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**REVISED CORE OPERATING LIMITS REPORT - CYCLE 12  
HOPE CREEK GENERATING STATION  
FACILITY OPERATING LICENSE NPF-57  
DOCKET NO. 50-354**

In accordance with section 6.9.1.9 of the Hope Creek Technical Specifications, PSEG Nuclear LLC submits Revision 1 of the Core Operating Limits Report (COLR) for Hope Creek Cycle 12 (NFS-0226, Rev. 1) in Attachment 1 to this letter.

Should you have any questions, please contact Mr. Paul Duke at (856) 339-1466.

Sincerely,

A handwritten signature in black ink, appearing to read "S. Mannon", written over a horizontal line.

S. Mannon  
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Attachment

A001

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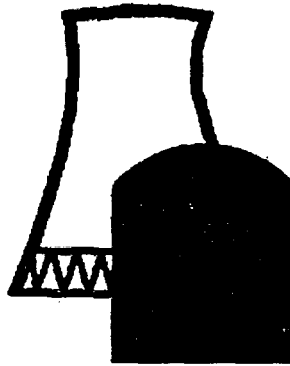
**NFS-0226, Rev. 1**

**Hope Creek Generating Station**

**Core Operating Limits Report**

**Cycle 12/ Reload 11**

**Effective Date:** 10/22/03



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## 1.0 INTRODUCTION

The purpose of this report is to provide the Core Operating Limits for Hope Creek Generation Station Unit 1 Cycle 12/ Reload 11 operation. In addition, this report will provide cycle information on single recirculation loop operation, nominal scram speed and determination of the Core Maximum Fraction of Limiting Power Density. Finally, this report also provides a reference to the most recent revision of the implemented approved methodology. The limits presented here correspond to the core thermal limits for Average Planar Linear Heat Generation Rate (APLHGR), Minimum Critical Power Ratio (MCPR), Power dependent MCPR ( $MCPR_p$ ), Flow dependent MCPR ( $MCPR_f$ ) and Linear Heat Generation Rate (LHGR).

These operating limit values have been determined using NRC approved methods contained in the Reference Safety Report for Boiling Water Reactor Reload Fuel [1], CENPD-300-P-A (Revision 0), and GESTAR-II [5], NEDE-24011-P-A (Revision 13) and are established such that all applicable fuel thermal-mechanical, core thermal-hydraulic, ECCS, and nuclear limits such as shutdown margin, and transient and accident analysis limits are met.

Hope Creek Technical Specifications Section 3.2 references this report as the source for certain LIMITING CONDITIONS FOR OPERATION. These are included in section 2 of this document. Hope Creek Technical Specification 6.9.1.9 also requires that this report, including any mid cycle revisions, shall be provided, upon issuance, to the NRC.

In addition, the operating limit LCO values or Related Reload Licensing Analysis Information in section 2.2 MINIMUM CRITICAL POWER RATIO also include a conservative penalty to account for the potential effects of a condition being evaluated or pending resolution through a corrective action program. The conservative penalty is associated with a degraded condition within the control rod drive system, which results in rod withdrawal speeds in excess of the design specification for the system. This degraded condition is documented in corrective action order number 70033715.

This document is specific to Hope Creek Generating Station Unit 1 Cycle 12 / Reload 11 and shall not be applicable to any other core or cycle design. The thermal limits contained in this report are applicable whether the Crossflow™ correction factor is applied or not applied. This report is applicable for Cycle 12 operation from the date of issuance through the end of effective full power capability or a cycle exposure of 13324MWd/MTU, whichever occurs first [2]. End of effective full power capability is reached when 100% rated power can no longer be maintained by increasing core flow (up to 105% of rated core flow), at rated feedwater temperatures, in the all-rods-out configuration.



## **2.0 TECHNICAL SPECIFICATIONS THAT REFERENCE THE COLR**

The TECHNICAL SPECIFICATIONS THAT REFERENCE THE COLR presented in this section are referenced by the Hope Creek Technical Specifications.

<b><u>Tech. Spec.</u></b>	<b><u>Title</u></b>
2.1	Safety Limit Bases
3/4.2.1	Average Planar Linear Generation Rate
3/4.2.3	Minimum Critical Power Ratio
3/4.2.4	Linear Heat Generation Rate
3/4.4.1	Recirculation System Recirculation Loops
3/4.2b	Power Distribution Bases
3/4.2.1b	Average Planar Linear Heat Generation Rate
6.9.1.9	Administrative Controls, Core Operating Limits Report

## **2.1 AVERAGE PLANAR LINEAR HEAT GENERATION RATE**

### **LIMITING CONDITION FOR OPERATION:**

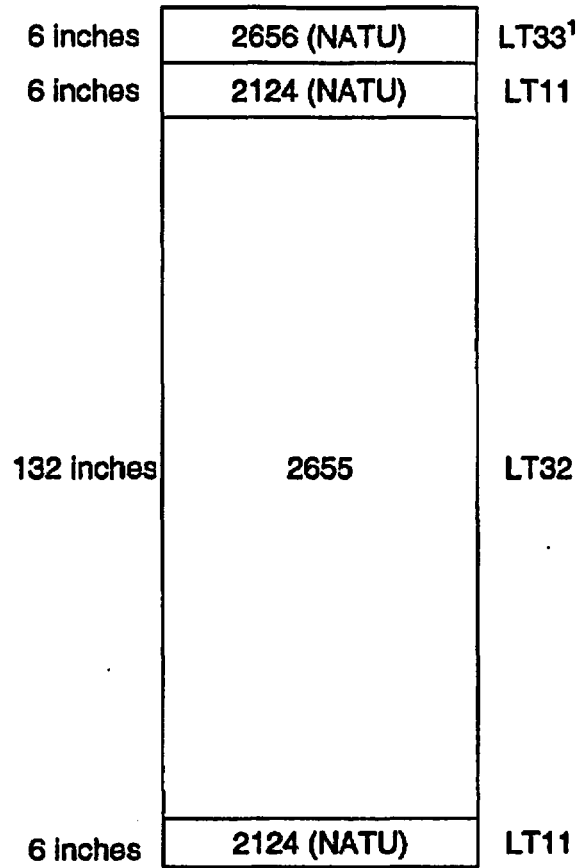
All AVERAGE PLANAR LINEAR HEAT GENERATION RATES (APLHGRs) for each type of fuel as a function of AVERAGE PLANAR EXPOSURE shall not exceed the limits specified in Table 2.1-1, Table 2.1-3, Table 2.1-5, Table 2.1-7, Table 2.1-9, Table 2.1-11 and Table 2.1-13.

When the Technical Specification Section 3/4.4.1 ACTION statement a.1.d is entered from that section's LCO, reduce the Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) limit to a value specified in Table 2.1-2, Table 2.1-4, Table 2.1-6, Table 2.1-8, Table 2.1-10, Table 2.1-12 and Table 2.1-14.

When hand calculations are required, all AVERAGE PLANAR LINEAR HEAT GENERATION RATES (APLHGRs) for each type of fuel as a function of AVERAGE EXPOSURE shall not exceed the limits specified in Figures 2.1-2, 2.1-4, 2.1-6, 2.1-8, 2.1-10, 2.1-12 and 2.1-14.

#### **NOTE**

Figures 2.1-2, 2.1-4, 2.1-6, 2.1-8, 2.1-10, 2.1-12 and 2.1-14 graphically represent the limiting column of Tables 2.1-1 through 2.1-14.



NATU = Natural Uranium Lattices, which are not included in the determination of the most limiting lattice APLHGR values.

1. These lattice designators (prefixed with LT) are used in the Core Monitoring System.

Figure 2.1-1: Lattice Definitions for Fuel Bundle HF09  
(Reference 6)

Table 2.1-1: APLHGR Data for Fuel Bundle HF09  
(Two Recirculation Loop Operation)

Lattice Exposure		Lattice APLHGR Limit (Kw/ft) <sup>1</sup>			
GWD/STU	MWD/MTU	#2124	#2655	#2656	Limiting
0.00	0.0	11.89	11.87	11.89	11.87
0.20	220.5	11.92	11.91	11.92	11.91
1.00	1102.3	12.05	12.03	12.05	12.03
2.00	2204.6	12.27	12.21	12.27	12.21
3.00	3306.9	12.34	12.40	12.49	12.40
4.00	4409.2	12.37	12.62	12.69	12.62
5.00	5511.5	12.40	12.85	12.73	12.85
6.00	6613.8	12.43	13.01	12.76	13.01
7.00	7716.1	12.46	13.15	12.79	13.15
8.00	8818.4	12.48	13.30	12.81	13.30
9.00	9920.7	12.50	13.43	12.83	13.43
10.00	11023.0	12.52	13.50	12.85	13.50
12.50	13778.8	12.36	13.49	12.73	13.49
15.00	16534.5	11.98	13.17	12.34	13.17
20.00	22046.0	11.20	12.54	11.56	12.54
25.00	27557.5	10.42	11.75	10.78	11.75
35.00	38580.5	8.87	10.30	9.23	10.30
45.00	49603.5	6.00	9.03	6.76	9.03
46.61	51378.2	5.18	8.29		8.29
47.85	52745.1		7.71	5.31	7.71
52.05	57374.7		5.77		5.77

1. See Figure 2.1-1 for the Lattice Definitions for this fuel assembly.

Table 2.1-2: APLHGR Data for Fuel Bundle HF09  
(Single Recirculation Loop Operation)

Lattice Exposure		Lattice APLHGR Limit (Kw/ft) <sup>1</sup>			
GWD/STU	MWD/MTU	#2124	#2655	#2656	Limiting
0.00	0.0	10.23	10.21	10.23	10.21
0.20	220.5	10.25	10.24	10.25	10.24
1.00	1102.3	10.36	10.35	10.36	10.35
2.00	2204.6	10.55	10.50	10.55	10.50
3.00	3306.9	10.61	10.66	10.74	10.66
4.00	4409.2	10.64	10.85	10.91	10.85
5.00	5511.5	10.66	11.05	10.95	11.05
6.00	6613.8	10.69	11.19	10.97	11.19
7.00	7716.1	10.72	11.31	11.00	11.31
8.00	8818.4	10.73	11.44	11.02	11.44
9.00	9920.7	10.75	11.55	11.03	11.55
10.00	11023.0	10.77	11.61	11.05	11.61
12.50	13778.8	10.63	11.60	10.95	11.60
15.00	16534.5	10.30	11.33	10.61	11.33
20.00	22046.0	9.63	10.78	9.94	10.78
25.00	27557.5	8.96	10.11	9.27	10.11
35.00	38580.5	7.63	8.86	7.94	8.86
45.00	49603.5	5.16	7.77	5.81	7.77
46.61	51378.2	4.45	7.13		7.13
47.85	52745.1		6.63	4.57	6.63
52.05	57374.7		4.96		4.96

1. See Figure 2.1-1 for the Lattice Definitions for this fuel assembly.

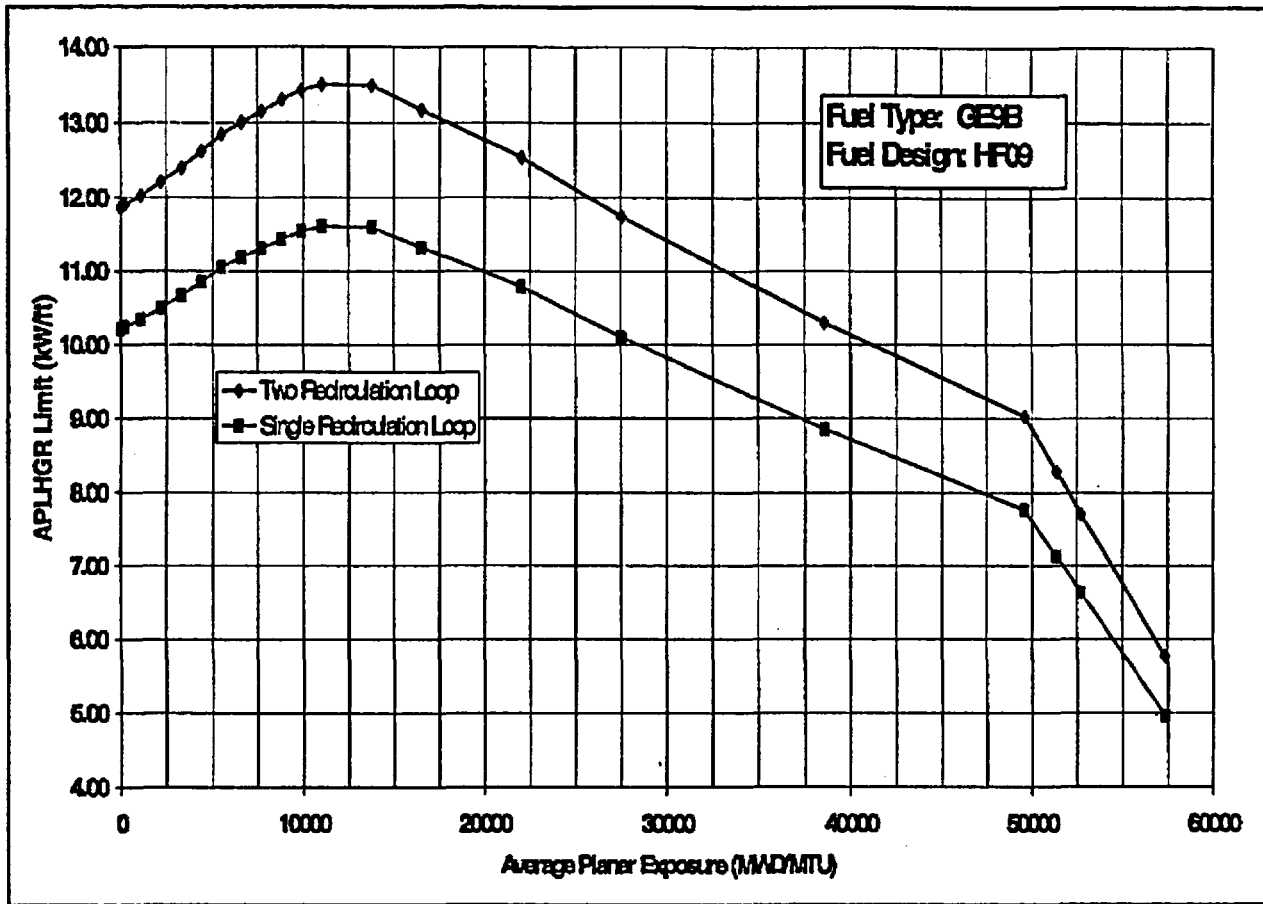
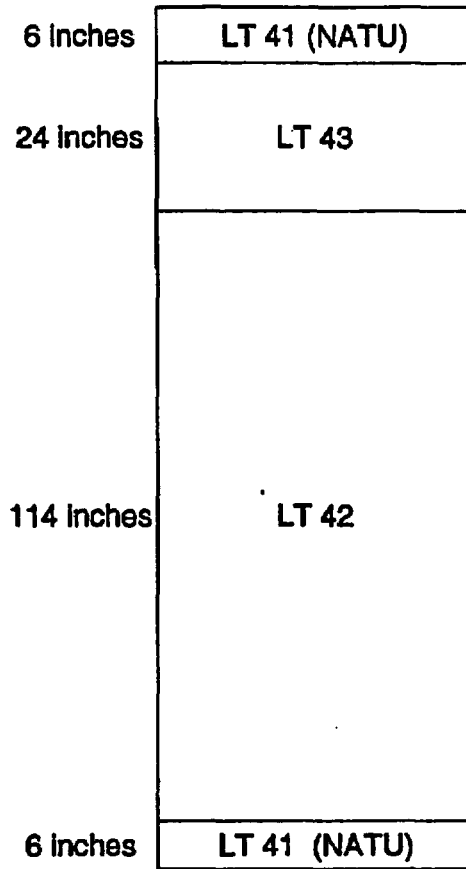


