rod Nodal Exposure (GWd/MTU)	LHGR Limit (kW/ft)
0.000	13.72
14.000	13.11
17.000	12.81
17.001	12.42
23.000	11.85
46.000	9.65
46.001	9.95
57.000	8.87
62.000	8.38
75.000	3.43

Table 5-5 LHGR Limits for Lattices 135, 141
(References 7, 24)

Rod Nodal Exposure (GWd/MTU)	LHGR Limit (kW/ft)
0.000	13.72
14.000	13.11
23.000	12.22
23.001	12.09
32.000	11.21
32.001	11.33
57.000	8.87
62.000	8.38
75.000	3.43

Table 5-6 LHGR Limits for Lattices 131, 132, 133, 136, 140, 142
(References 7, 24)

Rod Nodal Exposure (GWd/MTU)	LHGR Limit (kW/ft)
0.000	13.72
14.000	13.11
15.000	13.01
15.001	12.75
23.000	11.97
46.000	9.75
46.001	9.95
57.000	8.87
62.000	8.38
75.000	3.43

Table 5-7 LHGR Limits for Lattice 134
(References 7, 24)

Rod Nodal Exposure (GWd/MTU)	LHGR Limit (kW/ft)
0.000	13.72
14.000	13.11
15.000	13.01
15.001	12.61
23.000	11.85
33.000	10.89
33.001	11.23
57.000	8.87
62.000	8.38
75.000	3.43

Table 5-8 LHGR Limits for Lattices 153, 159
(Reference 4, 22)

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 5-9 LHGR Limits for Lattices 149, 150, 151, 154, 158, 160
(Reference 4, 22)

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 5-10 LHGR Limits for Lattice 152
(Reference 4, 22)

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 5-11: LHGR Limit for lattices 81, 89
(References 3, 4, 7, 10)

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 5-12: LHGRFAC(P) Multipliers
(Reference 3)

EOOS Combination	Core Thermal Power (% of rated)							
	0	25	≤ 38.5	> 38.5	50	60	80	100
Base	0.47	0.62	0.70	0.72	0.79	0.81	0.85	1.00
Base SLO	0.47	0.62	0.70	0.72	0.79	0.81	0.85	1.00
PLUOOS	0.47	0.62	0.70	0.70	0.74	0.80	0.83	1.00
PLUOOS SLO	0.47	0.62	0.70	0.70	0.74	0.80	0.83	1.00
TBVOOS	0.29	0.45	0.52	0.68	0.74	0.74	0.77	1.00
TBVOOS SLO	0.29	0.45	0.52	0.68	0.74	0.74	0.77	1.00
TCV Slow Closure	0.47	0.62	0.70	0.70	0.74	0.80	0.83	1.00
TCV Slow Closure SLO	0.47	0.62	0.70	0.70	0.74	0.80	0.83	1.00
TCV Stuck Closed	0.47	0.62	0.70	0.72	0.79	0.81	0.85	1.00
TCV Stuck Closed SLO	0.47	0.62	0.70	0.72	0.79	0.81	0.85	1.00

Table 5-13: LHGRFAC(F) Multipliers
(Reference 3)

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 in Table 6-1:

Table 6-1 Rod Block Monitor Upscale Instrumentation Setpoints
(Reference 17)

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%

The setpoint may be lower/higher and will still comply with the RWE analysis because RWE is analyzed unblocked (Reference 20).

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

7. Stability Protection Setpoints

Technical Specifications Section 3.3.1.3

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

Table 7-1 OPRM PBDA Trip Settings
(Reference 3)

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 3).

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 equipment out-of-service are as described in Table 8-1:

Table 8-1 Modes of Operation
(Reference 3)

EOOS Options	Thermal Limit Sets
Base	Base (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 (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 Stuck Closed and to the combination of one TCV and one TSV stuck closed in the same line.

