LIMITING CONDITIONS FOR OPERATION

3.11 REACTOR FUEL ASSEMBLIES

Applicability:

The Limiting Conditions for Operation associated with the fuel rods apply to these parameters which monitor the fuel rod operating conditions.

Objective:

The Objective of the Limiting Conditions for Operation is to assure the performance of the fuel rods.

Specifications:

A. Average Planar Linear Heat Generation Rate (APLHGR)

During steady state power operation, the APLHGR for each type of fuel as a function of average planar exposure shall not exceed the limiting values shown in Tables 3.11-1A through J. For single recirculation loop operation, the limiting values shall be the values from Tables 3.11-1B through E and Table 3.11-1G through J listed under the heading "Single Loop Operation." These values are obtained by multiplying the values for two loop operation by 0.83. If at any time during steady-steate operation it is determined by normal surveillance that the limiting value for APLHGR is being exceeded, action shall be initiated within 15 minutes to restore operation to within the prescribed

SURVEILLANCE REQUIREMENTS

4.11 REACTOR FUEL ASSEMBLIES

Applicability:

The Surveillance Requirements apply to the parameters which monitor the fuel rod operating conditions.

Objective:

The Objective of the Surveillance Requirements is to specify the type and frequency of surveillance to be applied to the fuel rods.

Specifications:

A. Average Planar Linear Heat Generation Rate (APLHGR)

The APLHGR for each type of fuel as a function of average planar exposure shall be determined daily during reactor operation at ≥25% rated thermal power.

LIMITING CONDITIONS FOR OPERATION

limits. If the APLHGR isnot returned to within prescribed limits within two (2) hours, the reactor shall be brought to the shutdown conditions within 36 hours. Surveillance and corresponding action shall continue until reactor operation is within the prescribed limits.

B. Linear Heat Generation Rate (LHGR)

During steady state power operation, the linear heat generation rate (LHGR) of any rod in any fuel assembly at any axial location shall not exceed the maximum allowable LHGR specified in Table 1.

If at any time during steady state operation it is determined by normal surveillance that the limiting value for LHGR is being exceeded, action shall be initiated within 15 minutes to restore operation to within the prescribed limits. If the LHGR is not returned to within the prescribed limits within two (2) hours, the reactor shall be brought to shutdown condition within 36 hours. Surveillance and corresponding action shall continue until reactor operation is within the prescribed limits.

SURVEILLANCE REQUIREMENTS

B. Linear Heat Generation Rate (LHGR)

The LHGR as a function of core height shall be checked daily during reactor operation at $\geq$25% rated thermal power.

C. Minimum Critical Power Ratio

MCPR shall be determined daily during reactor power operation at $\geq$25% rated thermal power and following any change in power level or distribution that would cause operation with a limiting control rod pattern as described in the bases for Specification 3.3.B.6.

Table 1

SIGNIFICANT INPUT PARAMETERS TO THE
LOSS-OF-COOLANT ACCIDENT ANALYSIS

Plant Parameters:

Core Thermal Power	1664 MWt, which corre ponds to 105% of rated steam flow
Vessel Steam Output	6.75×10^6 lbm/h, which corresponds to 105% of rated steam flow
Vessel Steam Dome Pressure	1055 psia
Recirculation Line Break Area for Large Breaks - Discharge	2.26 ft^2 (DBA)
- Suction	4.14 ft^2
Number of Drilled Bundles	220

Fuel Parameters:

	Fuel Type	Fuel Bundle Geometry	Peak Technical Specification Linear Heat Generation Rate (kW/ft)	Design Axial Peaking Factor	Initial Minimum Critical Power Ratio*
A.	7D230	7 x 7	18.5	1.4	1.2
B.	8D219	8 x 8	13.4	1.4	1.2
C.	8D274L	8 x 8	13.4	1.4	1.2
D.	8D274H	8 x 8	13.4	1.4	1.2
E.	8D274 (High Gd)	8 x 8	13.4	1.4	1.2
F.	LTA	8 x 8	13.4	1.4	1.2
G.	8DPB289 & P8DPB289	8 x 8	13.4	1.4	1.2
H.	BP8DRB299	8 x 8	13.4	1.4	1.2
I.	BD324B	8 x 8EB	14.4	1.4	1.2
J.	BD326B	8 x 8EB	14.4	1.4	1.2

* To account for the 2% uncertainty in bundle power required by Appendix K, the SCAT calculation is performed with an MCPR of 1.18 (i.e., 1.2 divided by 1.02) for a bundle with an initial MCPR of 1.20.

