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CORE OPERATING LIMITS REPORT
HOPE CREEK GENERATING STATION
CYCLE 6 / RELOAD 5

February 15, 1994

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1.0 INTRODUCTION

The purpose of this report is to provide a description of the Core Operating Limits for the Hope Creek Generating Station Unit 1 Cycle 6 operation. The specific parameter limits are : Average Planar Linear Heat Generation Rate (APLHGR); Minimum Critical Power Ratio (MCPR); Flow Adjustment Factor, K_f ; and Linear Heat Generation Rate (LHGR). These values have been determined using NRC-approved methodology (REF. 1) and are established such that all applicable limits, namely; fuel thermal-mechanical, core thermal-hydraulic, ECCS, and nuclear limits such as shutdown margin, and transient and accident analysis limits; of the plant safety analysis are met.

This report is intended to be used for operation of the Hope Creek reactor core and for the training of the operations staff with respect to the cycle specific aspects of core operation.

The Hope Creek Technical Specifications references this report as the source for certain LIMITING CONDITIONS FOR OPERATION. These are included in section 2 of this document.

This document is specific to Hope Creek Cycle 6 / Reload 5 and shall not be applicable to any other core or cycle design.

2.0 LIMITING CONDITIONS FOR OPERATION

The LIMITING CONDITIONS FOR OPERATION presented in this section are referenced by the Hope Creek Technical Specifications.

| <u>Tech. Spec</u> | <u>Title</u> |
|-------------------|--|
| 3/4.2.1 | Average Planar Linear Heat Generation Rate |
| 3/4.2.3 | Minimum Critical Power Ratio |
| 3/4.2.4 | Linear Heat Generation Rate |

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 this report.

All APLHGRs for bundle type P8CRB300L as a function of AVERAGE PLANAR EXPOSURE shall not exceed the limits shown in Figure 2-1. When hand calculations are required, the APLHGRs for each lattice type (excluding natural Uranium) in bundle P8CWB325-11GZ2, P8CWB325-11GZ1 and P8CWB324-9GZ1 as a function of AVERAGE PLANAR EXPOSURE shall not exceed the limits shown in Figure 2-2, Figure 2-3, and Figure 2-4, respectively. The limits of these figures shall be reduced to a value of 0.86 times the two recirculation loop operation limit when in single recirculation loop operation.