Figure 2.1-2: APLHGR Limit for Fuel Bundle HF09



NATU = Natural Uranium Lattices, which are not included in the determination of the most limiting lattice APLHGR values.

1. These lattice designators (prefixed with LT) are used in the Core Monitoring System.

Figure 2.1-3: Lattice Definitions for Fuel Bundle PA10

(Reference 7)

Table 2.1-3: APLHGR Data for Fuel Bundle PA10  
(Two Recirculation Loop Operation)

Exposure MWD/MTU	Lattice APLHGR Limit (Kw/ft) <sup>1</sup>		
	LT 41, 42	LT 43	Limiting
0	9.1	9.1	9.1
350	9.1	9.1	9.1
1000	9.2	9.2	9.2
7000	-----	9.2	9.2
9500	9.2	8.9	8.9
10000	9.1	-----	8.9
14000	8.5	8.5	8.5
18000	8.0	8.0	8.0
22000	7.6	7.6	7.6
24000	7.7	7.7	7.7
26000	8.4	8.4	8.4
28000	8.4	8.4	8.4
34000	8.4	8.4	8.4
42000	8.4	8.4	8.4
52000	8.2	8.2	8.2
54000	8.1	8.1	8.1
59000	7.9	7.9	7.9

1. See Figure 2.1-3 for the Lattice Definitions for this fuel assembly.



Table 2.1-4: APLHGR Data for Fuel Bundle PA10  
(Single Recirculation Loop Operation)

Exposure MWD/MTU	Lattice APLHGR Limit (Kw/ft) <sup>1</sup>		
	LT 41, 42	LT 43	Limiting
0	8.2	8.2	8.2
350	8.2	8.2	8.2
1000	8.3	8.3	8.3
7000	-----	8.3	8.3
9500	8.3	8.0	8.0
10000	8.2	----	8.0
14000	7.7	7.7	7.7
18000	7.2	7.2	7.2
22000	6.8	6.8	6.8
24000	6.9	6.9	6.9
26000	7.6	7.6	7.6
28000	7.6	7.6	7.6
34000	7.6	7.6	7.6
42000	7.6	7.6	7.6
52000	7.4	7.4	7.4
54000	7.3	7.3	7.3
59000	7.1	7.1	7.1

1. See Figure 2.1-3 for the Lattice Definitions for this fuel assembly.

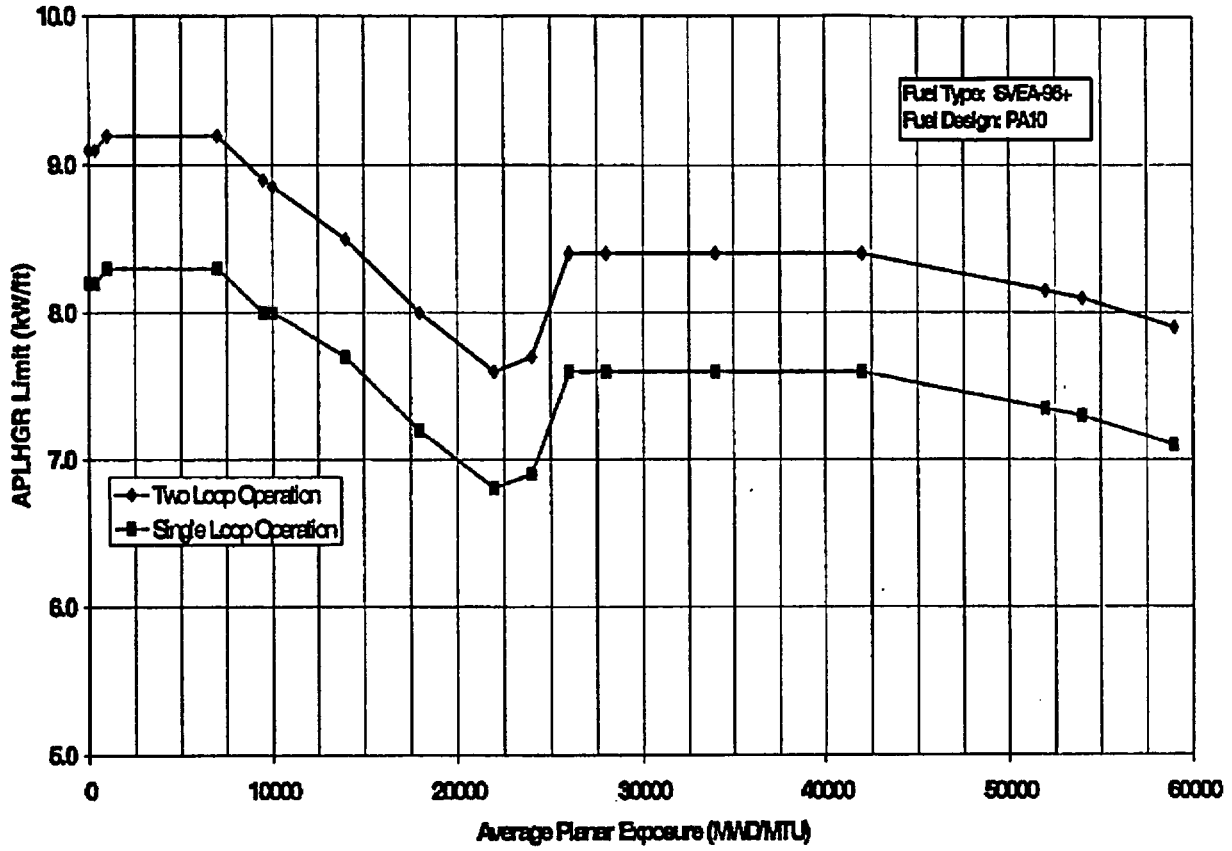
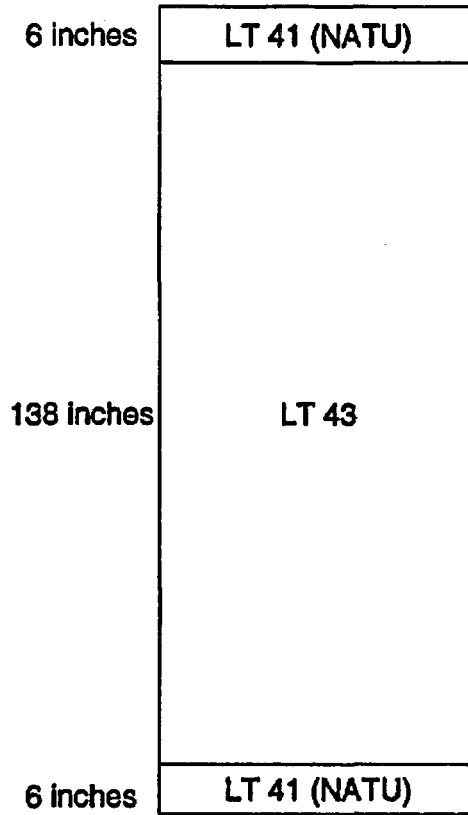


Figure 2.1-4: APLHGR Limit for Fuel Bundle PA10



NATU = Natural Uranium Lattices, which are not included in the determination of the most limiting lattice APLHGR values.

1. These lattice designators (prefixed with LT) are used in the Core Monitoring System.

Figure 2.1-5: Lattice Definitions for Fuel Bundle PB10

(Reference 7)

Table 2.1-5: APLHGR Data for Fuel Bundle PB10  
(Two Recirculation Loop Operation)

Exposure MWD/MTU	Lattice APLHGR Limit (Kw/ft) <sup>1</sup>		
	LT 41	LT 43	Limiting
0	9.1	9.1	9.1
350	9.1	9.1	9.1
1000	9.2	9.2	9.2
7000	-----	9.2	9.2
9500	9.2	8.9	8.9
10000	9.1	-----	8.9
14000	8.5	8.5	8.5
18000	8.0	8.0	8.0
22000	7.6	7.6	7.6
24000	7.7	7.7	7.7
26000	8.4	8.4	8.4
28000	8.4	8.4	8.4
34000	8.4	8.4	8.4
42000	8.4	8.4	8.4
52000	8.2	8.2	8.2
54000	8.1	8.1	8.1
59000	7.9	7.9	7.9

1. See Figure 2.1-5 for the Lattice Definitions for this fuel assembly.

Table 2.1-6: APLHGR Data for Fuel Bundle PB10  
(Single Recirculation Loop Operation)

Exposure MWD/MTU	Lattice APLHGR Limit (Kw/ft) <sup>1</sup>		
	LT 41	LT 43	Limiting
0	8.2	8.2	8.2
350	8.2	8.2	8.2
1000	8.3	8.3	8.3
7000	-----	8.3	8.3
9500	8.3	8.0	8.0
10000	8.2	-----	8.0
14000	7.7	7.7	7.7
18000	7.2	7.2	7.2
22000	6.8	6.8	6.8
24000	6.9	6.9	6.9
26000	7.6	7.6	7.6
28000	7.6	7.6	7.6
34000	7.6	7.6	7.6
42000	7.6	7.6	7.6
52000	7.4	7.4	7.4
54000	7.3	7.3	7.3
59000	7.1	7.1	7.1