TABLE 3.11-1I

MAPLHGR Versus Average Planar Exposure

Plant: Vermont Yankee

Fuel Type: BD324B

Average Planar Exposure (MWd/t)	MAPLHGR (kW/ft) for Two Loop Operation			
	Majority Lattice	Shutdown Margin Zone	Power Peaking Zone	Natural Ends
200.0	11.76	11.24	11.71	11.50
1,000.0	11.90	11.42	11.83	11.30
2,000.0	12.05	11.61	11.96	11.28
3,000.0	12.21	11.85	12.15	11.33
5,000.0	12.51	12.17	12.40	11.47
7,000.0	12.63	12.54	12.63	11.61
10,000.0	12.80	12.80	12.80	11.72
14,400.0	12.80	12.80	12.80	11.15
15,000.0	12.75	12.74	12.74	11.07
20,000.0	12.07	12.05	12.06	10.29
25,000.0	11.41	11.39	11.40	9.50
35,000.0	10.14	10.12	10.12	7.93
43,360.0	8.80	8.[illegible]	8.74	4.66
50,000.0	6.08	5.99	6.02	-

Source: NEDO-21697, August 1977 (Revised)

Average Planar Exposure (MWd/t)	MAPLHGR (kW/ft) for Single Loop Operation*			
	Majority Lattice	Shutdown Margin Zone	Power Peaking Zone	Natural Ends
200.0	9.76	9.32	9.71	9.54
1,000.0	9.87	9.47	9.81	9.37
2,000.0	10.00	9.63	9.92	9.36
3,000.0	10.13	9.83	10.08	9.40
5,000.0	10.38	10.10	10.29	9.52
7,000.0	10.48	10.40	10.48	9.63
10,000.0	10.62	10.62	10.62	9.72
14,400.0	10.62	10.62	10.62	9.25
15,000.0	10.58	10.57	10.57	9.18
20,000.0	10.01	10.00	10.00	8.54
25,000.0	9.47	9.45	9.46	7.88
35,000.0	8.41	8.39	8.39	6.58
43,360.0	7.30	7.24	7.25	3.86
50,000.0	5.04	4.97	4.99	-

* MAPLHGR for single loop operation is obtained by multiplying MAPLHGR for two loop operation by 0.83.

TABLE 3.11-1J

MAPLHGR Versus Average Planar Exposure

Plant: Vermont Yankee Fuel Type: BD326B

Average Planar Exposure (MWd/t)	MAPLHGR (kW/ft) for Two Loop Operation			
	Majority Lattice	Shutdown Margin Zone	Power Peaking Zone	Natural Ends
200.0	11.80	11.35	11.76	11.50
1,000.0	11.86	11.42	11.79	11.30
2,000.0	11.97	11.56	11.88	11.28
3,000.0	12.10	11.74	11.99	11.33
5,000.0	12.48	12.16	12.33	11.47
7,000.0	12.69	12.66	12.69	11.61
10,000.0	12.90	12.90	12.90	11.72
14,400.0	12.90	12.90	12.90	11.15
15,000.0	12.84	12.82	12.82	11.07
20,000.0	12.14	12.12	12.12	10.29
25,000.0	11.46	11.44	11.45	9.50
35,000.0	10.17	10.15	10.16	7.93
43,360.0	8.94	8.87	8.91	4.66
50,000.0	6.25	6.17	6.22	-

Source: NEDO-21697, August 1977 (Revised)