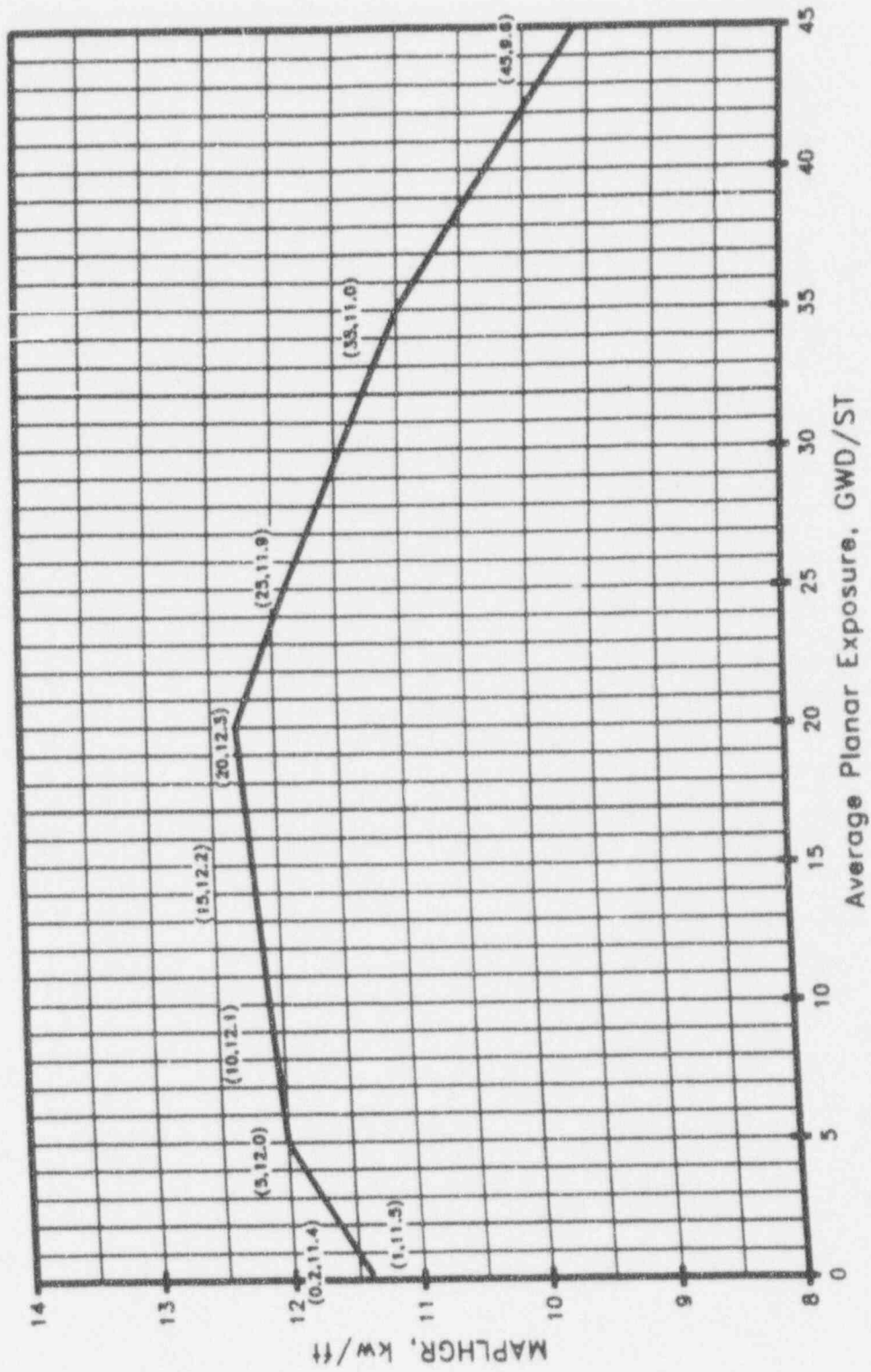


Fig. 2-1 MAPLHGR Versus Exposure for Fuel Bundle Type P8CRB300L

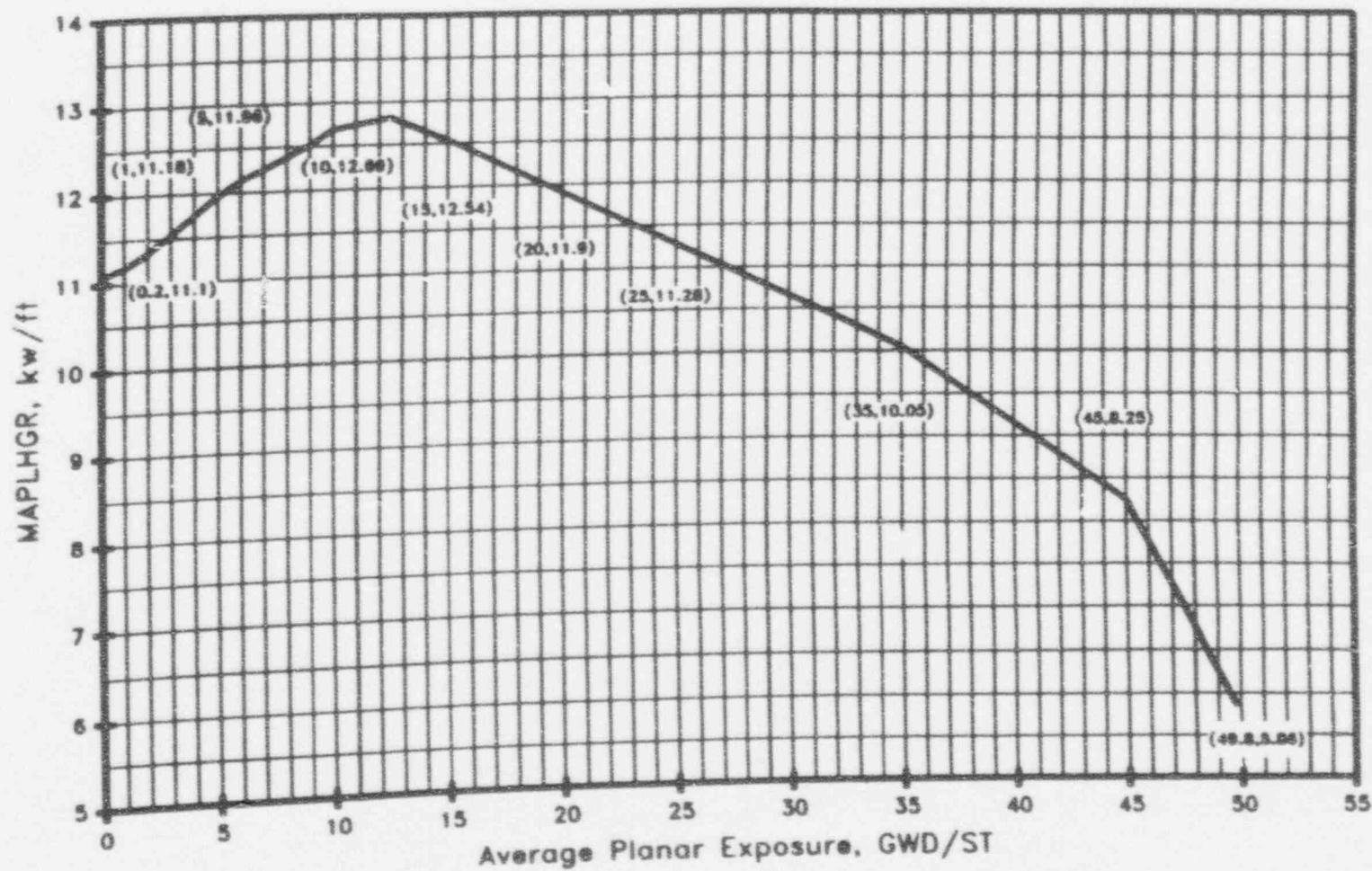


Fig. 2-2 MAPLHGR Versus Exposure for the Most Limiting Lattice
of Fuel Bundle Type P8CWB325-11GZ2