** EOOS condition TCV Stuck Closed 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), and coastdown subject to the power restrictions in Table 8-2 (Reference 3). Either EOC must be reached or coastdown must begin prior to exceeding 7357 MWd/MTU (Reference 6). The combined exposure of D3C24 and D3C24A full power operation to EOFPL+25 EFPD is 16117 MWd/MTU (Reference 3). The licensing analysis remains valid down to a coastdown power level of 55% of rated thermal power given all burnup limits are satisfied per Methodology 4 (Reference 25). 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 16) provided the requirements for utilizing SUBTIP methodology are met as clarified in Reference 19.
    b. Up to 50% of the LPRMs OOS (Reference 16)
    c. An LPRM calibration frequency of up to 2500 EFPH (2000 EFPH + 25%) (Reference 16)

2. Nominal FWT results are valid for application within a +10°F/-30°F temperature band around the nominal FWT curve (Reference 20) and within the operating steam dome pressure region (Reference 20). The FWTR results are valid for the minimum FWT curve (Reference 20). 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 for cycle operation through EOC subject to the restriction in Reference 21 for feedwater temperature reductions of greater than 100°F. The restriction requires that for a FWT reduction greater than 100F, operation needs to be restricted to less than the 100% load line. For a feedwater temperature reduction of between 30°F and 120°F the FWTR limits should be applied.

3. All analyses support the fastest Turbine Bypass Valve (assumed to be #1) OOS, with the remaining 8 TBVs meeting the assumed opening profile for a turbine trip in Reference 14. The analyses also support Turbine Bypass flow of 29.8% of vessel rated steam flow, equivalent to one TBV OOS (or partially closed TBVs equivalent to one closed TBV), if the assumed opening profile for the remaining TBVs is met. If the opening profile is **NOT** met, or if the TBV system **CANNOT** pass an equivalent of 29.8% of vessel rated steam flow, utilize the TBVOOS condition.

4. 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 turbine bypass valves are available for pressure control (Reference 3).

5. A single MSIV may be taken OOS (shut) under any of the specified OOS options as long as core thermal power is maintained ≤ 75% of 2957 MWth (Reference 3).

Table 8-2 Core Thermal Power Restriction for OOS Conditions
(Reference 3)

EOOS Condition	Core Thermal Power (% of Rated Power)
One TCV Stuck Closed *, PCOOS and one TCV Stuck Closed*, PLUOOS and one TCV Stuck Closed*	≤ 75**

* Also applicable to one TSV stuck closed or one TCV and TSV stuck closed in the same line (Reference 3).
** 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 3.

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. Removed
2. NEDE-24011-P-A-15 (Revision 15), "General Electric Standard Application for Reactor Fuel (GESTAR)," September 2005.
3. GE Topical Report, NEDO-32465-A, "Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology for Reload Applications," August 1996.
4. Westinghouse Topical Report CENPD-300-P-A, "Reference Safety Report for Boiling Water Reactor Reload Fuel," July 1996.
5. Westinghouse Report WCAP-16081-P-A, "10x10 SVEA Fuel Critical Power Experiments and CPR Correlation: SVEA-96 Optima2," March 2005.
6. Westinghouse Report WCAP-15682-P-A, "Westinghouse BWR ECCS Evaluation Model: Supplement 2 to Code Description, Qualification and Application," April 2003.
7. Westinghouse Report WCAP-16078-P-A, "Westinghouse BWR ECCS Evaluation Model: Supplement 3 to Code Description, Qualification and Application to SVEA-96 Optima2 Fuel," November 2004.
8. Westinghouse Topical Report WCAP-15836-P-A, "Fuel Rod Design Methods for Boiling Water Reactors – Supplement 1," April 2006.
9. Westinghouse Topical Report WCAP-15942-P-A, "Fuel Assembly Mechanical Design Methodology for Boiling Water Reactors Supplement 1 to CENP-287-P-A," March 2006.
10. Westinghouse Topical Report CENPD-390-P-A, "The Advanced PHOENIX and POLCA Codes for Nuclear Design of Boiling Water Reactors," December 2000.
11. Westinghouse Report WCAP-16081-P-A, Addendum 1-A, Revision 0, "SVEA-96 Optima2 CPR Correlation (D4): High and Low Flow Applications," March 2009.
12. Westinghouse Report WCAP-16081-P-A, Addendum 2-A, Revision 0, "SVEA-96 Optima2 CPR Correlation (D4): Modified R-factors for Part-Length Rods," February 2009.

10. References

1. Exelon Generation Company, LLC, Docket No. 50-249, Dresden Nuclear Power Station, Unit 3, Facility Operating License, License No. DPR-25.