Average Planar Exposure (MWd/t)	MAPLHGR (kW/ft) for Single Loop Operation*			
	Majority Lattice	Shutdown Margin Zone	Power Peaking Zone	Natural Ends
200.0	9.79	9.42	9.76	9.54
1,000.0	9.84	9.47	9.78	9.37
2,000.0	9.93	9.59	9.86	9.36
3,000.0	10.04	9.74	9.95	9.40
5,000.0	10.35	10.09	10.23	9.52
7,000.0	10.53	10.50	10.53	9.63
10,000.0	10.70	10.70	10.70	9.72
14,400.0	10.70	10.70	10.70	9.25
15,000.0	10.65	10.64	10.64	9.18
20,000.0	10.07	10.05	10.05	8.54
25,000.0	9.51	9.49	9.50	7.88
35,000.0	8.44	8.42	8.43	6.58
43,360.0	7.42	7.36	7.39	3.86
50,000.0	5.18	5.12	5.16	-

* MAPLHGR for single loop operation is obtained by multiplying MAPLHGR for two loop operation by 0.83.

5.5 Spent and New Fuel Storage

A. The new fuel storage facility shall be such that the effective multiplication factor (K_{eff}) of the fuel when dry is less than 0.90 and when flooded is less than 0.95.

B. The K_{eff} of the fuel in the spent fuel storage pool shall be less than or equal to 0.95.

C. Spent fuel storage racks may be moved (only) in accordance with written procedures which ensure that no rack modules are moved over fuel assemblies.

D. The number of spent fuel assemblies stored in the spent fuel pool shall not exceed 2,000.

E. The maximum core geometry infinite lattice multiplication factor of any segment of the fuel assembly stored in the spent fuel storage pool or the new fuel storage facility shall be less than or equal to 1.31 at 20°C.

ATTACHMENT A

New Fuel Assembly Descriptions and the Technical Basis of Their APLHGR Limits

For the purpose of NRC review, the two new fuel types proposed for insertion into Vermont Yankee are described in general terms in this attachment. These assemblies are specific designs of the generic GE8x8EB design described in Reference (b) and approved by the NRC. The specific lattice descriptions (enrichment and gadolinium distribution, water rods placement, and axial zone location) are contained in the vendor proprietary document: "Supplement 1 to Loss-of-Coolant Accident Analysis Report for Vermont Yankee Nuclear Power Station," NEDE-21697, Supplement 1, dated November 1987. Upon request, the latter will be provided, under separate cover letter, to be handled as proprietary information in accordance with 10CFR2.790.

Fuel Description

Each of the proposed new fuel types contains an enriched middle portion with short natural uranium ends at both the top and bottom of the assembly. The latter are called "Natural Ends" in the Technical Specification change. The enriched middle portion of the assembly is broken down into three distinct lattices which have the same enrichment distribution, but differ by number and w/o of gadolinium pins. These are called zones. There is a "Power Peaking Zone" near the bottom of the lattice. This is designed with a higher w/o gadolinium to control the peaking of the predominently bottom peaked BWR. The "Shutdown Margin Zone" is near the top of each assembly. It contains additional, part-length, gadolinium pins to control the flux peak near the top of the reactor when the reactor is in the cold shutdown condition. The remainder of the assembly is called the "Majority Lattice" in the Technical Specification change.

Technical Basis of APLHGR Limits

The specific lattices must be taken into account in the calculation of APLHGR limits because the limit consists of two components: 1) the ECCS limit, or LOCA limit, for the assembly as a whole, and 2) the thermal-mechanical (T-M) limit which is a unique function of the local peaking factor of each lattice; that is, each axial zone. For a given lattice, the T-M and ECCS limits may take turns at being more limiting. Thus, the final APLHGR limits are unique to each lattice or axial zone of the assembly and consist of the most limiting of either the ECCS or T-M MAPLHGR at each given exposure point.

The ECCS, or LOCA limits are presented in Table 1 for each of the assembly types. Also shown, at each exposure statepoint, are the calculated peak cladding temperature (PCT) and local oxidation fraction. These values were transmitted in Reference (i) and calculated using the NRC-approved methods described in Reference (c).