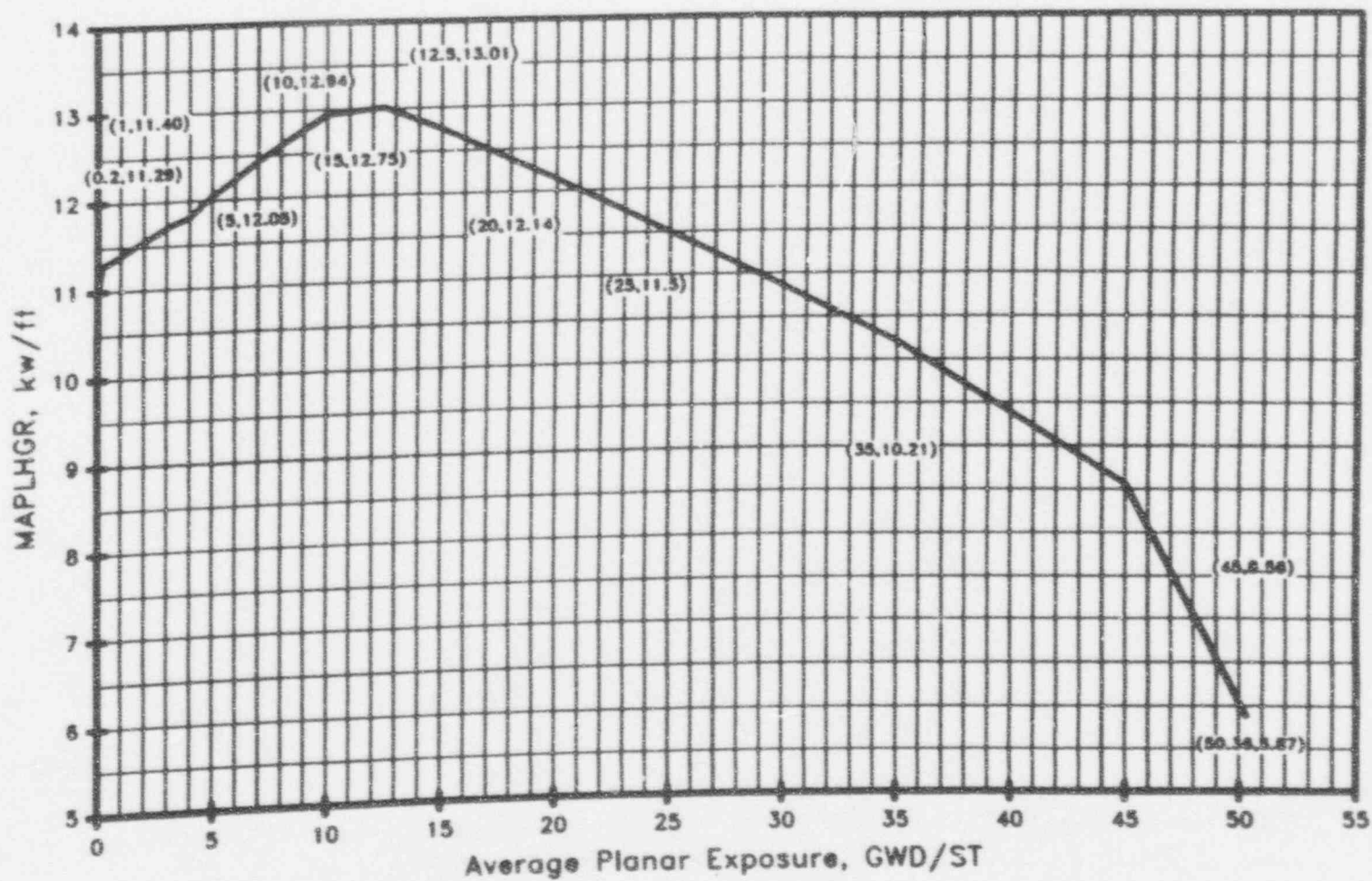


Fig. 2-3 MAPLHGR Versus Exposure for the Most Limiting Lattice
of Fuel Bundle Type P8CWB325-11GZ1

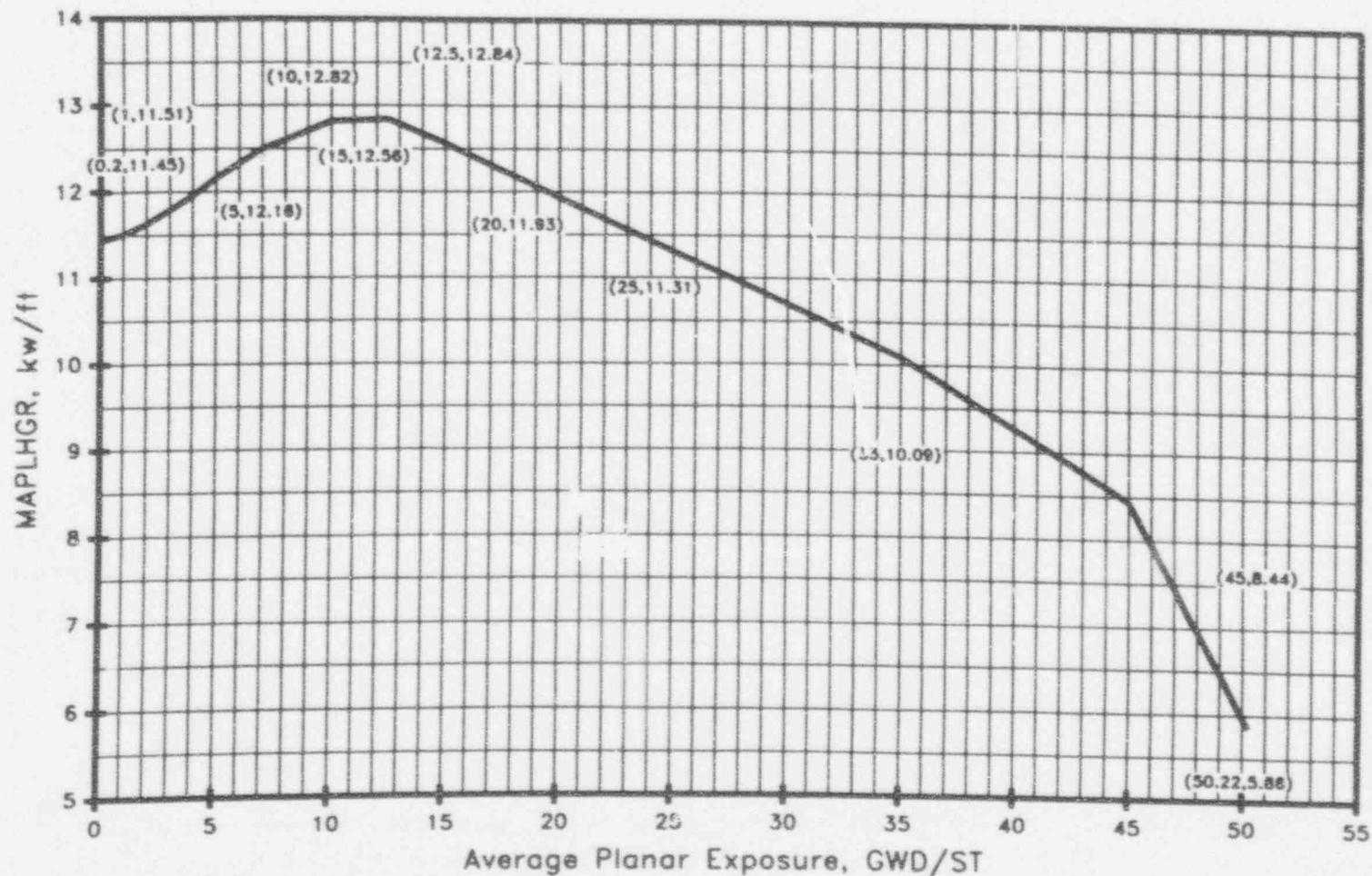


Fig. 2-4 MAPLHGR Versus Exposure for the Most Limiting Lattice of Fuel Bundle Type P8CWB324-9GZ1

2.2 MINIMUM CRITICAL POWER RATIO

LIMITING CONDITION FOR OPERATION: The MINIMUM CRITICAL POWER RATIO (MCPR) shall be equal to or greater than the CPR limit times the k_f curve.

The CPR limit is shown in Figure 2-5 for GE9B bundles and in Figure 2-6 for GE7B bundles. The K_f curve is shown in Figure 2-7.

It requires an adjustment to the K_f values for bundle flows below 0.4 Mlb/ft²-hr, this adjustment is incorporated in Fig. 2-7. It also requires the incorporation of a 3% adjustment factor if inlet subcooling exceeds 70 Btu/lbm.

The CPR limit is a function of Core Average Exposure, and core average scram speed, τ (Tau), defined by Technical Specification 3.2.3.

End-of-Cycle Recirculation Pump Trip system status is defined operable or inoperable per Technical Specification 3.3.4.2.

Main Turbine Bypass must be operable per Technical Specification 3.7.7.