1. See Figure 2.1-5 for the Lattice Definitions for this fuel assembly.

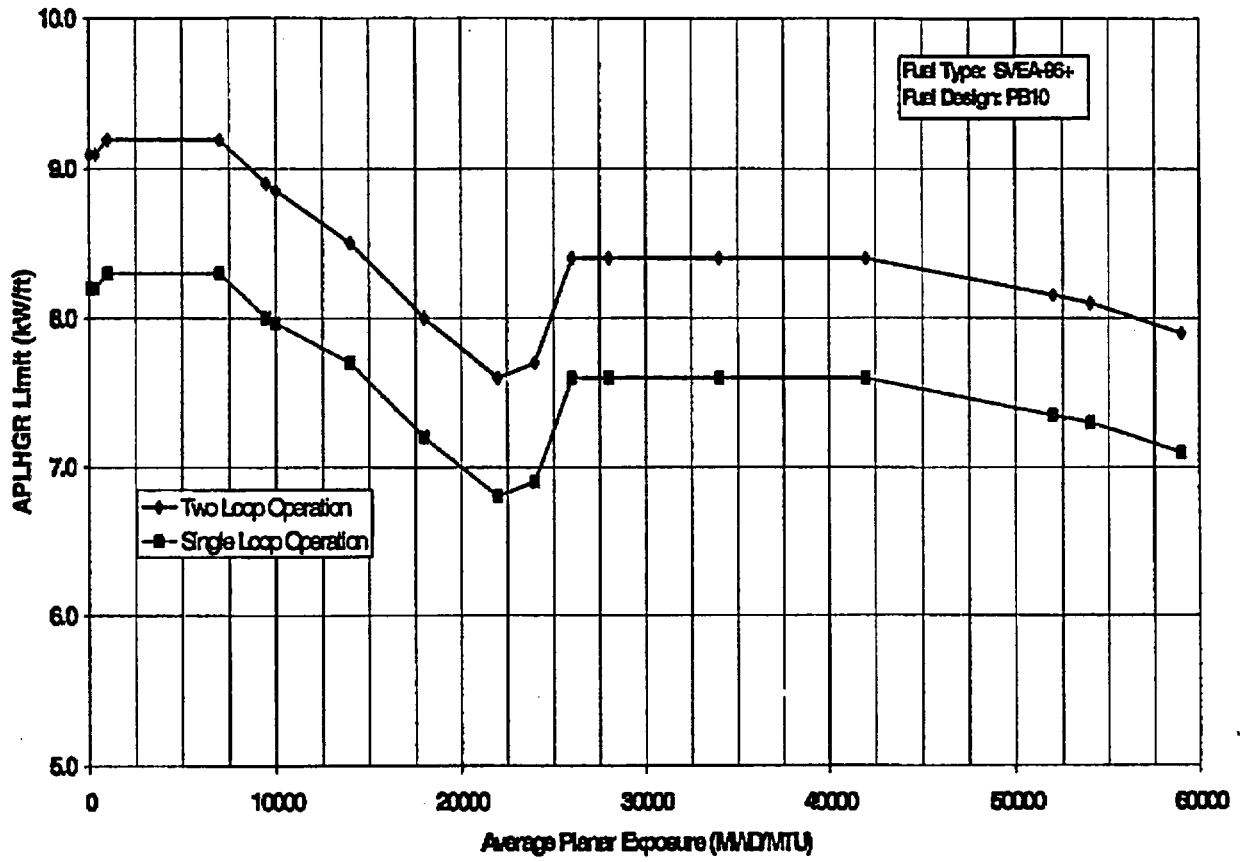
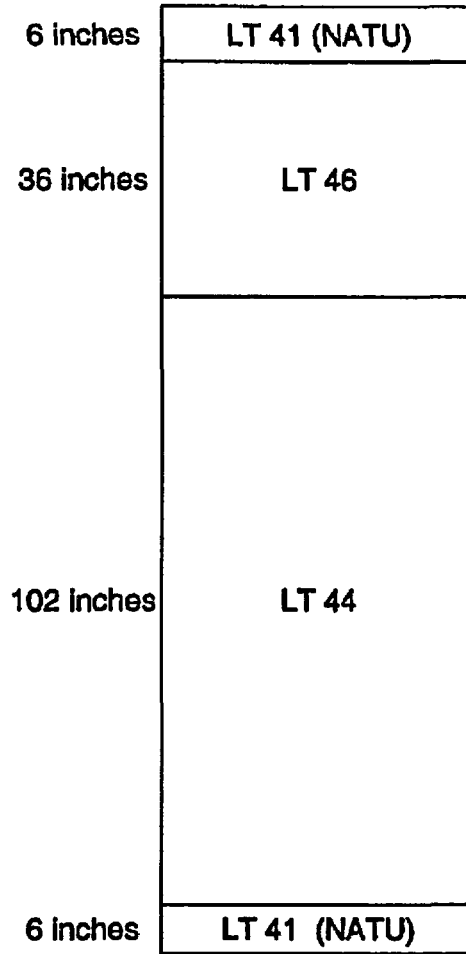


Figure 2.1-6: APLHGR Limit for Fuel Bundle PB10



**NATU = Natural Uranium Lattices, which are not included in the determination of the most limiting lattice APLHGR values.**

**Figure 2.1-7: Lattice Definitions for Fuel Bundle PC11**

**(Reference 8)**

Table 2.1-7: APLHGR Data for Fuel Bundle PC11  
(Two Recirculation Loop Operation)

Exposure MWD/MTU	Lattice APLHGR Limit (Kw/ft) <sup>1</sup>			
	LT 41	LT 44	LT 46	Limiting
0	9.1	11.0	11.0	11.0
350	9.1	11.0	11.0	11.0
1000	9.2	11.0	11.0	11.0
7000	-----	10.8	10.8	10.8
9500	9.2	10.7	10.7	10.7
10000	9.1	10.7	10.7	10.7
14000	8.5	10.4	10.4	10.4
18000	8.0	10.0	10.0	10.0
22000	7.6	9.6	9.6	9.6
24000	7.7	9.4	9.4	9.4
26000	8.4	9.3	9.3	9.3
28000	8.4	9.2	9.2	9.2
34000	8.4	9.1	9.1	9.1
42000	8.4	8.9	8.9	8.9
54000	8.1	8.5	8.5	8.5
59000	7.9	8.1	8.1	8.1

1. See Figure 2.1-7 for the Lattice Definitions for this fuel assembly.



Table 2.1-8: APLHGR Data for Fuel Bundle PC11  
(Single Recirculation Loop Operation)

Exposure MWD/MTU	Lattice APLHGR Limit (Kw/ft) <sup>1</sup>			
	LT 41	LT 44	LT 46	Limiting
0	8.2	9.9	9.9	9.9
350	8.2	9.9	9.9	9.9
1000	8.3	9.9	9.9	9.9
7000	-----	9.7	9.7	9.7
9500	8.3	9.6	9.6	9.6
10000	8.2	9.6	9.6	9.6
14000	7.7	9.3	9.3	9.3
18000	7.2	9.0	9.0	9.0
22000	6.8	8.6	8.6	8.6
24000	6.9	8.4	8.4	8.4
26000	7.6	8.3	8.3	8.3
28000	7.6	8.2	8.2	8.2
34000	7.6	8.1	8.1	8.1
42000	7.6	8.0	8.0	8.0
54000	7.3	7.6	7.6	7.6
59000	7.1	7.2	7.2	7.2

1. See Figure 2.1-7 for the Lattice Definitions for this fuel assembly.

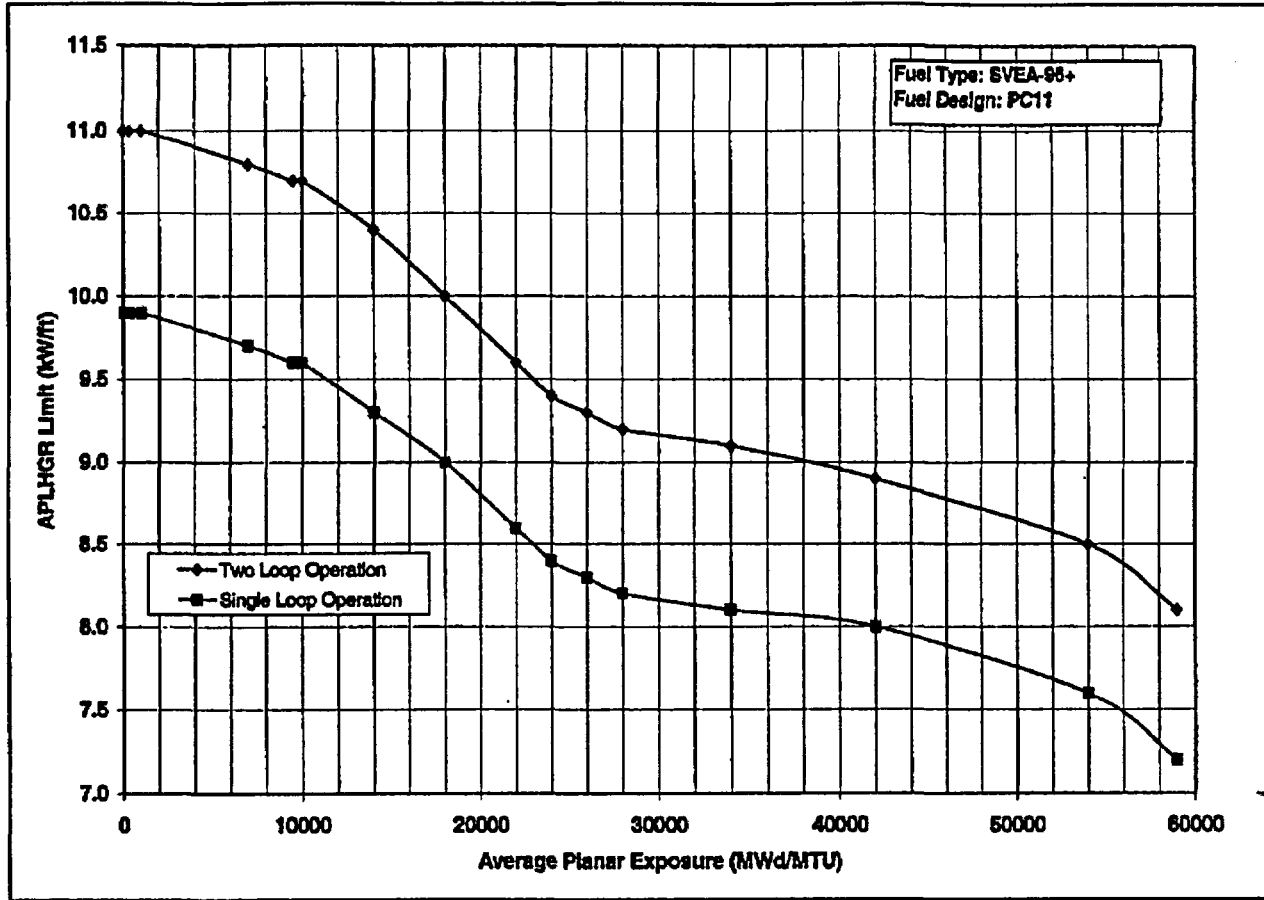
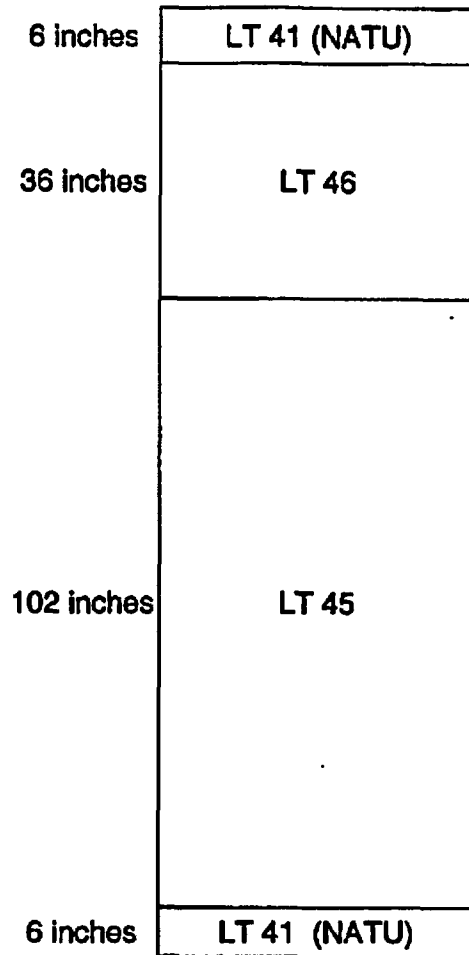


Figure 2.1-8: APLHGR Limit for Fuel Bundle PC11



NATU = Natural Uranium Lattices, which are not included in the determination of the most limiting lattice APLHGR values.

Figure 2.1-9: Lattice Definitions for Fuel Bundle PD11

(Reference 8)

Table 2.1-9: APLHGR Data for Fuel Bundle PD11  
(Two Recirculation Loop Operation)

Exposure MWD/MTU	Lattice APLHGR Limit (Kw/ft) <sup>1</sup>			
	LT 41	LT 45	LT 46	Limiting
0	9.1	11.0	11.0	11.0
350	9.1	11.0	11.0	11.0
1000	9.2	11.0	11.0	11.0
7000	-----	10.8	10.8	10.8
9500	9.2	10.7	10.7	10.7
10000	9.1	10.7	10.7	10.7
14000	8.5	10.4	10.4	10.4
18000	8.0	10.0	10.0	10.0
22000	7.6	9.6	9.6	9.6
24000	7.7	9.4	9.4	9.4
26000	8.4	9.3	9.3	9.3
28000	8.4	9.2	9.2	9.2
34000	8.4	9.1	9.1	9.1
42000	8.4	8.9	8.9	8.9
54000	8.1	8.5	8.5	8.5
59000	7.9	8.1	8.1	8.1

1. See Figure 2.1-9 for the Lattice Definitions for this fuel assembly.

Table 2.1-10: APLHGR Data for Fuel Bundle PD11  
(Single Recirculation Loop Operation)

Exposure MWD/MTU	Lattice APLHGR Limit (Kw/ft) <sup>1</sup>			
	LT 41	LT 45	LT 46	Limiting
0	8.2	9.9	9.9	9.9
350	8.2	9.9	9.9	9.9
1000	8.3	9.9	9.9	9.9
7000	-----	9.7	9.7	9.7
9500	8.3	9.6	9.6	9.6
10000	8.2	9.6	9.6	9.6
14000	7.7	9.3	9.3	9.3
18000	7.2	9.0	9.0	9.0
22000	6.8	8.6	8.6	8.6
24000	6.9	8.4	8.4	8.4
26000	7.6	8.3	8.3	8.3
28000	7.6	8.2	8.2	8.2
34000	7.6	8.1	8.1	8.1
42000	7.6	8.0	8.0	8.0
54000	7.3	7.6	7.6	7.6
59000	7.1	7.2	7.2	7.2