The T-M limits are derived by dividing the LHGR limiting duty curve by an appropriate local peaking factor. The limiting duty curve varies with exposure; the local peaking factor varies with the lattice type (zone) and exposure. Therefore, each zone has a T-M MAPLHGR, defined as a function of exposure. The T-M MAPLHGRs for each lattice were transmitted in Reference (j).

Generation of APLHGR Limits

Both the ECCS and T-M limits were used to derive the APLHGR limits using the more limiting, i.e., the lesser of either the T-M or ECCS MAPLHGR values at each exposure statepoint. Because the ECCS limits were specifically calculated at fewer exposure statepoints, the intermediate statepoints were calculated by means of linear interpolation between the ECCS calculated statepoints. The final APLHGR limit resides at, or below, any interpolated data as well.

For each lattice, this "auctioneering" process of deriving the APLHGR limit is shown in the following:

Table	Fuel Type	Lattice (Axial Zone)
2A	BD234B	Natural Ends
2B	BD234B	Majority Lattice
2C	BD234B	Shutdown Margin Zone
2D	BD234B	Power Peaking Zone
3A	BD236B	Natural Ends
3B	BD236B	Majority Lattice
3C	BD236B	Shutdown Margin Zone
3D	BD236B	Power Peaking Zone

For any given table, the ECCS and T-M limits are supplied directly from References (i) and (j), respectively. Where data is missing from the references, an interpolated value has been supplied. The middle column shows the minimum of either the ECCS or T-M limits. The next column shows the Technical Specification proposed change APLHGR limits. These are at or below the minimum of either the ECCS or T-M limits. This is conservative. Notice that the Technical Specification limits are not supplied at every exposure statepoint. This is because of process computer limitations. To demonstrate conservatism at the missing exposure statepoints, the interpolated value for the Technical Specification limits are supplied. The last column is the APLHGR limit for single loop operation. It is derived by multiplying the normal APLHGR limits by 0.83. For conservatism, the results of this calculation are truncated to two decimal places.

Please notice that the exposure on the natural ends data does not extend beyond 43,360 MWd/St. Thus, the natural ends are not validated for exposure beyond this point. Because of their high neutron leakage, low power locations, the natural ends are not expected to approach this exposure limit.

TABLE 1

LOCA Analysis Results for Proposed Vermont Yankee New Fuel Types

A. ECCS Based MAPLHGR Table for Bundle Type BD234B

Exposure (MWd/St)	MAPLHGR (KW/Ft)	PCT (DEG-F)	Local Oxidation (Fraction)
200	11.76	1995.	0.042
1,000	11.90	2015.	0.045
5,000	12.53	2115.	0.062
10,000	12.80	2198.	0.080
15,000	12.80	2198.	0.080
20,000	12.25	2106.	0.060
25,000	11.60	2013.	0.044
35,000	10.60	1854.	0.023
45,000	9.40	1692.	0.005
50,000	8.40	1591.	0.003

B. ECCS Based MAPLHGR Table for Bundle Type BD236B

Exposure (MWd/St)	MAPLHGR (KW/Ft)	PCT (DEG-F)	Local Oxidation (Fraction)
200	11.80	2050.	0.052
1,000	11.86	2059.	0.054
5,000	12.55	2145.	0.069
10,000	12.90	2197.	0.079
15,000	12.90	2192.	0.078
20,000	12.30	2095.	0.058
25,000	11.70	2008.	0.042
35,000	10.60	1850.	0.022
45,000	9.50	1690.	0.005
50,000	8.40	1592.	0.003