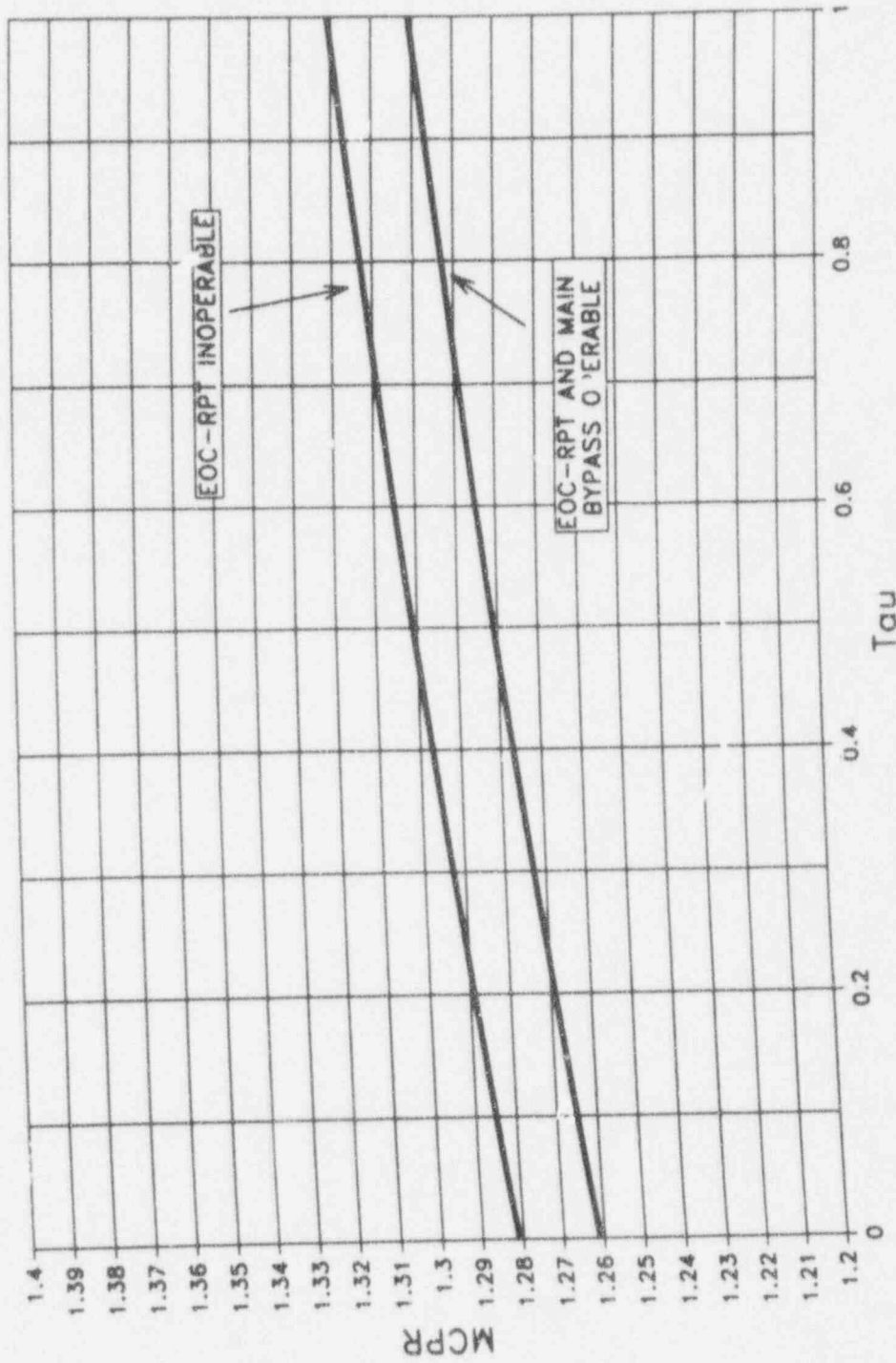


Fig. 2-5 MCPR Versus Tau At Rated Flow For Fuel Bundle Type GE9B From BOC To EOC

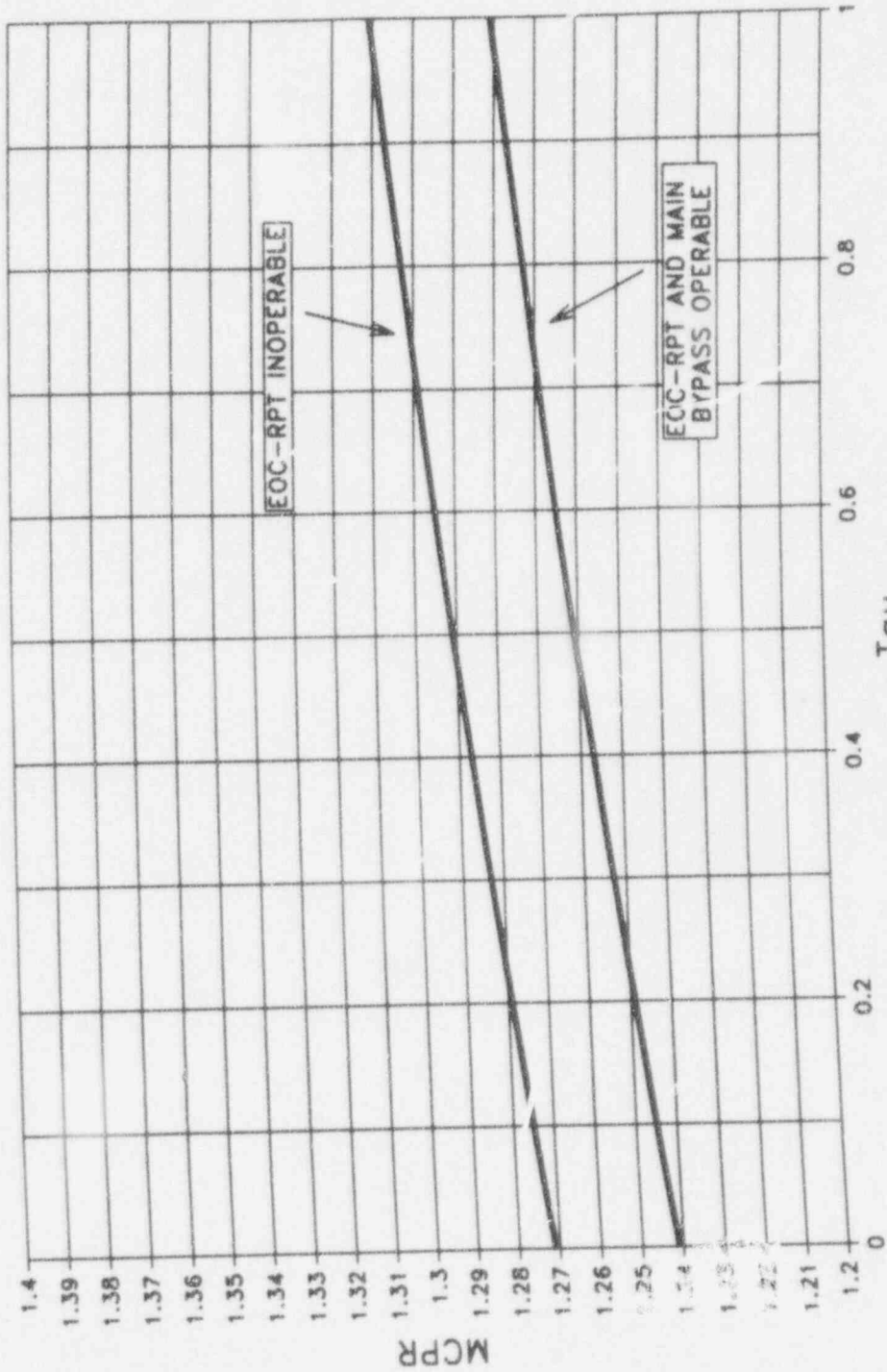


Fig. 2-6 MCPR Versus Tau At Rated Flow For Fuel Bundle Type GE7B From BOC To EOC

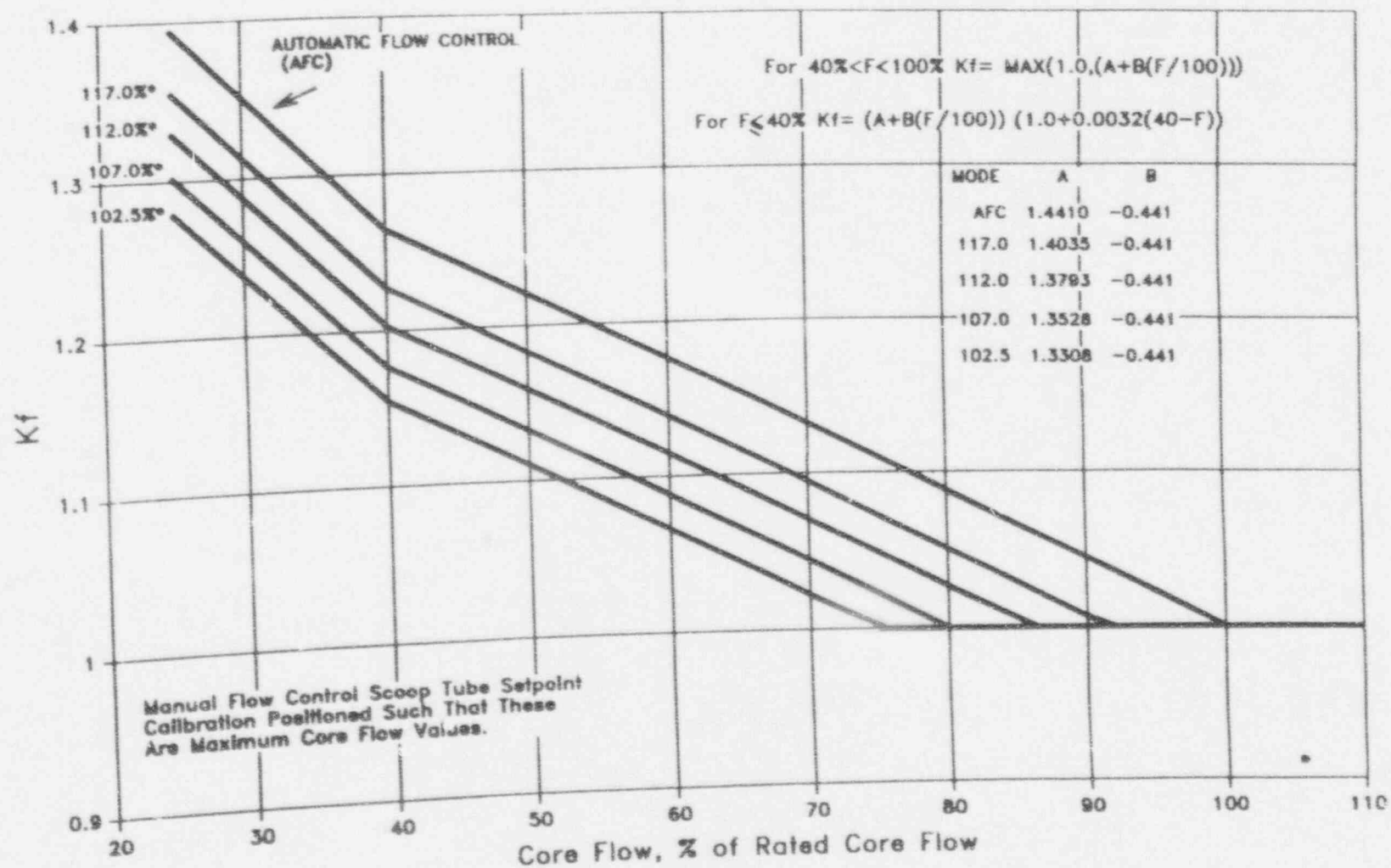


Fig. 2-7 Kf Versus Core Flow

2.3 LINEAR HEAT GENERATION RATE

LIMITING CONDITION FOR OPERATION : The LINEAR HEAT GENERATION RATE (LHGR) for each type of fuel shall not exceed the applicable limits:

TABLE 2-1 LHGR Limits

| <u>Fuel Type</u> | <u>LHGR Limit (Kw/ft)</u> |
|---------------------|---------------------------|
| GE7B-P8CRB300L | 13.4 |
| GE9B-P8CWB325-11GZ1 | 14.4 |
| GE9B-P8CWB325-11GZ2 | 14.4 |
| GE9B-P8CWB324-9GZ1 | 14.4 |

3.0 REFERENCES

1. "General Electric Standard Application For Reactor Fuel", NEDE-24011-P-A, Revision 10, February, 1991.
2. R.B. Linford, "Analytical Methods of Plant Transient Evaluation for the GE BWR", NEDO-10802, February 1973.
3. "Qualification of the One Dimensional Core Transient Model for Boiling Water Reactors", NEDO-24154, October 1978.
4. A.D.Vaughn (General Electric) to E.S. Rosenfeld (PSE&G), "MAPLHGR Limits for Hope Creek Reload 1 Fuel Assemblies", December 8, 1987, NFUI-87-552.
5. A.D.Vaughn (General Electric) to E.S. Rosenfeld (PSE&G), "Hope Creek Reload 3 GE9B Fuel Data", November 19, 1990, NFUI 90-437.
6. "General Electric Standard Application For Reactor Fuel", Safety Evaluation Report For Application of Amendment 15, NEDE-24011-P-A, Revision 9, September, 1988.
7. NFU-VTDGE93-076-00, "Supplemental Reload Licensing Submittal for Hope Creek Generating Station Unit 1, Reload 5 Cycle 6", General Electric Company, 23A7219, Rev 0, November, 1993.
8. NFU-VTDGE93-077-00, "Lattice-Dependent MAPLHGR Report for Hope Creek Generating Station Unit 1, Reload 5, Cycle 6", 23A7219AA, Rev.0, November, 1993