2. Removed.

3. Westinghouse Report NF-BEX-14-94, "Dresden Nuclear Power Station Unit 3 Cycle 24 Reload Licensing Report", September 2014, Attachment to Westinghouse Letter NF-BEX-14-105, Rev. 0, "Transmittal of NF-BEX-14-94 Revision 0, 'Dresden Nuclear Power Station Unit 3 Cycle 24 Reload Licensing Report'", September 11, 2014. (Available in EDMS Nuclear Fuels Reference Folders)

4. Westinghouse Letter NF-BEX-14-50 "Bundle Design Report for Dresden 3 Cycle 24", April 8, 2014. (Available in EDMS Nuclear Fuels Reference Folders)

5. Westinghouse Report NF-BEX-14-77-NP Revision 0, "Dresden Nuclear Power Station Unit 3 Cycle 24 MAPLHGR Report", September 2014, Attachment to Westinghouse Letter NF-BEX-14-107, Rev. 0, "Dresden Nuclear Power Station Unit 3 Cycle 24 Final MAPLHGR Report Transmittal," September 11, 2014. (Available in EDMS Nuclear Fuels Reference Folders)

6. Exelon TODI NF151397 Revision 0, "Dresden 3 Cycle 24 Contingency Core Loadings for Mid-Cycle Outage Efforts", 9/15/2015.

7. Westinghouse Letter NF-BEX-12-66 "Bundle Design Report for Dresden 3 Cycle 23," April 11, 2012. (Available in EDMS NF Reference Folders)

8. Westinghouse Report NF-BEX-12-100-NP Revision 1, "Dresden Nuclear Power Station Unit 3 Cycle 23 MAPLHGR Report", May 2015, Attachment to Westinghouse Letter LTR-TLA-15-034, Rev. 0, "Dresden Nuclear Power Station Transmittal of Dresden 3 MAPLHGR Reports Updated for Revised TMOL," May 29, 2015. (Available in EDMS NF Reference Folders)

9. Removed

10. Westinghouse Letter NF-BEX-10-57, "Transmittal of Bundle Design Report for Dresden 3 Cycle 22," April 23, 2010. (Attachment 3 to FCP 377653)

11. Westinghouse Report NF-BEX-10-80-NP Revision 1, "Dresden Nuclear Power Station Unit 3 Cycle 22 MAPLHGR Report", May 2015, Attachment to Westinghouse Letter LTR-TLA-15-034 Rev. 0, "Dresden Nuclear Power Station Transmittal of Dresden 3 MAPLHGR Reports Updated for Revised TMOL," May 29, 2015. (Available in EDMS NF Reference Folders)

12. Westinghouse Letter NF-BEX-14-66, "Safety Limit MCPR for Dresden Unit 3 Cycle 24," May 21, 2014. (Available in EDMS Nuclear Fuels Reference Folders)

13. Removed

14. Exelon TODI Ops Ltr 14-09, Revision 1, "OPL-W Parameters for Dresden Unit 3 Cycle 24 Transient Analysis," May 8, 2014. (Available in EDMS)

15. Exelon Technical Specifications for Dresden 2 and 3, Table 3.1.4-1, "Control Rod Scram Times."

16. Exelon Engineering Evaluation, EC 357691-000, "EVALUATION OF APPROPRIATE UNCERTAINTIES FOR USE BY WESTINGHOUSE IN SAFETY LIMIT MCPR ANALYSES", November 28, 2005.

17. Exelon Design Analysis GE DRF C51-00217-01, "Instrument Setpoint Calculation Nuclear Instrumentation Rod Block Monitor," July 30, 2012.

18. Westinghouse Document BTD 09-0311, Revision 1, "Westinghouse CMS – Operation guidelines for Dresden and Quad Cities plants," July 20, 2009. (Available in EDMS Nuclear Fuels Reference Folders)

19. FANP Letter, NJC:04:031/FAB04-496, "Startup with TIP Equipment Out of Service," April 20, 2004. (Exelon EC 348897-000)

20. Westinghouse Report NF-BEX-14-89, Revision 0, "Dresden Nuclear Power Station Unit 3 Cycle 24 Reload Engineering Report", September 2014, Attachment to Westinghouse Letter NF-BEX-14-103, Rev. 0, "Transmittal of NF-BEX-14-89 Revision 0, 'Dresden Nuclear Power Station Unit 3 Cycle 24 Reload Engineering Report'," September 8, 2014. (Available in EDMS Nuclear Fuels Reference Folders)

21. 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. (Available in EDMS)

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