TABLE 2A

Derivation of APLHGR Limits for BD324B Fuel, Natural Ends Zone

Exposure Statepoint (MWd/St)	ECCS (LOCA) Limit (Ref. (i)) (Kw/ft)	Thermo-Mech. Limit (Ref. (j)) (Kw/ft)	Minimum of T-M or ECCS Limit (Kw/ft)	Tech. Spec. APLHGR Limit (Kw/ft)	Single Loop APLHGR Limit (Kw/ft)
0.0	(11.7250)	11.57	11.5700	(11.5500)	–
200.0	11.76	11.50	11.5000	11.50	9.54
1,000.0	11.90	11.30	11.3000	11.30	9.37
2,000.0	(12.0575)	11.28	11.2800	11.28	9.36
3,000.0	(12.2150)	11.33	11.3300	11.33	9.40
4,000.0	(12.3725)	11.40	11.4000	(11.4000)	–
5,000.0	12.53	11.48	11.4800	11.47	9.52
6,000.0	(12.5840)	11.55	11.5500	(11.5400)	–
7,000.0	(12.6380)	11.61	11.6100	11.61	9.63
8,000.0	(12.6920)	11.66	11.6600	(11.6467)	–
9,000.0	(12.7460)	11.69	11.6900	(11.6833)	–
10,000.0	12.80	11.72	11.7200	11.72	9.72
12,500.0	(12.8000)	11.44	11.4400	(11.3961)	–
14,400.0	(12.8000)	(11.1588)	11.1588	11.15	9.25
15,000.0	12.80	11.07	11.0700	11.07	9.18
20,000.0	12.25	10.29	10.2900	10.29	8.54
25,000.0	11.60	9.50	9.5000	9.50	7.88
35,000.0	10.60	7.93	7.9300	7.93	6.58
43,360.0	(9.5968)	4.66	4.6600	4.66	3.86
45,000.0	9.40	N/A	–	–	–
50,000.0	8.40	N/A	–	–	–

N/A Not analyzed beyond this exposure statepoint.

( ) Parentheses denote linearly interpolated value.

TABLE 2B

Derivation of APLHGR Limits for BD324B Fuel, Majority Lattice Zone

Exposure Statepoint (MWd/St)	ECCS (LOCA) Limit (Ref. (i)) (Kw/ft)	Thermo-Mech. Limit (Ref. (j)) (Kw/ft)	Minimum of T-M or ECCS Limit (Kw/ft)	Tech. Spec. APLHGR Limit (Kw/ft)	Single Loop APLHGR Limit (Kw/ft)
0.0	(11.7250)	11.73	11.7250	(11.7250)	-
200.0	11.76	11.78	11.7600	11.76	9.76
1,000.0	11.90	11.90	11.9000	11.90	9.87
2,000.0	(12.0575)	12.08	12.0575	12.05	10.00
3,000.0	(12.2150)	12.24	12.2150	12.21	10.13
4,000.0	(12.3725)	12.37	12.3700	(12.3600)	-
5,000.0	12.53	12.51	12.5100	12.51	10.38
6,000.0	(12.5840)	12.65	12.5840	(12.5700)	-
7,000.0	(12.6380)	12.79	12.6380	12.63	10.48
8,000.0	(12.6920)	12.95	12.6920	(12.6867)	-
9,000.0	(12.7460)	13.11	12.7460	(12.7433)	-
10,000.0	12.80	13.19	12.8000	12.80	10.62
12,500.0	(12.8000)	13.09	12.8000	(12.8000)	-
14,400.0	(12.8000)	(12.8316)	12.8000	12.80	10.62
15,000.0	12.80	12.75	12.7500	12.75	10.58
20,000.0	12.25	12.07	12.0700	12.07	10.01
25,000.0	11.60	11.41	11.4100	11.41	9.47
35,000.0	10.60	10.14	10.1400	10.14	8.41
43,360.0	(9.5968)	(8.8024)	8.8024	8.80	7.30
45,000.0	9.40	8.54	8.5400	(8.1282)	-
50,000.0	8.40	6.08	6.0800	6.08	5.04

( ) Parentheses denote linearly interpolated value.