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Appendix A

Bundle Descriptions And Composite MAPLHGRs For Fuel Bundle

GE9B-P8CWB325-11GZ1-80M-150T and GE9B-P8CWB325-11GZ2-80M-150T

A.1 Bundle Descriptions:

The axial locations of each lattice for fuel bundle GE9B-P8CWB325-11GZ1-80M-150T and GE9B-P8CWB325-11GZ2-80M-150T are shown in Fig. A-1 and Fig. A-2 respectively. The description of lattice types in GE9B-P8CWB325-11GZ1-80M-150T is shown in Table A-1. The description of lattice types in GE9B-P8CWB325-11GZ2-80M-150T is shown in Table A-2.

A.2 Composite MAPLHGRs

The composite MAPLHGR of each lattice type in bundle GE9B-P8CWB325-11GZ1-80M-150T is shown in Table A-3 through Table A-8. The composite MAPLHGR of each lattice type in bundle GE9B-P8CWB325-11GZ2-80M-150T is shown in Table A-9 through Table A-14.

A.3 References

1. Letter from A. D. Vaughn to E. S. Rosenfeld, "Bundle Design Report For GE9B-P8CWB325-11GZ1-80M-150T", NFUI 90-099, May 1990
2. Letter from A. D. Vaughn to E. S. Rosenfeld, "Bundle Design Report For GE9B-P8CWB325-11GZ2-80M-150T", NFUI 90-100, May 1990
3. Letter from A. D. Vaughn to E. S. Rosenfeld, "Hope creek Reload 3 GE 9B Fuel Data", NFUI 90-437, November 19, 1990

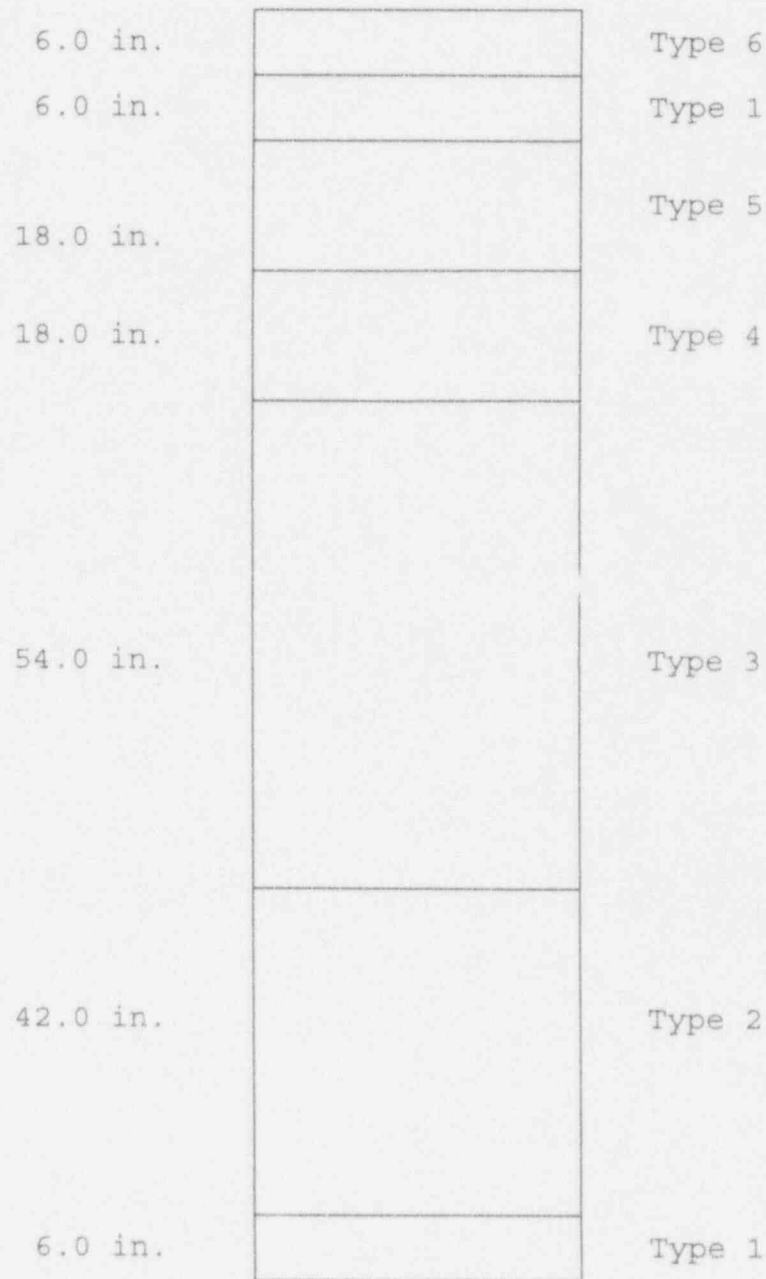


Fig. A-1 Axial Location of Fuel Lattices for
Bundle GE9B-P8CWB325-11GZ1-80M-150-T