1. See Figure 2.1-9 for the Lattice Definitions for this fuel assembly.

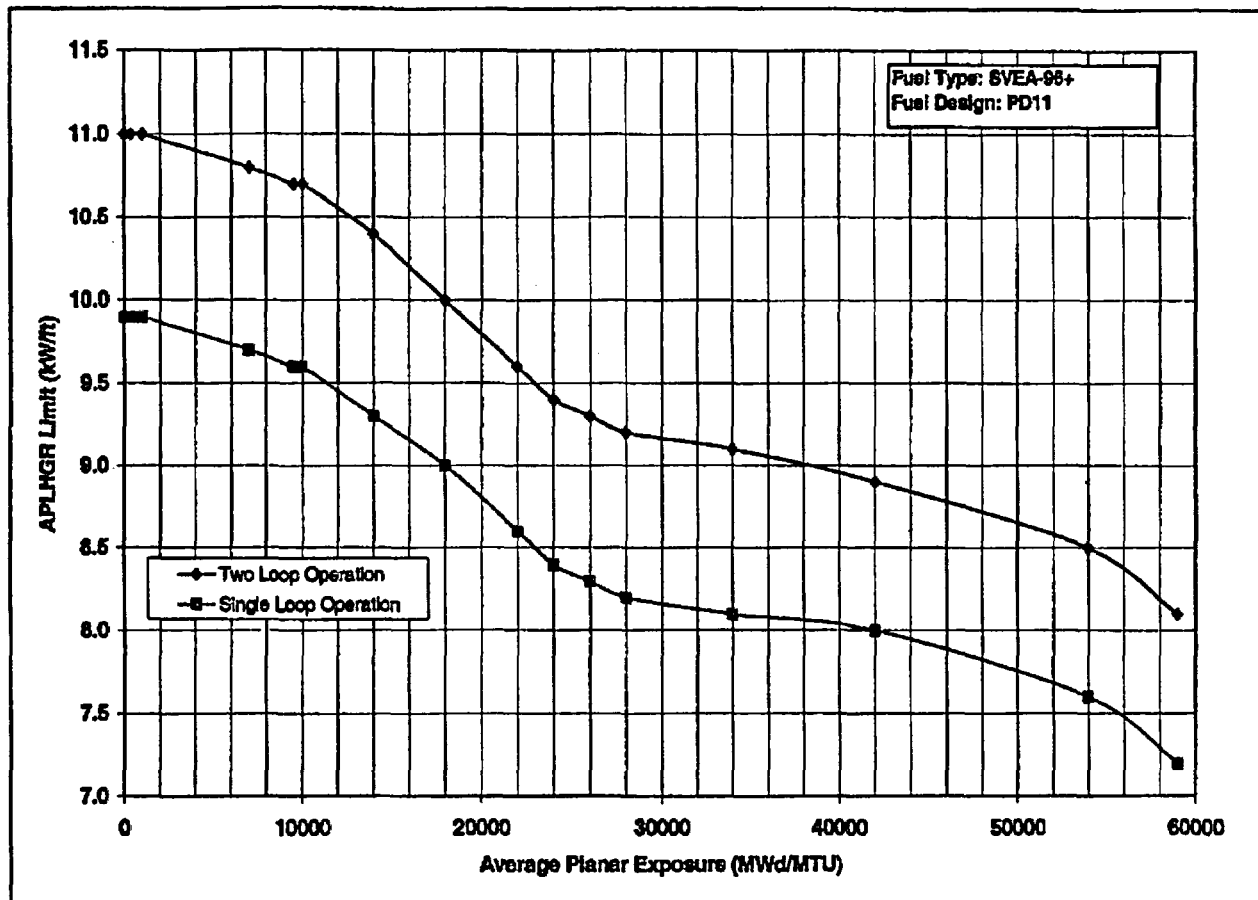
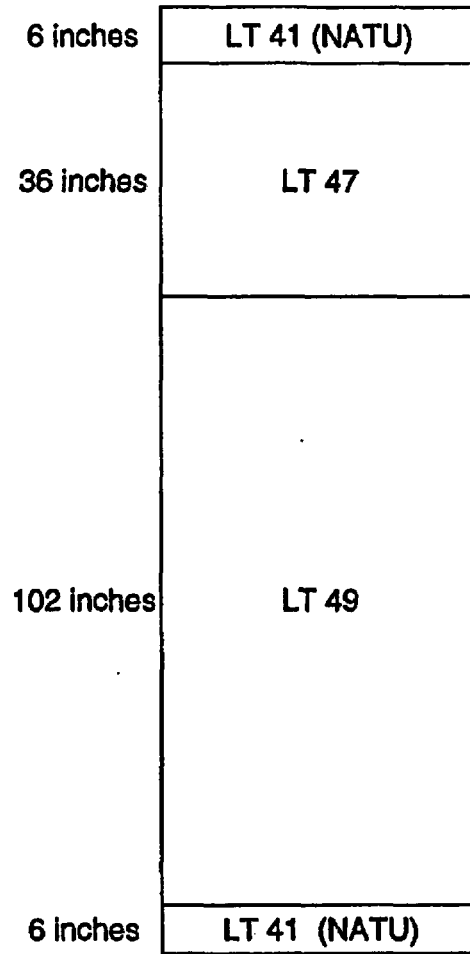


Figure 2.1-10: APLHGR Limit for Fuel Bundle PD11



NATU = Natural Uranium Lattices, which are not included in the determination of the most limiting lattice APLHGR values.

Figure 2.1-11: Lattice Definitions for Fuel Bundle PE12  
(Reference 9)

Table 2.1-11: APLHGR Data for Fuel Bundle PE12  
(Two Recirculation Loop Operation)

Exposure MWD/MTU	Lattice APLHGR Limit (Kw/ft) <sup>1</sup>			
	LT 41	LT 47	LT 49	Limiting
0	9.1	11.0	11.0	11.0
350	9.1	11.0	11.0	11.0
1000	9.2	11.0	11.0	11.0
7000	-----	10.8	10.8	10.8
9500	9.2	10.7	10.7	10.7
10000	9.1	10.7	10.7	10.7
14000	8.5	10.4	10.4	10.4
18000	8.0	10.0	10.0	10.0
22000	7.6	9.6	9.6	9.6
24000	7.7	9.4	9.4	9.4
26000	8.4	9.3	9.3	9.3
28000	8.4	9.2	9.2	9.2
34000	8.4	9.1	9.1	9.1
42000	8.4	8.9	8.9	8.9
54000	8.1	8.5	8.5	8.5
59000	7.9	8.1	8.1	8.1

1. See Figure 2.1-11 for the Lattice Definitions for this fuel assembly.



Table 2.1-12: APLHGR Data for Fuel Bundle PE12  
(Single Recirculation Loop Operation)

Exposure MWD/MTU	Lattice APLHGR Limit (Kw/ft) <sup>1</sup>			
	LT 41	LT 47	LT 49	Limiting
0	8.2	9.9	9.9	9.9
350	8.2	9.9	9.9	9.9
1000	8.3	9.9	9.9	9.9
7000	-----	9.7	9.7	9.7
9500	8.3	9.6	9.6	9.6
10000	8.2	9.6	9.6	9.6
14000	7.7	9.3	9.3	9.3
18000	7.2	9.0	9.0	9.0
22000	6.8	8.6	8.6	8.6
24000	6.9	8.4	8.4	8.4
26000	7.6	8.3	8.3	8.3
28000	7.6	8.2	8.2	8.2
34000	7.6	8.1	8.1	8.1
42000	7.6	8.0	8.0	8.0
54000	7.3	7.6	7.6	7.6
59000	7.1	7.2	7.2	7.2

1. See Figure 2.1-11 for the Lattice Definitions for this fuel assembly.

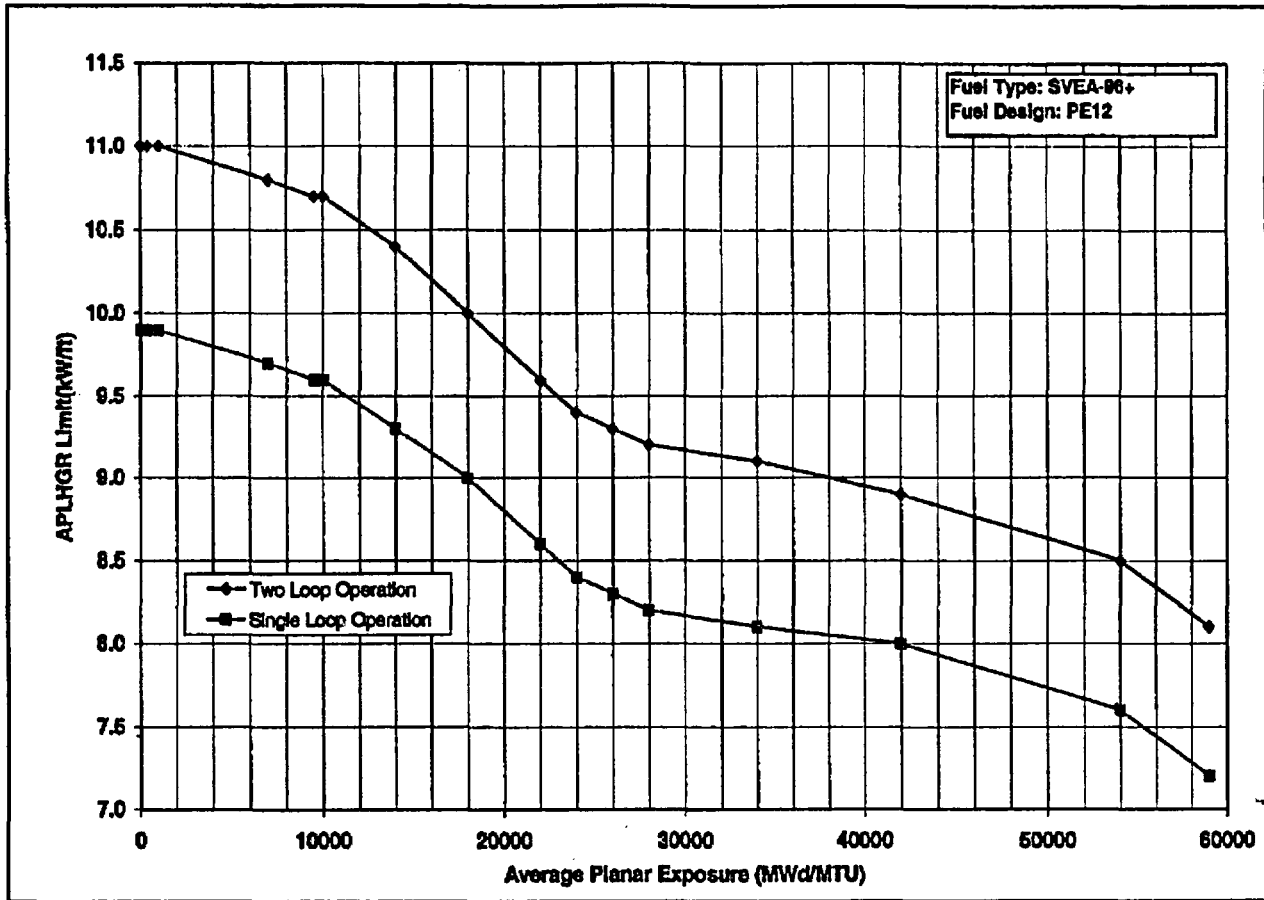
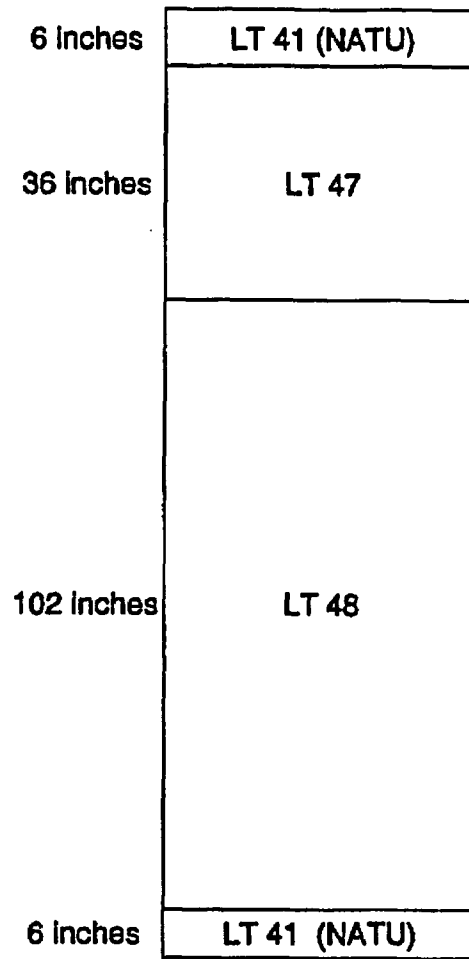


Figure 2.1-12: APLHGR Limit for Fuel Bundle PE12



NATU = Natural Uranium Lattices, which are not included in the determination of the most limiting lattice APLHGR values.