TABLE 2C

Derivation of APLHGR Limits for BD324B Fuel, Shutdown Margin Zone

Exposure Statepoint (MWd/St)	ECCS (LOCA) Limit (Ref. (i)) (Kw/ft)	Thermo-Mech. Limit (Ref. (j)) (Kw/ft)	Minimum of T-M or ECCS Limit (Kw/ft)	Tech. Spec. APLHGR Limit (Kw/ft)	Single Loop APLHGR Limit (Kw/ft)
0.0	(11.7250)	11.20	11.2000	(11.1950)	–
200.0	11.76	11.27	11.2700	11.24	9.32
1,000.0	11.90	11.42	11.4200	11.42	9.47
2,000.0	(12.0575)	11.61	11.6100	11.61	9.63
3,000.0	(12.2150)	11.85	11.8500	11.85	9.83
4,000.0	(12.3725)	12.01	12.0100	(12.0100)	–
5,000.0	12.53	12.18	12.1800	12.17	10.10
6,000.0	(12.5840)	12.36	12.3600	(12.3550)	–
7,000.0	(12.6380)	12.54	12.5400	12.54	10.40
8,000.0	(12.6920)	12.74	12.6920	(12.6267)	–
9,000.0	(12.7460)	12.95	12.7460	(12.7133)	–
10,000.0	12.80	13.12	12.8000	12.80	10.62
12,500.0	(12.8000)	13.06	12.8000	(12.8000)	–
14,400.0	(12.8000)	(12.8168)	12.8000	12.80	10.62
15,000.0	12.80	12.74	12.7400	12.74	10.57
20,000.0	12.25	12.05	12.0500	12.05	10.00
25,000.0	11.60	11.39	11.3900	11.39	9.45
35,000.0	10.60	10.12	10.1200	10.12	8.39
43,360.0	(9.5968)	(8.7322)	8.7322	8.73	7.24
45,000.0	9.40	8.46	8.4600	(8.0533)	–
50,000.0	8.40	5.99	5.9900	5.99	4.97

( ) Parentheses denote linearly interpolated value.

TABLE 2D

Derivation of APLHGR Limits for BD324B Fuel, Power Peaking Zone

Exposure Statepoint (MWd/St)	ECCS (LOCA) Limit (Ref. (i)) (Kw/ft)	Thermo-Mech. Limit (Ref. (j)) (Kw/ft)	Minimum of T-M or ECCS Limit (Kw/ft)	Tech. Spec. APLHGR Limit (Kw/ft)	Single Loop APLHGR Limit (Kw/ft)
0.0	(11.7250)	11.68	11.6800	(11.6800)	–
200.0	11.76	11.73	11.7300	11.71	9.71
1,000.0	11.90	11.83	11.8300	11.83	9.81
2,000.0	(12.0575)	11.96	11.9600	11.96	9.92
3,000.0	(12.2150)	12.15	12.1500	12.15	10.08
4,000.0	(12.3725)	12.28	12.2800	(12.2750)	–
5,000.0	12.53	12.40	12.4000	12.40	10.29
6,000.0	(12.5840)	12.53	12.5300	(12.5150)	–
7,000.0	(12.6380)	12.66	12.6380	12.63	10.48
8,000.0	(12.6920)	12.79	12.6920	(12.6867)	–
9,000.0	(12.7460)	12.92	12.7460	(12.7433)	–
10,000.0	12.80	13.07	12.8000	12.80	10.62
12,500.0	(12.8000)	13.06	12.8000	(12.8000)	–
14,400.0	(12.8000)	(12.8168)	12.8000	12.80	10.62
15,000.0	12.80	12.74	12.7400	12.74	10.57
20,000.0	12.25	12.06	12.0600	12.06	10.00
25,000.0	11.60	11.40	11.4000	11.40	9.46
35,000.0	10.60	10.12	10.1200	10.12	8.39
43,360.0	(9.5968)	(8.7490)	8.7490	8.74	7.25
45,000.0	9.40	8.48	8.4800	(8.0682)	–
50,000.0	8.40	6.02	6.0200	6.02	4.99

( ) Parentheses denote linearly interpolated value.