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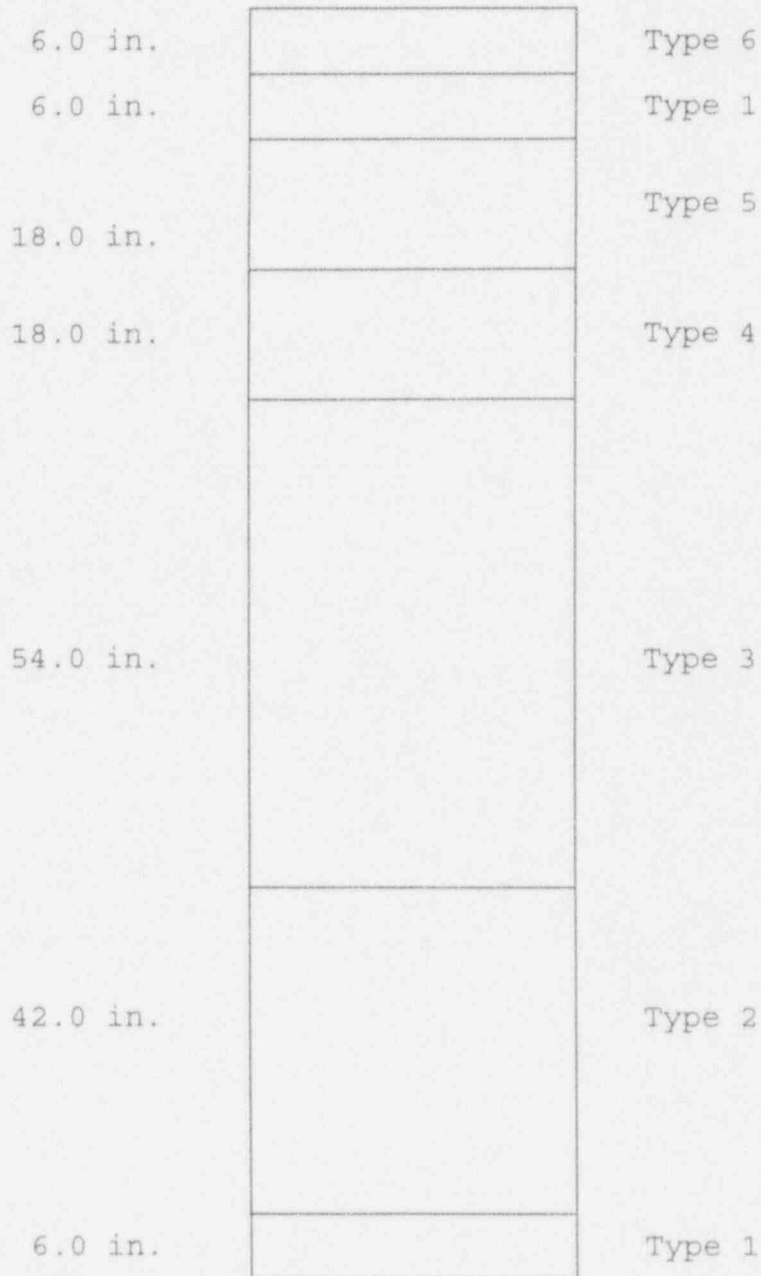


Fig. A-2 Axial Location of Fuel Lattices for
Bundle GE9B-P8CWB325-11GZ2-80M-150-T

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Table A-1 Lattice Descriptions in Fuel bundle GE9B-P8CWB325-
11GZ1-80M-150-T

| Lattice Type | Description |
|--------------|----------------------------|
| 1 | P8CWL071-NOG-80M-T |
| 2 | P8CWL349-5G5.0/4G4.0-80M-T |
| 3 | P8CWL366-9G4.0-80M-T |
| 4 | P8CWL366-2G5.0/9G4.0-80M-T |
| 5 | P8CWL349-9G4.0-80M-T |
| 6 | P8CWL071-11GE-80M-T |

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Table A-2 Lattice Descriptions in Fuel bundle GE9B-P8CWB325-
11GZ2-80M-150-T

| Lattice Type | Description |
|--------------|----------------------------|
| 1 | P8CWL071-NOG-80M-T |
| 2 | P8CWL350-9G5.0-80M-T |
| 3 | P8CWL366-7G5.0/2G4.0-80M-T |
| 4 | P8CWL366-9G5.0/2G4.0-80M-T |
| 5 | P8CWL350-7G5.0/2G4.0-80M-T |
| 6 | P8CWL071-11GE1-80M-T |

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Table A-3 Composite MAPLHGR Versus Exposure for Lattice P8CWL071-
NOG-80M-T (Type 1) in Bundle GE9B-P8CWB325-11GZ1-80M-
150-T

Exposure, GWD/ST

Composite MAPLHGR, Kw/ft

(GE23A6526AA
Pg.6)

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Table A-4 Composite MAPLHGR Versus Exposure for Lattice P8CWL349-
5G5.0/4G4.0-80M-T (Type 2) in Bundle GE9B-P8CWB325-
11GZ1-80M-150-T

Exposure, GWD/ST

Composite MAPLHGR, Kw/ft

(GE23A6526AA
Pg.6)

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Table A-5 Composite MAPLHGR Versus Exposure for Lattice P8CWL366-9G4.0-80M-T (Type 3) in Bundle GE9B-P8CWB325-11GZ1-80M-150-T

Exposure, GWD/ST

Composite MAPLHGR, Kw/ft

(GE23A6526AA
Pg.6)

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Table A-6 Composite MAPLHGR Versus Exposure for Lattice P8CWL366-
2G5.0/9G4.0-80M-T (Type 4) in Bundle GE9B-P8CWB325-
11GZ1-80M-150-T

Exposure, GWD/ST

Composite MAPLHGR, Kw/ft

(GE23A6526AA
Pg.6)

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Table A-7 Composite MAPLHGR Versus Exposure for Lattice P8CWL349-9G4.0-80M-T (Type 5) in Bundle GE9B-P8CWB325-11GZ1-80M-150-T

Exposure, GWD/ST

Composite MAPLHGR, Kw/ft

(GE23A6526AA
Pg.6)

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Table A-8 Composite MAPLHGR Versus Exposure for Lattice P8CWL071-
11GE-80M-T (Type 6) in Bundle GE9B-P8CWB325-11GZ1-80M-
150-T

Exposure, GWD/ST

Composite MAPLHGR, Kw/ft

(GE23A6526AA
Pg.6)

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Table A-9 Composite MAPLHGR Versus Exposure for Lattice P8CWL071-
NOG-80M-T (Type 1) in Bundle GE9B-P8CWB325-11GZ2-80M-
150-T

Exposure, GWD/ST

Composite MAPLHGR, Kw/ft

(GE23A6526AA
Pg.7)

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Table A-10 Composite MAPLHGR Versus Exposure for Lattice
P8CWL350-9G5.0-80M-T (Type 2) in Bundle GE9B-P8CWB325-
11GZ2-80M-150-T

Exposure, GWD/ST

Composite MAPLHGR, Kw/ft

(GE23A6526AA
Pg. 7)

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Table A-11 Composite MAPLHGR Versus Exposure for Lattice
P8CWL366-7G5.0/2G4.0-80M-T (Type 3) in Bundle GE9B-
P8CWB325-11GZ2-80M-150-T

Exposure, GWD/ST

Composite MAPLHGR, Kw/ft

(GE23A6526AA
Pg.7)