Figure 2.1-13: Lattice Definitions for Fuel Bundle PF12  
(Reference 9)

Table 2.1-13: APLHGR Data for Fuel Bundle PF12  
(Two Recirculation Loop Operation)

Exposure MWD/MTU	Lattice APLHGR Limit (Kw/ft) <sup>1</sup>			
	LT 41	LT 47	LT 48	Limiting
0	9.1	11.0	11.0	11.0
350	9.1	11.0	11.0	11.0
1000	9.2	11.0	11.0	11.0
7000	-----	10.8	10.8	10.8
9500	9.2	10.7	10.7	10.7
10000	9.1	10.7	10.7	10.7
14000	8.5	10.4	10.4	10.4
18000	8.0	10.0	10.0	10.0
22000	7.6	9.6	9.6	9.6
24000	7.7	9.4	9.4	9.4
26000	8.4	9.3	9.3	9.3
28000	8.4	9.2	9.2	9.2
34000	8.4	9.1	9.1	9.1
42000	8.4	8.9	8.9	8.9
54000	8.1	8.5	8.5	8.5
59000	7.9	8.1	8.1	8.1

1. See Figure 2.1-13 for the Lattice Definitions for this fuel assembly.

Table 2.1-14: APLHGR Data for Fuel Bundle PF12  
(Single Recirculation Loop Operation)

Exposure MWD/MTU	Lattice APLHGR Limit (Kw/ft) <sup>1</sup>			
	LT 41	LT 47	LT 48	Limiting
0	8.2	9.9	9.9	9.9
350	8.2	9.9	9.9	9.9
1000	8.3	9.9	9.9	9.9
7000	-----	9.7	9.7	9.7
9500	8.3	9.6	9.6	9.6
10000	8.2	9.6	9.6	9.6
14000	7.7	9.3	9.3	9.3
18000	7.2	9.0	9.0	9.0
22000	6.8	8.6	8.6	8.6
24000	6.9	8.4	8.4	8.4
26000	7.6	8.3	8.3	8.3
28000	7.6	8.2	8.2	8.2
34000	7.6	8.1	8.1	8.1
42000	7.6	8.0	8.0	8.0
54000	7.3	7.6	7.6	7.6
59000	7.1	7.2	7.2	7.2

1. See Figure 2.1-13 for the Lattice Definitions for this fuel assembly.

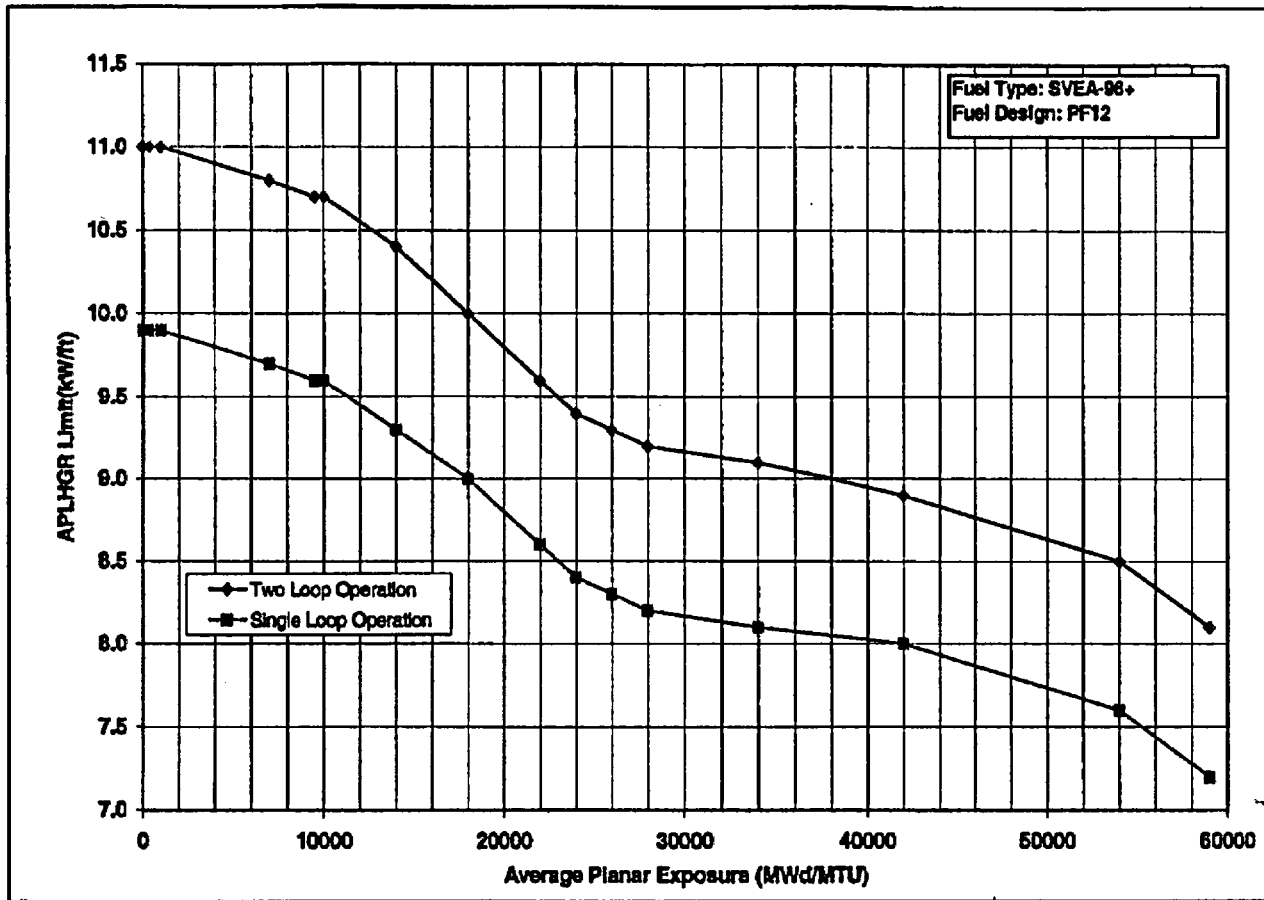


Figure 2.1-14: APLHGR Limit for Fuel Bundle PF12

## 2.2 MINIMUM CRITICAL POWER RATIO

### LIMITING CONDITION FOR OPERATION

The MINIMUM CRITICAL POWER RATIO (MCPR) shall be equal to or greater than the MCPR limit specified in Table 2.2-2 and Table 2.2-3. A conservative penalty has been added to the values in Table 2.2-2 and Table 2.2-3 to account for a degraded condition in the control rod drive system as documented in corrective action order number 70033715.

The Technical Specification Scram Speed (TSSS) is defined by Hope Creek Technical Specification 3.1.3.3. The Nominal Scram Speed (NSS) is defined in reference [4] and is repeated below in Table 2.2-1.

Table 2.2-1: Nominal Scram Speed

Position Inserted from fully withdrawn	Average Scram Insertion Time (seconds)
Notch 45	0.375
Notch 39	0.673
Notch 25	1.399
Notch 5	2.526

#### NOTE

The Operating Limit MCPR determined with NSS shall be used when the control rod insertion time is less-than or equal-to that documented in Table 2.2.1. If the control rod insertion time is greater-than that assumed for the NSS then the Operating Limit MCPR shall be determined with the TSSS.

The Operating limit MCPR is the maximum of the 'Full Power,' 'Power Dependent' and 'Flow Dependent' values presented in Tables 2.2.2 and 2.2.3 for the various operating conditions.

The MCPR limit is a function of core average scram speed, Cycle Exposure, EOC-RPT operability and Main Turbine Bypass operability.

EOC-RPT system operability is defined by Hope Creek Technical Specification 3.3.4.2.

Main Turbine Bypass operability is defined by Hope Creek Technical Specification 3.7.7.

Table 2.2-2: Hope Creek Cycle 12 MCPR Operating limits:  
Cycle Exposure  $\leq 9179\text{MWd/MTU}$

<b>Main Turbine Bypass Operable Cycle Exposure <math>\leq 9179\text{MWd/MTU}</math></b>			
<b>Conditions</b>	<b>Limit</b>	<b>SVEA-96+ <sup>(3)</sup></b>	<b>GE9B <sup>(4)</sup></b>
NSS <sup>(1)</sup> EOC-RPT Operable	Full Power	1.48 <sup>(5)</sup>	1.64 <sup>(5)</sup>
	Flow Dependent	Figure 2.2.1	Figure 2.2.1
	Power Dependent <sup>(2)</sup>	Figure 2.2.2	Figure 2.2.2
TSSS <sup>(1)</sup> EOC-RPT Operable	Full Power	1.48 <sup>(5)</sup>	1.64 <sup>(5)</sup>
	Flow Dependent	Figure 2.2.1	Figure 2.2.1
	Power Dependent <sup>(2)</sup>	Figure 2.2.3	Figure 2.2.3
NSS <sup>(1)</sup> EOC-RPT Inoperable	Full Power	1.48 <sup>(5)</sup>	1.64 <sup>(5)</sup>
	Flow Dependent	Figure 2.2.1	Figure 2.2.1
	Power Dependent <sup>(2)</sup>	Figure 2.2.4	Figure 2.2.4
TSSS <sup>(1)</sup> EOC-RPT Inoperable	Full Power	1.48 <sup>(5)</sup>	1.64 <sup>(5)</sup>
	Flow Dependent	Figure 2.2.1	Figure 2.2.1
	Power Dependent <sup>(2)</sup>	Figure 2.2.5	Figure 2.2.5

1. The TSSS MCPR values are based on the required speed of Technical Specification 3.1.3.3. The NSS MCPR values are based on the Westinghouse transient analysis performed using the control rod insertion times shown in Table 2.2-1. Administrative controls have been established to control the determination of the MCPR operating limit with regard to scram speed.
  2. Power dependent MCPR limits are provided for core thermal powers greater than or equal to 25% of rated power at all core flows. A step change in the power dependent MCPR limits occurs at 30% of rated power because direct scram on turbine control valve closure is automatically bypassed below 30% of rated power.
  3. Fuel design PA10, PB10, PC11, PD11, PE12, and PF12 are SVEA-96+ fuel assemblies.
  4. Fuel design HF09 represents GE9B fuel assemblies.
- |  |
|--|
| 5. As stated in section 2.2, a conservative MCPR penalty has been applied to this value to account for a degraded condition within the control rod drive system, as documented in corrective action order number 70033715. |
|--|

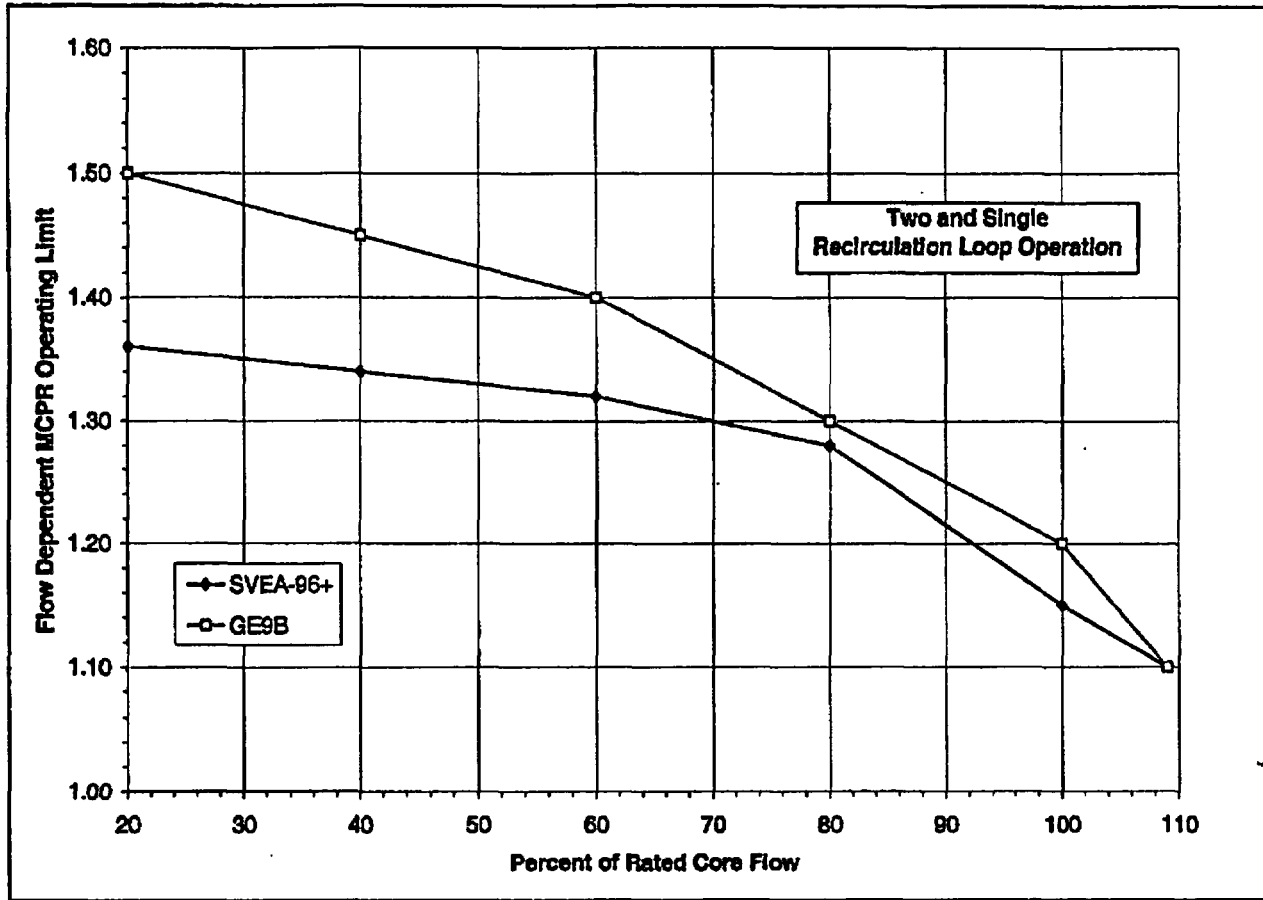


Table 2.2-3: Hope Creek Cycle 12 MCPR Operating limits:  
Cycle Exposure > 9179MWd/MTU

<b>Main Turbine Bypass Operable</b> <b>9179MWd/MTU &lt; Cycle Exposure ≤ 13324MWd/MTU</b>			
Conditions	Limit	SVEA-96+ <sup>(3)</sup>	GE9B <sup>(4)</sup>
NSS <sup>(1)</sup> EOC-RPT Operable	Full Power	1.48 <sup>(5)</sup>	1.64 <sup>(5)</sup>
	Flow Dependent	Figure 2.2.1	Figure 2.2.1
	Power Dependent <sup>(2)</sup>	Figure 2.2.6	Figure 2.2.6
TSSS <sup>(1)</sup> EOC-RPT Operable	Full Power	1.48 <sup>(5)</sup>	1.64 <sup>(5)</sup>
	Flow Dependent	Figure 2.2.1	Figure 2.2.1
	Power Dependent <sup>(2)</sup>	Figure 2.2.7	Figure 2.2.7
NSS <sup>(1)</sup> EOC-RPT Inoperable	Full Power	1.48 <sup>(5)</sup>	1.64 <sup>(5)</sup>
	Flow Dependent	Figure 2.2.1	Figure 2.2.1
	Power Dependent <sup>(2)</sup>	Figure 2.2.8	Figure 2.2.8
TSSS <sup>(1)</sup> EOC-RPT Inoperable	Full Power	1.48 <sup>(5)</sup>	1.64 <sup>(5)</sup>
	Flow Dependent	Figure 2.2.1	Figure 2.2.1
	Power Dependent <sup>(2)</sup>	Figure 2.2.9	Figure 2.2.9