TABLE 3A

Derivation of APLHGR Limits for BD326B Fuel, Natural Ends Zone

Exposure Statepoint (MWd/St)	ECCS (LOCA) Limit (Ref. (i)) (Kw/ft)	Thermo-Mech. Limit (Ref. (j)) (Kw/ft)	Minimum of T-M or ECCS Limit (Kw/ft)	Tech. Spec. APLHGR Limit (Kw/ft)	Single Loop APLHGR Limit (Kw/ft)
0.0	(11.7850)	11.57	11.5500	(11.5500)	–
200.0	11.80	11.50	11.5000	11.50	9.54
1,000.0	11.86	11.30	11.3000	11.30	9.37
2,000.0	(12.0325)	11.28	11.2800	11.28	9.36
3,000.0	(12.2050)	11.33	11.3300	11.33	9.40
4,000.0	(12.3775)	11.40	11.4000	(11.4000)	–
5,000.0	12.55	11.48	11.4800	11.47	9.52
6,000.0	(12.6200)	11.55	11.5500	(11.5400)	–
7,000.0	(12.6900)	11.61	11.6100	11.61	9.63
8,000.0	(12.7600)	11.66	11.6600	(11.6467)	–
9,000.0	(12.8300)	11.69	11.6900	(11.6833)	–
10,000.0	12.90	11.72	11.7200	11.72	9.72
12,500.0	(12.9000)	11.44	11.4400	(11.3961)	–
14,400.0	(12.9000)	(11.1588)	11.1588	11.15	9.25
15,000.0	12.90	11.07	11.0700	11.07	9.18
20,000.0	12.30	10.29	10.2900	10.29	8.54
25,000.0	11.70	9.50	9.5000	9.50	7.88
35,000.0	10.60	7.93	7.9300	7.93	6.58
43,360.0	(9.6804)	4.66	4.6600	4.66	3.86
45,000.0	9.50	N/A	–	–	–
50,000.0	8.40	N/A	–	–	–

N/A Not analyzed beyond this exposure statepoint.

( ) Parentheses denote linearly interpolated value.

TABLE 3B

Derivation of APLHGR Limits for BD326B Fuel, Majority Lattice Zone

Exposure Statepoint (MWd/St)	ECCS (LOCA) Limit (Ref. (i)) (Kw/ft)	Thermo-Mech. Limit (Ref. (j)) (Kw/ft)	Minimum of T-M or ECCS Limit (Kw/ft)	Tech. Spec. APLHGR Limit (Kw/ft)	Single Loop APLHGR Limit (Kw/ft)
0.0	(11.7850)	11.82	11.7850	(11.7850)	–
200.0	11.80	11.81	11.8000	11.80	9.79
1,000.0	11.86	11.86	11.8600	11.86	9.84
2,000.0	(12.0325)	11.97	11.9700	11.97	9.93
3,000.0	(12.2050)	12.12	12.1200	12.10	10.04
4,000.0	(12.3775)	12.29	12.2900	(12.2900)	–
5,000.0	12.55	12.49	12.4900	12.48	10.35
6,000.0	(12.6200)	12.69	12.6200	(12.5850)	–
7,000.0	(12.6900)	12.91	12.6900	12.69	10.53
8,000.0	(12.7600)	13.13	12.7600	(12.7600)	–
9,000.0	(12.8300)	13.22	12.8300	(12.8300)	–
10,000.0	12.90	13.25	12.9000	12.90	10.70
12,500.0	(12.9000)	13.19	12.9000	(12.9000)	–
14,400.0	(12.9000)	(12.9240)	12.9000	12.90	10.70
15,000.0	12.90	12.84	12.8400	12.84	10.65
20,000.0	12.30	12.14	12.1400	12.14	10.07
25,000.0	11.70	11.46	11.4600	11.46	9.51
35,000.0	10.60	10.17	10.1700	10.17	8.44
43,360.0	(9.6804)	(8.9494)	8.9494	8.94	7.42
45,000.0	9.50	8.71	8.7100	(8.2756)	–
50,000.0	8.40	6.25	6.2500	6.25	5.18

( ) Parentheses denote linearly interpolated value.