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Table A-12 Composite MAPLHGR Versus Exposure for Lattice
P8CWL366-9G5.0/2G4.0-80M-T (Type 4) in Bundle GE9B-
P8CWB325-11GZ2-80M-150-T

Exposure, GWD/ST

Composite MAPLHGR, Kw/ft

(GE23A6526AA
Pg.7)

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Table A-13 Composite MAPLHGR Versus Exposure for Lattice
P8CWL350-7G5.0/2G4.0-80M-T (Type 5) in Bundle GE9B-
P8CWB325-11GZ2-80M-150-F

Exposure, GWD/ST

Composite MAPLHGR, Kw/ft

(GE23A6526AA
Pg.7)

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Table A-14 Composite MAPLHGR Versus Exposure for Lattice
P8CWL071-11GE1-80M-T (Type 6) in Bundle GE9B-P8CWB325-
11GZ2-80M-150-T

Exposure, GWD/ST

Composite MAPLHGR, Kw/ft

(GE23A6526AA
Pg.7)

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Appendix B

Bundle Descriptions And Composite MAPLHGRs For Fuel Bundle

GE9B-P8CWB324-9GZ1-80M-150T

B.1 Bundle Descriptions:

The axial locations of each lattice for fuel bundle GE9B-P8CWB324-9GZ1-80M-150T is shown in Fig. B-1. The description of lattice types in GE9B-P8CWB324-9GZ1-80M-150T is shown in Table B-1.

B.2 Composite MAPLHGRs

The composite MAPLHGR of each lattice type in bundle GE9B-P8CWB324-9GZ1-80M-150T is shown in Table B-2 through Table B-5.

B.3 References

1. Letter from L. F. Rubino to E. S. Rosenfeld, "Transmittal of Hope Creek Reload 5 Licensing Documents", NFSI 93-626, October, 1993

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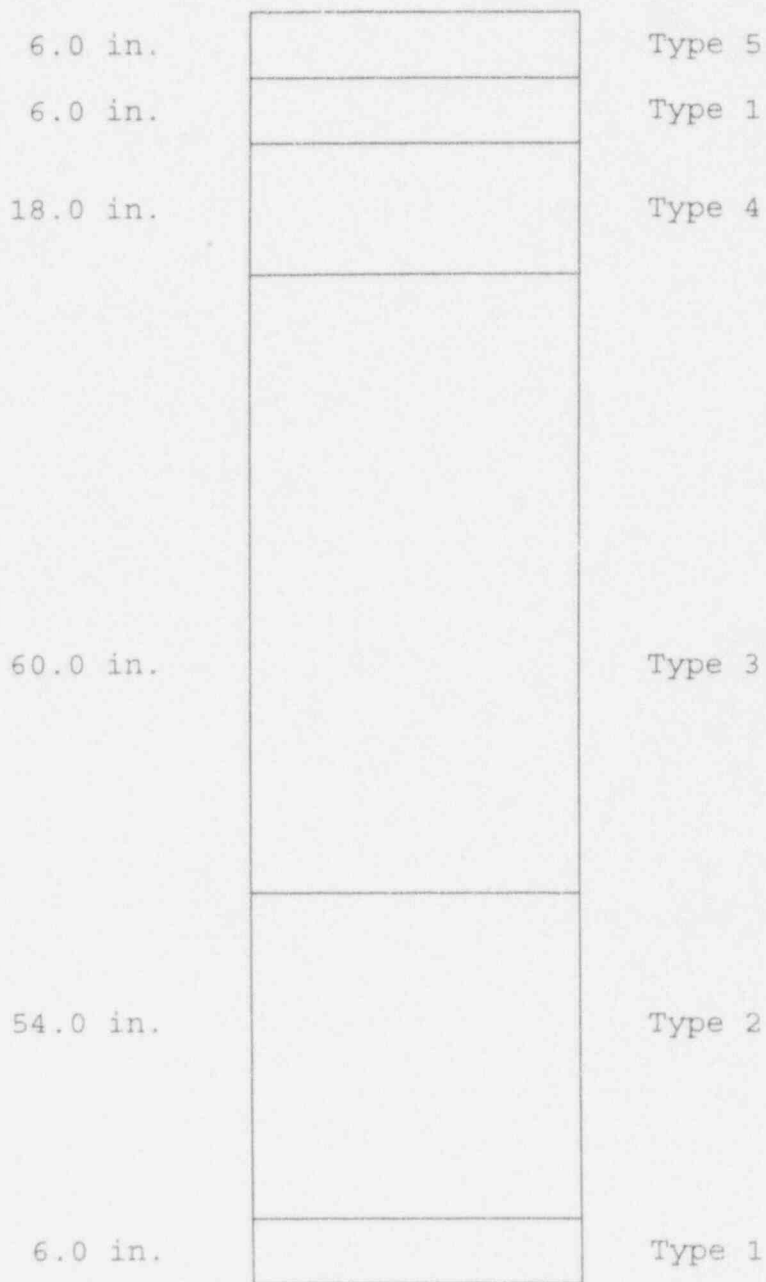


Fig. B-1 Axial Location of Fuel Lattices for
Bundle GE9B-P8CWB324-9GZ1-80M-150-T

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Table B-1 Lattice Descriptions in Fuel bundle GE9B-P8CWB324-
9GZ1-80M-150-T

| Lattice Type | Description |
|--------------|-------------|
| 1 | 732 |
| 2 | 1046 |
| 3 | 1047 |
| 4 | 1770 |
| 5 | 1757 |

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Table B-2 Composite MAPLHGR Versus Exposure for Lattice
732 & 1757 (Type 1 and 5) in Bundle GE9B-
P8CWB324-9GZ1-80M-150-T

Exposure, GWD/ST

Composite MAPLHGR, Kw/ft

(GE23A7219AA
Pg.6)

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Table B-3 Composite MAPLHGR Versus Exposure for Lattice
1046 (Type 2) in Bundle GE9B-P8CWB324-9GZ1-80M-150-T

Exposure, GWD/ST

Composite MAPLHGR, Kw/ft

(GE23A7219AA
Pg.6)

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Table B-4 Composite MAPLHGR Versus Exposure for Lattice
1047 (Type 3) in Bundle GE9B-P8CWB324-9GZ1-80M-150-T

Exposure, GWD/ST

Composite MAPLHGR, Kw/ft

(GE23A7219AA
Pg.6)

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Table B-5 Composite MAPLHGR Versus Exposure for Lattice
1770 (Type 4) in Bundle GE9B-P8CWB324-9GZ1-80M-150-T

Exposure, GWD/ST

Composite MAPLHGR, Kw/ft

(GE23A7219AA
Pg.6)