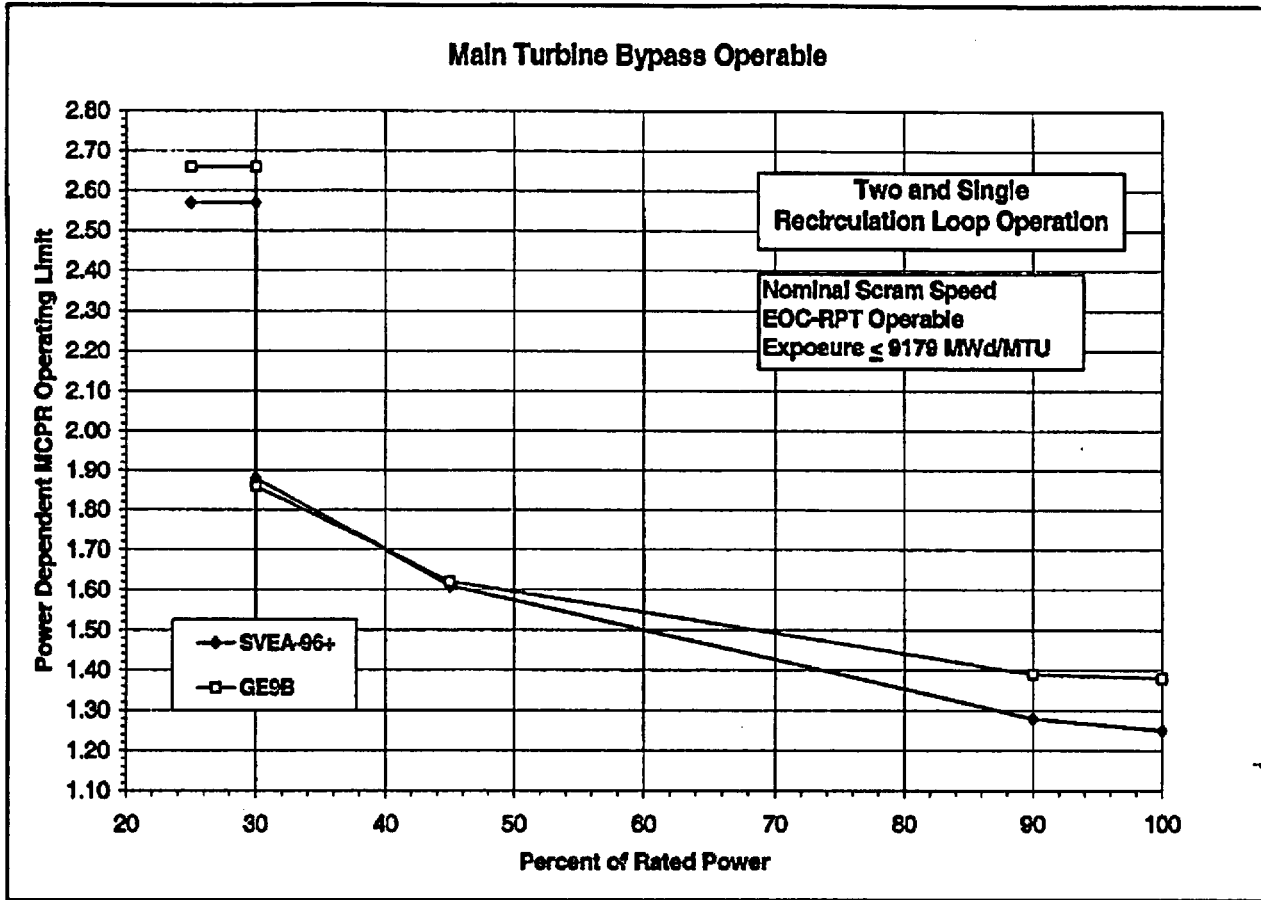
1. See note 1 in Table 2.2-2
2. See note 2 in Table 2.2-2
3. Fuel design PA10, PB10, PC11, PD11, FE12, and PF12 are SVEA-96+ fuel assemblies.
4. Fuel design HF09 represents GE9B fuel assemblies.

5. As stated in section 2.2, a conservative MCPR penalty has been applied to this value to account for a degraded condition within the control rod drive system, as documented in corrective action order number 70033715.



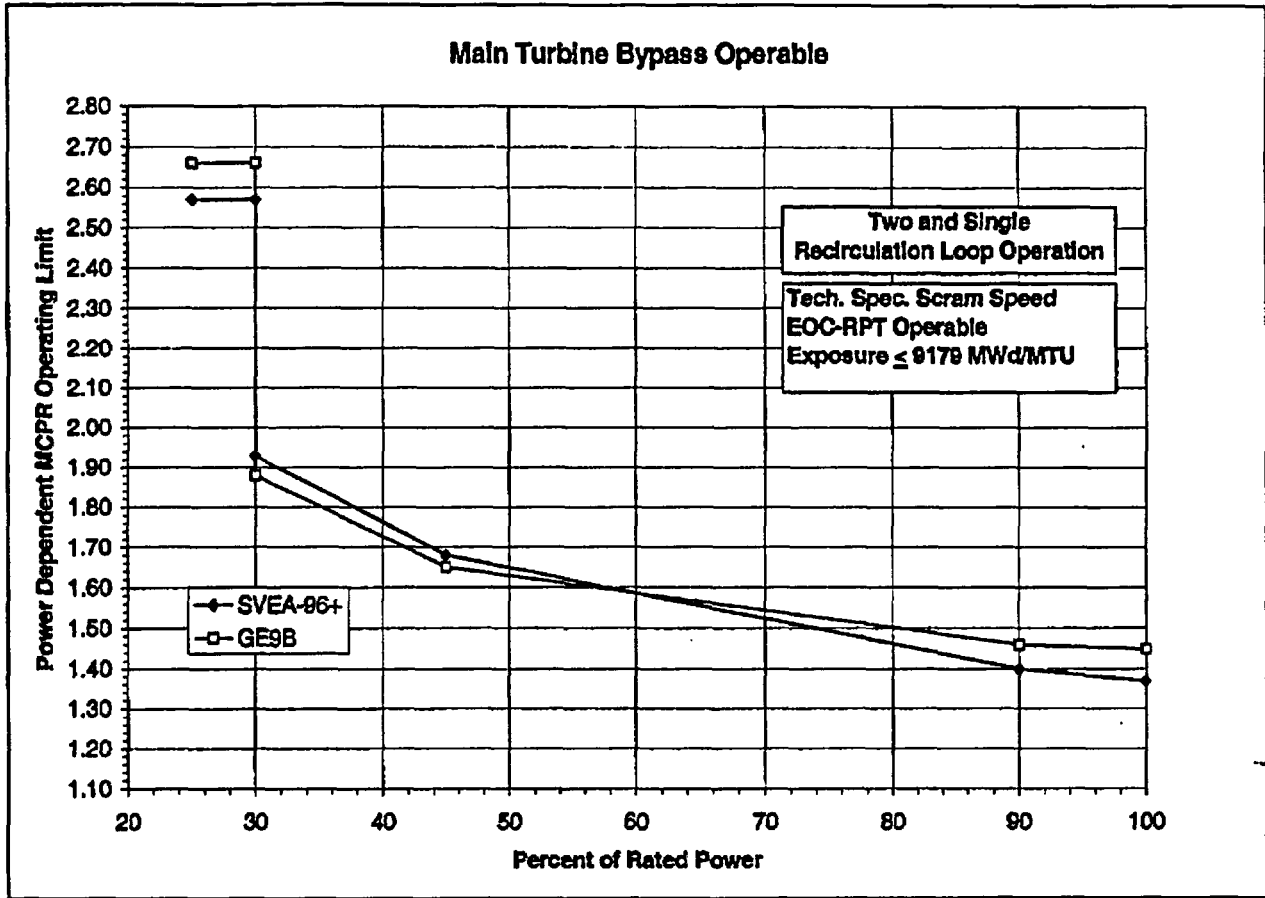
Initial Flow (% of Rated Flow)	MCPR <sub>f</sub>	
	SVEA-96+ OLMCPR	GE9B OLMCPR
20	1.36	1.50
40	1.34	1.45
60	1.32	1.40
80	1.28	1.30
100	1.15	1.20
109	1.10	1.10

Figure 2.2-1: Flow Dependent MCPR Limit



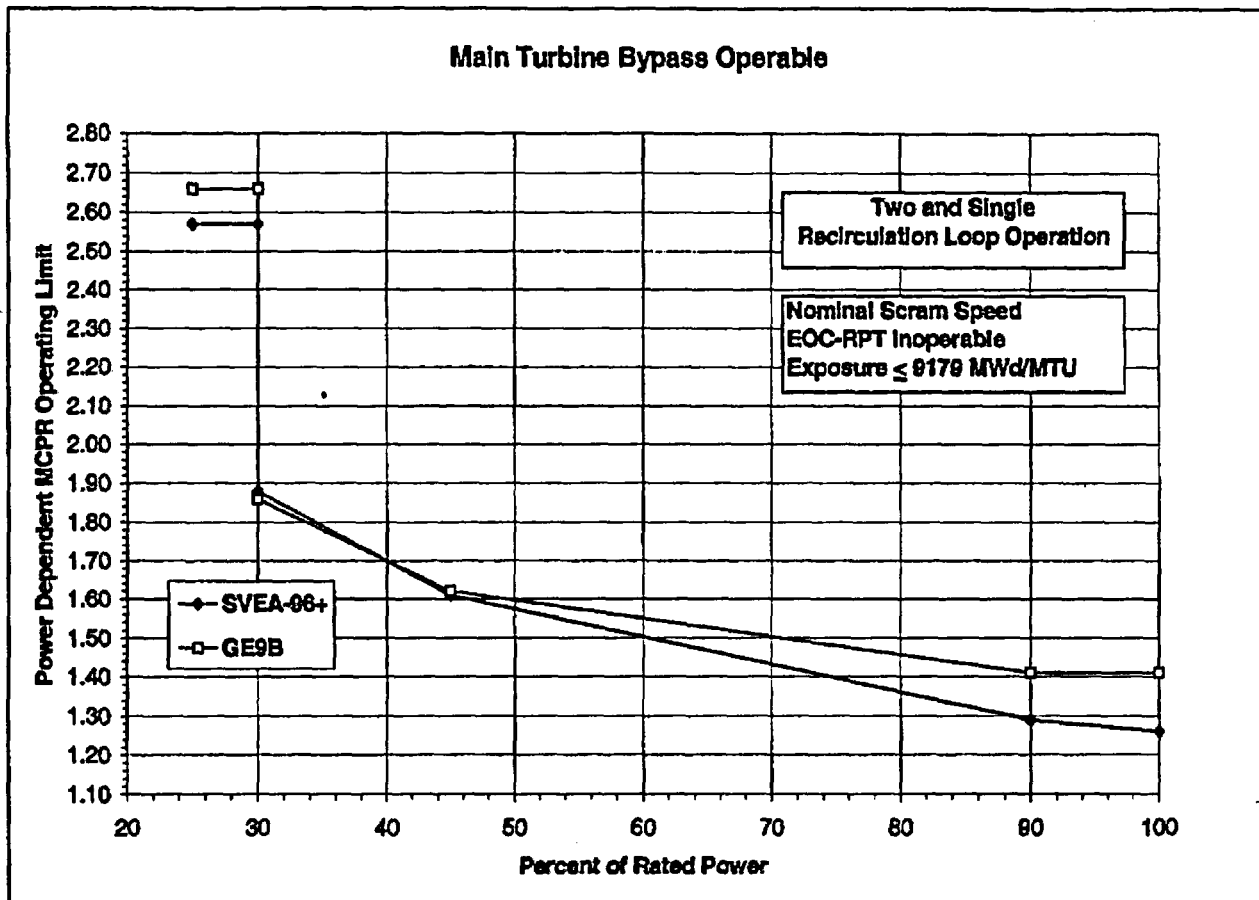
Notes	Initial Power (% of Rated)	MCPR <sub>p</sub>	
		SVEA-96+	GE9B
All Core Flows, Power $\geq 30\%$ , Credit Direct Scrams	100	1.25	1.38
	90	1.28	1.39
	45	1.61	1.62
	30	1.88	1.86
All Core Flows, Power $< 30\%$ , Bypass Direct Scrams	30	2.57	2.66
	25	2.57	2.66

Figure 2.2-2: Power Dependent MCPR Limit:  
NSS, Cycle Exposure  $\leq 9179$  MWd/MTU, EOC-RPT Operable