TABLE 3C

Derivation of APLHGR Limits for BD326B Fuel, Shutdown Margin Zone

Exposure Statepoint (MWd/St)	ECCS (LOCA) Limit (Ref. (i)) (Kw/ft)	Thermo-Mech. Limit (Ref. (j)) (Kw/ft)	Minimum of T-M or ECCS Limit (Kw/ft)	Tech. Spec. APLHGR Limit (Kw/ft)	Single Loop APLHGR Limit (Kw/ft)
0.0	(11.7850)	11.35	11.3500	(11.3325)	–
200.0	11.80	11.36	11.3600	11.35	9.42
1,000.0	11.86	11.42	11.4200	11.42	9.47
2,000.0	(12.0325)	11.56	11.5600	11.56	9.59
3,000.0	(12.2050)	11.74	11.7400	11.74	9.74
4,000.0	(12.3775)	11.95	11.9500	(11.9500)	–
5,000.0	12.55	12.17	12.1700	12.16	10.09
6,000.0	(12.6200)	12.41	12.4100	(12.4100)	–
7,000.0	(12.6900)	12.67	12.6700	12.66	10.50
8,000.0	(12.7600)	12.93	12.7600	(12.7400)	–
9,000.0	(12.8300)	13.13	12.8300	(12.8200)	–
10,000.0	12.90	13.18	12.9000	12.90	10.70
12,500.0	(12.9000)	13.16	12.9000	(12.9000)	–
14,400.0	(12.9000)	(12.9016)	12.9000	12.90	10.70
15,000.0	12.90	12.82	12.8200	12.82	10.64
20,000.0	12.30	12.12	12.1200	12.12	10.05
25,000.0	11.70	11.44	11.4400	11.44	9.49
35,000.0	10.60	10.15	10.1500	10.15	8.42
43,360.0	(9.6804)	(8.8793)	8.8793	8.87	7.36
45,000.0	9.50	8.63	8.6300	(8.2031)	–
50,000.0	8.40	6.17	6.1700	6.17	5.12

( ) Parentheses denote linearly interpolated value.

TABLE 3D

Derivation of APLHGR Limits for BD326B Fuel, Power Peaking Zone

Exposure Statepoint (MWd/St)	ECCS (LOCA) Limit (Ref. (i)) (Kw/ft)	Thermo-Mech. Limit (Ref. (j)) (Kw/ft)	Minimum of T-M or ECCS Limit (Kw/ft)	Tech. Spec. APLHGR Limit (Kw/ft)	Single Loop APLHGR Limit (Kw/ft)
0.0	(11.7850)	11.77	11.7700	(11.7525)	–
200.0	11.80	11.76	11.7600	11.76	9.76
1,000.0	11.86	11.79	11.7900	11.79	9.78
2,000.0	(12.0325)	11.88	11.8800	11.88	9.86
3,000.0	(12.2050)	12.01	12.0100	11.99	9.95
4,000.0	(12.3775)	12.16	12.1600	(12.1600)	–
5,000.0	12.55	12.33	12.3300	12.33	10.23
6,000.0	(12.6200)	12.51	12.5100	(12.5100)	–
7,000.0	(12.6900)	12.71	12.6900	12.69	10.53
8,000.0	(12.7600)	12.91	12.7600	(12.7600)	–
9,000.0	(12.8300)	13.12	12.8300	(12.8300)	–
10,000.0	12.90	13.21	12.9000	12.90	10.70
12,500.0	(12.9000)	13.16	12.9000	(12.9000)	–
14,400.0	(12.9000)	(12.9016)	12.9000	12.90	10.70
15,000.0	12.90	12.82	12.8200	12.82	10.64
20,000.0	12.30	12.12	12.1200	12.12	10.05
25,000.0	11.70	11.45	11.4500	11.45	9.50
35,000.0	10.60	10.16	10.1600	10.16	8.43
43,360.0	(9.6804)	(8.9144)	8.9144	8.91	7.39
45,000.0	9.50	8.67	8.6700	(8.2456)	–
50,000.0	8.40	6.22	6.2200	6.22	5.16

( ) Parentheses denote linearly interpolated value.