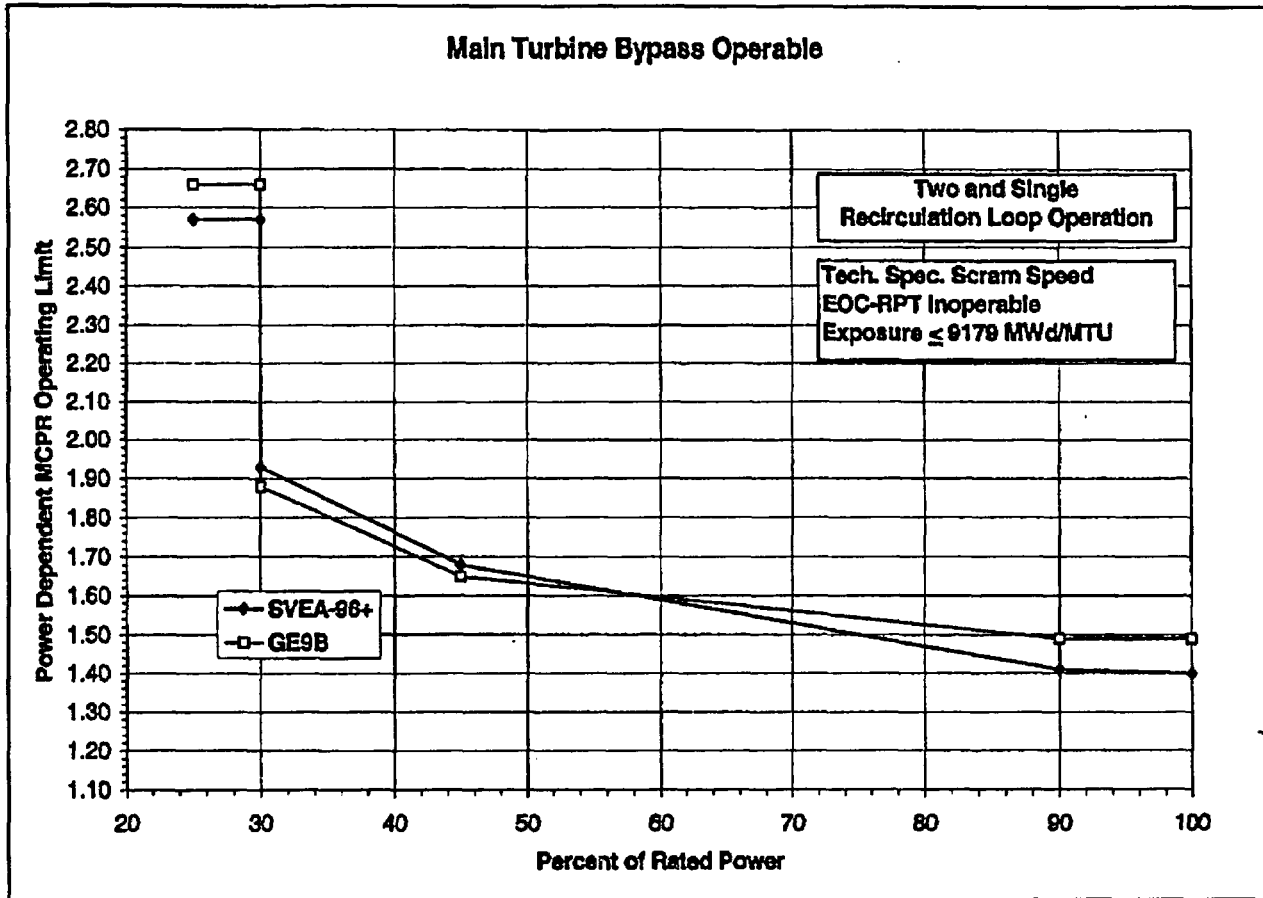
Notes	Initial Power (% of Rated)	MCPR <sub>p</sub>	
		SVEA-96+	GE9B
All Core Flows, Power ≥ 30%, Credit Direct Scrams	100	1.37	1.45
	90	1.40	1.46
	45	1.68	1.65
	30	1.93	1.88
All Core Flows, Power < 30%, Bypass Direct Scrams	30	2.57	2.66
	25	2.57	2.66

Figure 2.2-3: Power Dependent MCPR Limit:  
TSSS, Cycle Exposure ≤ 9179MWd/MTU, EOC-RPT Operable



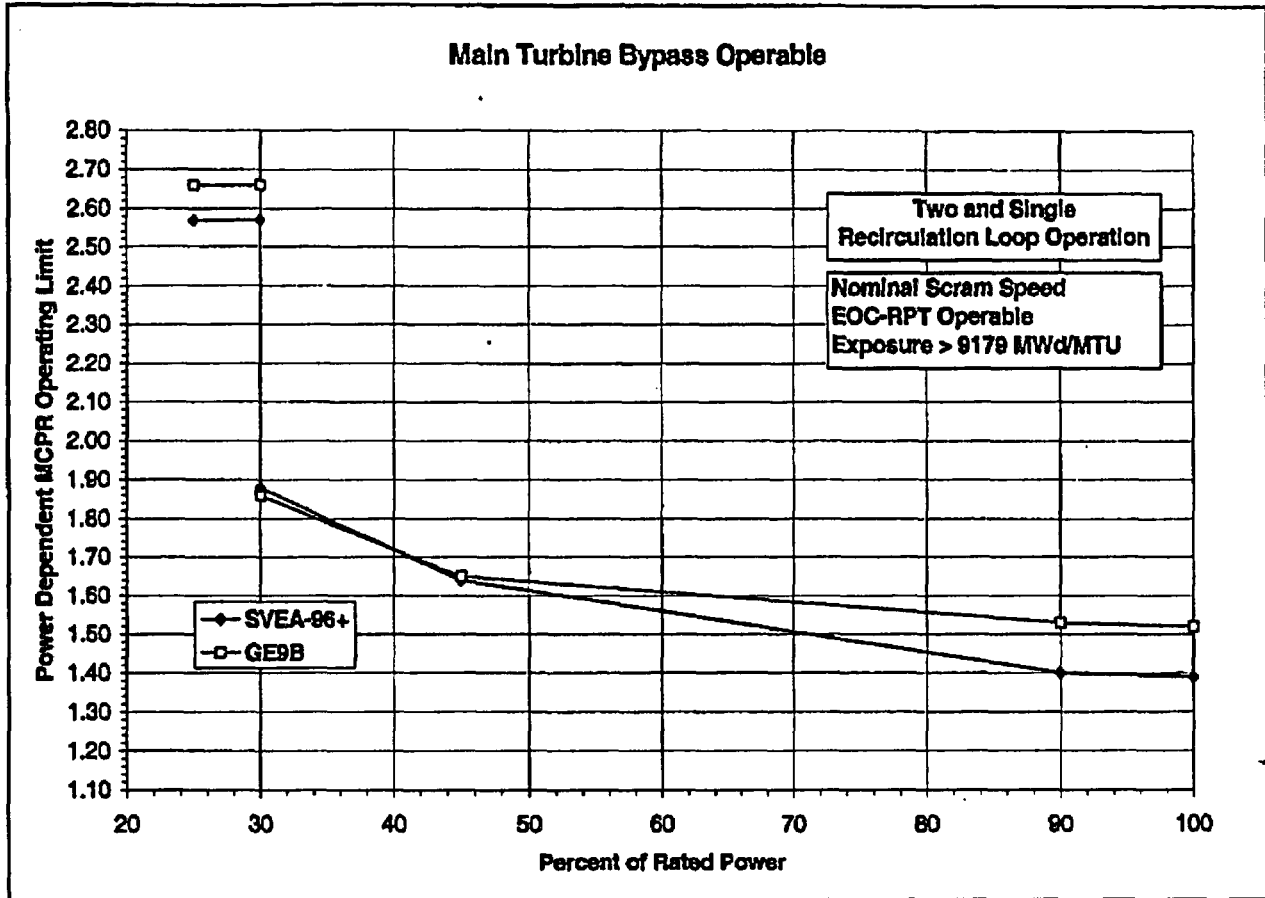
Notes	Initial Power (% of Rated)	MCPR <sub>p</sub>	
		SVEA-96+	GE9B
All Core Flows, Power ≥ 30%, Credit Direct Scrams	100	1.26	1.41
	90	1.29	1.41
	45	1.61	1.62
	30	1.88	1.86
All Core Flows, Power < 30%, Bypass Direct Scrams	30	2.57	2.66
	25	2.57	2.66

Figure 2.2-4: Power Dependent MCPR Limit:  
NSS, Cycle Exposure ≤ 9179 MWd/MTU, EOC-RPT Inoperable



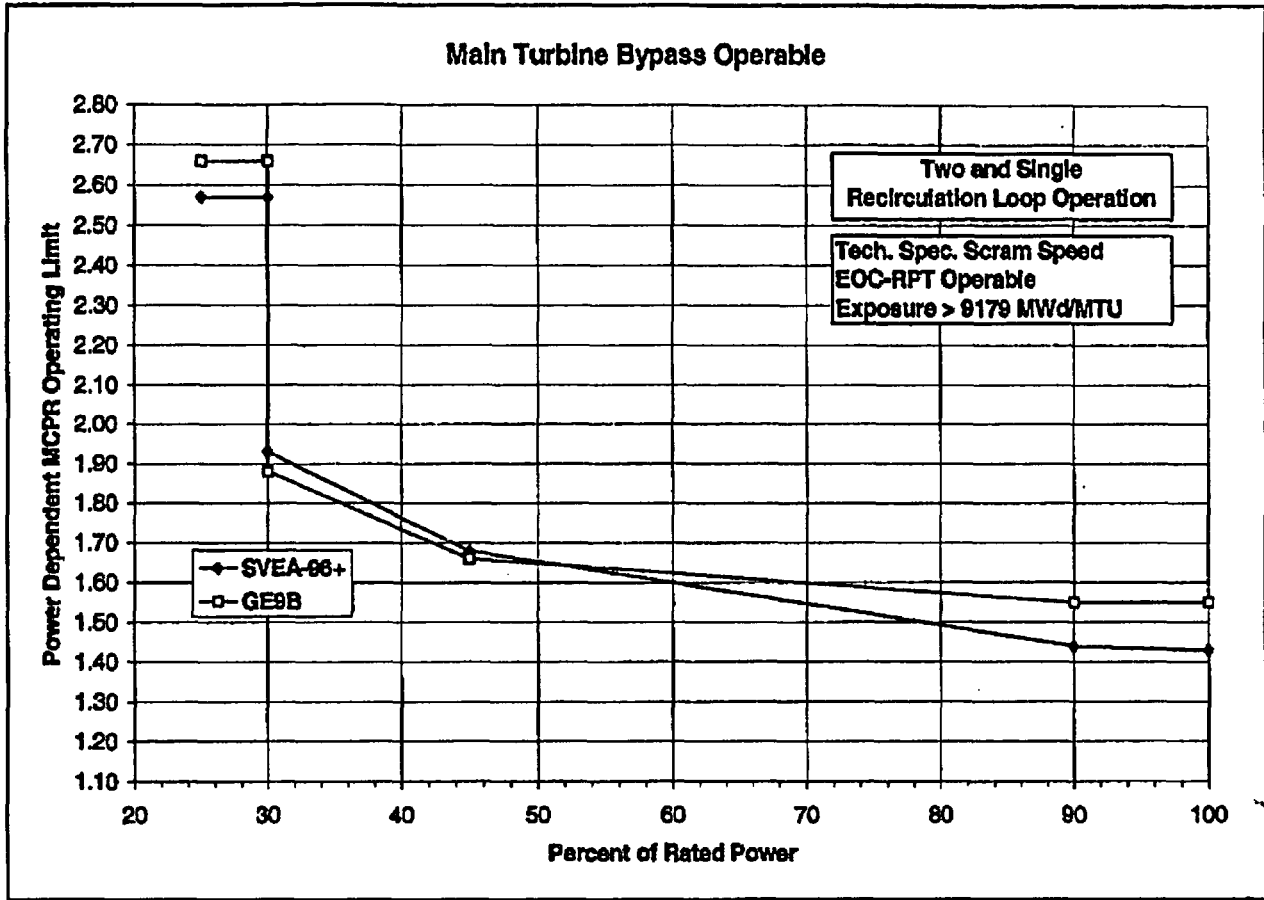
Notes	Initial Power (% of Rated)	MCPR <sub>p</sub>	
		SVEA-96+	GE9B
All Core Flows, Power $\geq 30\%$ , Credit Direct Scrams	100	1.40	1.49
	90	1.41	1.49
	45	1.68	1.65
	30	1.93	1.88
All Core Flows, Power $< 30\%$ , Bypass Direct Scrams	30	2.57	2.66
	25	2.57	2.66

Figure 2.2-5: Power Dependent MCPR Limit:  
TSSS, Cycle Exposure  $\leq 9179$  MWd/MTU, EOC-RPT Inoperable



Notes	Initial Power (% of Rated)	MCPR <sub>p</sub>	
		SVEA-96+	GE9B
All Core Flows, Power ≥ 30%, Credit Direct Scrams	100	1.39	1.52
	90	1.40	1.53
	45	1.64	1.65
	30	1.88	1.86
All Core Flows, Power < 30%, Bypass Direct Scrams	30	2.57	2.66
	25	2.57	2.66

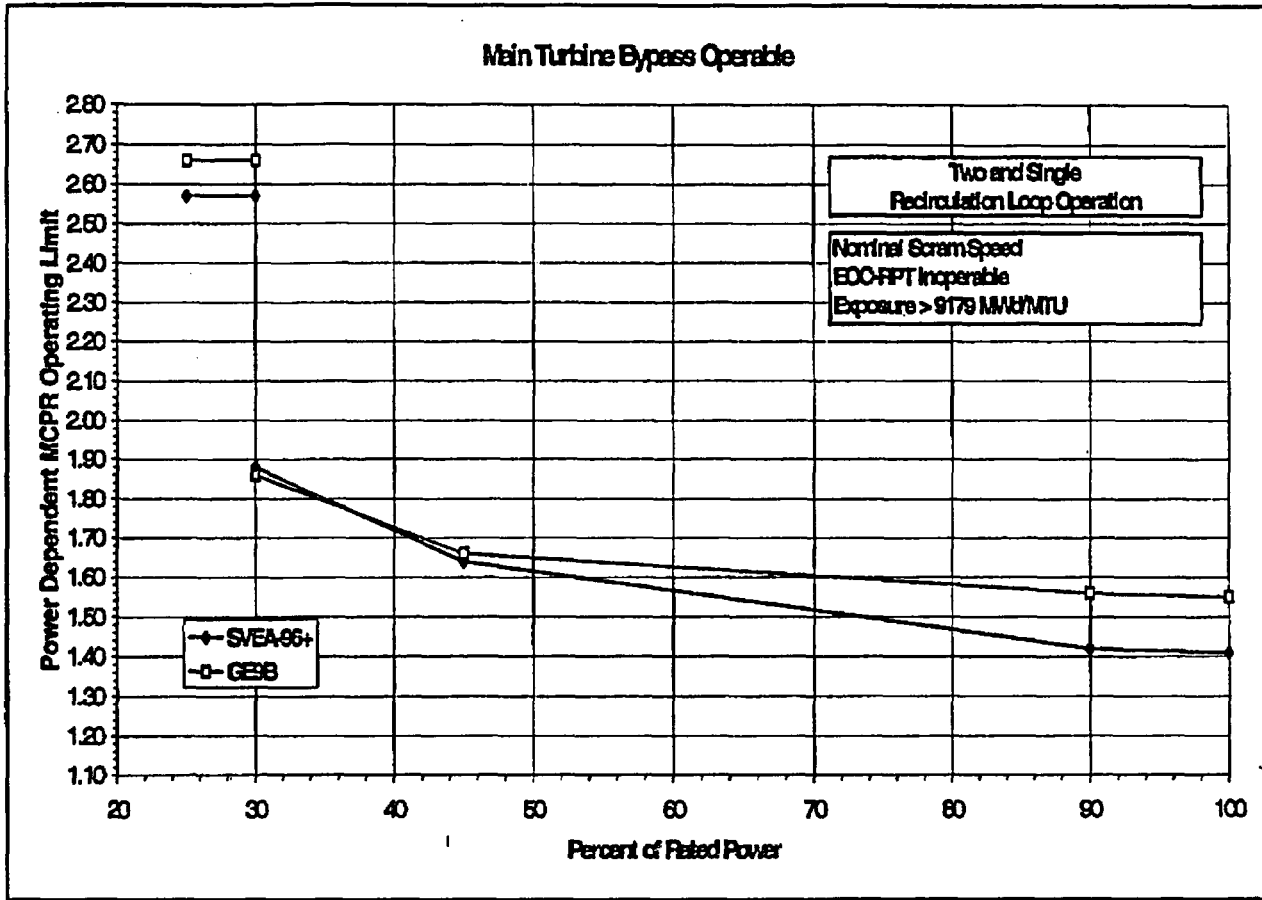
Figure 2.2-6: Power Dependent MCPR Limit:  
NSS, Cycle Exposure > 9179MWd/MTU, EOC-RPT Operable



Notes	Initial Power (% of Rated)	MCPR <sub>p</sub>	
		SVEA-96+	GE9B
All Core Flows, Power ≥ 30%, Credit Direct Scrams	100	1.43	1.55
	90	1.44	1.55
	45	1.68	1.66
	30	1.93	1.88
All Core Flows, Power < 30%, Bypass Direct Scrams	30	2.57	2.66
	25	2.57	2.66

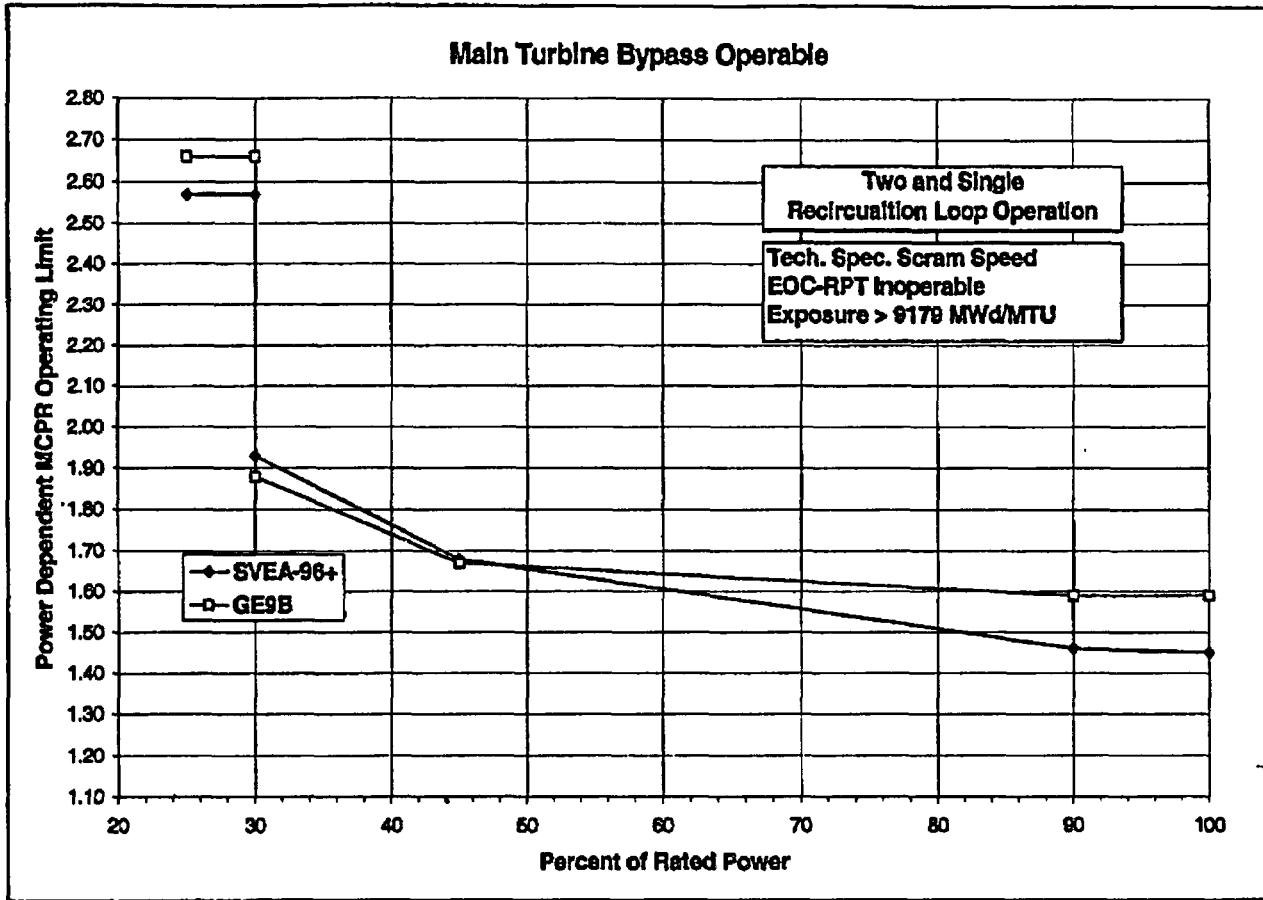
Figure 2.2-7: Power Dependent MCPR Limit:  
TSSS, Cycle Exposure > 9179MWd/MTU, EOC-RPT Operable





Notes	Initial Power (% of Rated)	MCPR <sub>p</sub>	
		SVEA-96+	GE9B
All Core Flows, Power ≥ 30%, Credit Direct Scrams	100	1.41	1.55
	90	1.42	1.56
	45	1.64	1.66
	30	1.88	1.86
All Core Flows, Power < 30%, Bypass Direct Scrams	30	2.57	2.66
	25	2.57	2.66

Figure 2.2-8: Power Dependent MCPR Limit:  
NSS, Cycle Exposure > 9179 MWd/MTU, EOC-RPT Inoperable



Notes	Initial Power (% of Rated)	MCPR <sub>p</sub>	
		SVEA-96+	GE9B
All Core Flows, Power ≥ 30%, Credit Direct Scrams	100	1.45	1.59
	90	1.46	1.59
	45	1.68	1.67
	30	1.93	1.88
All Core Flows, Power < 30%, Bypass Direct Scrams	30	2.57	2.66
	25	2.57	2.66

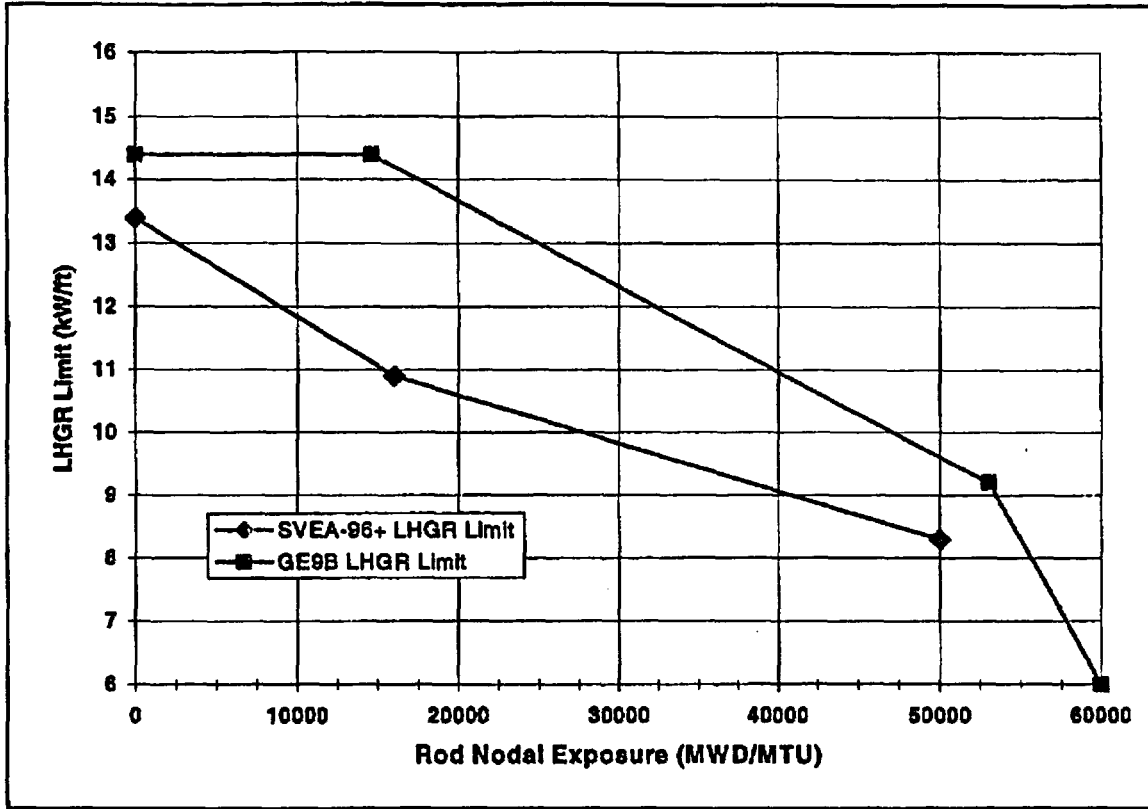
Figure 2.2-9: Power Dependent MCPR Limit:  
TSSS, Cycle Exposure > 9179MWd/MTU, EOC-RPT Inoperable

## **2.3 LINEAR HEAT GENERATION RATE**

### **LIMITING CONDITION FOR OPERATION**

The LINEAR HEAT GENERATION RATE (LHGR) shall not exceed the limit specified in Figure 2.3-1.

The CORE MAXIMUM FRACTION OF LIMITING POWER DENSITY as implemented in Technical Specification Section 3/4.2.2 shall use a FRACTION OF LIMITING POWER DENSITY that is based on a specified LHGR equal to the exposure dependent LHGR in Figure 2.3-1 for the SVEA-96+ fuel assemblies and a constant LHGR of 14.4kw/ft for the GE9B fuel assemblies.



Rod Nodal Exposure (MWD/MTU)	LHGR Limit (kW / ft)	
	SVEA-96+	GE9B
0	13.4	14.4
14591	----	14.4
16000	10.9	----
50000	8.3	----
53000	Not Applicable	9.2
60000	Not Applicable	6.0

Figure 2.3-1: Exposure Dependent LHGR Limits

### 3.0 REFERENCES

1. "Reference Safety Report for Boiling Water Reactor Reload Fuel," ABB Combustion Engineering Nuclear Operations, CENPD-300-P-A, Revision 0, July 1996.
2. Nuclear Fuel Section Vendor Technical Document, NFVD-AB-2003-001-00, "HCGS Cycle 12 Reload Licensing Report," Westinghouse Electric Company LLC, WCAP-16016 Rev. 0, February 2003.
3. Nuclear Fuel Section Design Input File, HCA.5-0039, "Cycle 10 GE9B Operating Limit and COLR Related Information."
4. Nuclear Fuel Section Vendor Technical Document, NFVD-AB-2003-003-00, "Conditions for Design: PSEG Nuclear LLC: Hope Creek: Cycle 12 Reload Analysis," Westinghouse Electric Company LLC, WCAP -16048 Rev. 0, April 2003.
5. "General Electric Standard Application for Reactor Fuel," General Electric Company, NEDE-24011-P-A, Revision 13, August 1996, and the U.S. Supplement NEDE-24011-P-A-US, Revision 13, August 1996.
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7. Nuclear Fuel Section Vendor Technical Document, NFVD-AB-2000-003-00, "HCGS Cycle 10 Core Design Report" ABB Combustion Engineering Nuclear Power, CE NPSD-860-P Rev. 1, January 2000.
8. Nuclear Fuel Section Vendor Technical Document, NFVD-AB-2001-007-01, "HCGS Cycle 11 Core Design Report" Westinghouse Electric Company LLC, CE NPSD-882-P Rev.1, July 2001.
9. Nuclear Fuel Section Vendor Technical Document, NFVD-AB-2002-007-02, "HCGS Cycle 12 Core Design Report" Westinghouse Electric Company LLC, Rev. 2, February 2003.