

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

September 20, 1995

PREPARED BY: *J. M. Haun* DATE: 9/20/95
J. M. Haun
Senior Staff Engineer

REVIEWED BY: *Francis J. Safin* DATE: 9/25/95
F. J. Safin
Senior Staff Engineer

CONCURRED BY: *R. S. Kent* DATE: 9/25/95
R. S. Kent
Nuclear Fuels Engineer

APPROVED BY: *R. S. Kent / E. S. Rosenfeld* DATE: 9/25/95
E. S. Rosenfeld
Manager - Nuclear Fuel

TABLE OF CONTENTS

<u>SECTION</u>	<u>TITLE</u>	<u>PAGE</u>
1.0	Introduction	6
2.0	Limiting Conditions for Operation	7
2.1	Maximum Average Planar Linear Heat Generation Rate	8
2.2	Minimum Critical Power Ratio	13
2.3	Linear Heat Generation Rate	17
3.0	References	18

Appendix A

Appendix B

LIST OF FIGURES

<u>NUMBER</u>	<u>TITLE</u>	<u>PAGE</u>
2-1	MAPLHGR Versus Exposure for Fuel Bundle Type P8CRB300L	9
2-2	MAPLHGR Versus Exposure for the Most Limiting Lattice of Fuel Bundle Type P8CWB325-11GZ2	10
2-3	MAPLHGR Versus Exposure for the Most Limiting Lattice of Fuel Bundle Type P8CWB325-11GZ1	11
2-4	MAPLHGR Versus Exposure for the Most Limiting Lattice of Fuel Bundle Type P8CWB325-9GZ1	12
2-5	MCPR Versus Tau At 105% Flow For Fuel Bundle Type GE9B For Cycle Extension Operation	14
2-6	MCPR Versus Tau At 105% Flow For Fuel Bundle Type GE7B For Cycle Extension Operation	15
2-7	K_f Versus Core Flow	16

LIST OF TABLES

<u>NUMBER</u>	<u>TITLE</u>	<u>PAGE</u>
2-1	LHGR Limits	15
A-1	Lattice Descriptions in Fuel bundle GE9B-P8CWB325-11GZ1-80M-150-T	A-4
A-2	Lattice Descriptions in Fuel bundle GE9B-P8CWB325-11GZ2-80M-150-T	A-5
A-3	Composite MAPLHGR Versus Exposure for Lattice P8CWL071-NOG-80M-T (Type 1) in Bundle GE9B-P8CWB325-11GZ1-80M-150-T	A-6
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	A-7
A-5	Composite MAPLHGR Versus Exposure for Lattice P8CWL366-9G4.0-80M-T (Type 3) in Bundle GE9B-P8CWB325-11GZ1-80M-150-T	A-8
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	A-9
A-7	Composite MAPLHGR Versus Exposure for Lattice P8CWL349-9G4.0-80M-T (Type 5) in Bundle GE9B-P8CWB325-11GZ1-80M-150-T	A-10
A-8	Composite MAPLHGR Versus Exposure for Lattice P8CWL071-11GE-80M-T (Type 6) in Bundle GE9B-P8CWB325-11GZ1-80M-150-T	A-11
A-9	Composite MAPLHGR Versus Exposure for Lattice P8CWL071-NOG-80M-T (Type 1) in Bundle GE9B-P8CWB325-11GZ2-80M-150-T	A-12
A-10	Composite MAPLHGR Versus Exposure for Lattice P8CWL350-9G5.0-80M-T (Type 2) in Bundle GE9B-P8CWB325-11GZ2-80M-150-T	A-13

<u>NUMBER</u>	<u>TITLE</u>	<u>PAGE</u>
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	A-14
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	A-15
A-13	Composite MAPLHGR Versus Exposure for Lattice P8CWL350-7G5.0/2G4.0-80M-T (Type 5) in Bundle GE9B-P8CWB325-11GZ2-80M-150-T	A-16
A-14	Composite MAPLHGR Versus Exposure for Lattice P8CWL071-11GE1-80M-T (Type 6) in Bundle GE9B-P8CWB325-11GZ2-80M-150-T	A-17
B-1	Lattice Descriptions in Fuel bundle GE9B-P8CWB324-9GZ1-80M-150-T	B-3
B-2	Composite MAPLHGR Versus Exposure for Lattice 732 & 1757 (Type 1 and 5) in Bundle GE9B-P8CWB324-9GZ1-80M-150-T	B-4
B-3	Composite MAPLHGR Versus Exposure for Lattice 1046 (Type 2) in Bundle GE9B-P8CWB324-9GZ1-80M-150-T	B-5
B-4	Composite MAPLHGR Versus Exposure for Lattice 1047 (Type 3) in Bundle GE9B-P8CWB324-9GZ1-80M-150-T	B-6
B-5	Composite MAPLHGR Versus Exposure for Lattice 1770 (Type 4) in Bundle GE9B-P8CWB324-9GZ1-80M-150-T	B-7

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 extended operation for Cycle 6. 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 operating limit values have been determined using NRC approved methods contained in GESTAR-II, NEDE-24011-P-A-10, 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.

In addition a penalty of 0.021 has been added to the OLMCPR to account for the time varying axial power shape (TVAPS) effects on the transient analysis (Reference 10).

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 the Hope Creek Cycle 6 extension and is not applicable to any other core or cycle design. Cycle extension at Hope Creek is defined to start when rated power cannot be maintained by core flow (up to 105%) in the all-rods-out condition or when a cycle exposure of 10650 MWD/ST is achieved, whichever comes earliest. This report must be in effect prior to the start of the cycle extension, however because the operating limits reported in this revision are more limiting than those in Revision 0, the new limits can be implemented in the plant anytime after the issuance of this document.

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

All APLHGRs for bundle types P8CWB325-11GZ2, P8CWB325-11GZ1 and P8CWB324-9GZ1 for each axial location as a function of AVERAGE PLANAR EXPOSURE shall not exceed the limits shown in Appendix A Tables A3 to A14 and Appendix B Tables B2 to B5, respectively.

NOTE

The APLHGRs for the P8CWB fuel types are included in Appendix A and B to accommodate GE proprietary considerations. The Appendices will be identified to contain GE proprietary data and handled accordingly by the NRC when they receive their copy of the COLR report.

The APLHGR LCOs contained in Appendix A and B shall have the same consideration and treatment by PSE&G personnel as if they were in the body of the COLR. In addition, note that the APLHGR LCOs in the appendices are established in the NSSS computer for thermal limits monitoring via approved plant procedures

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

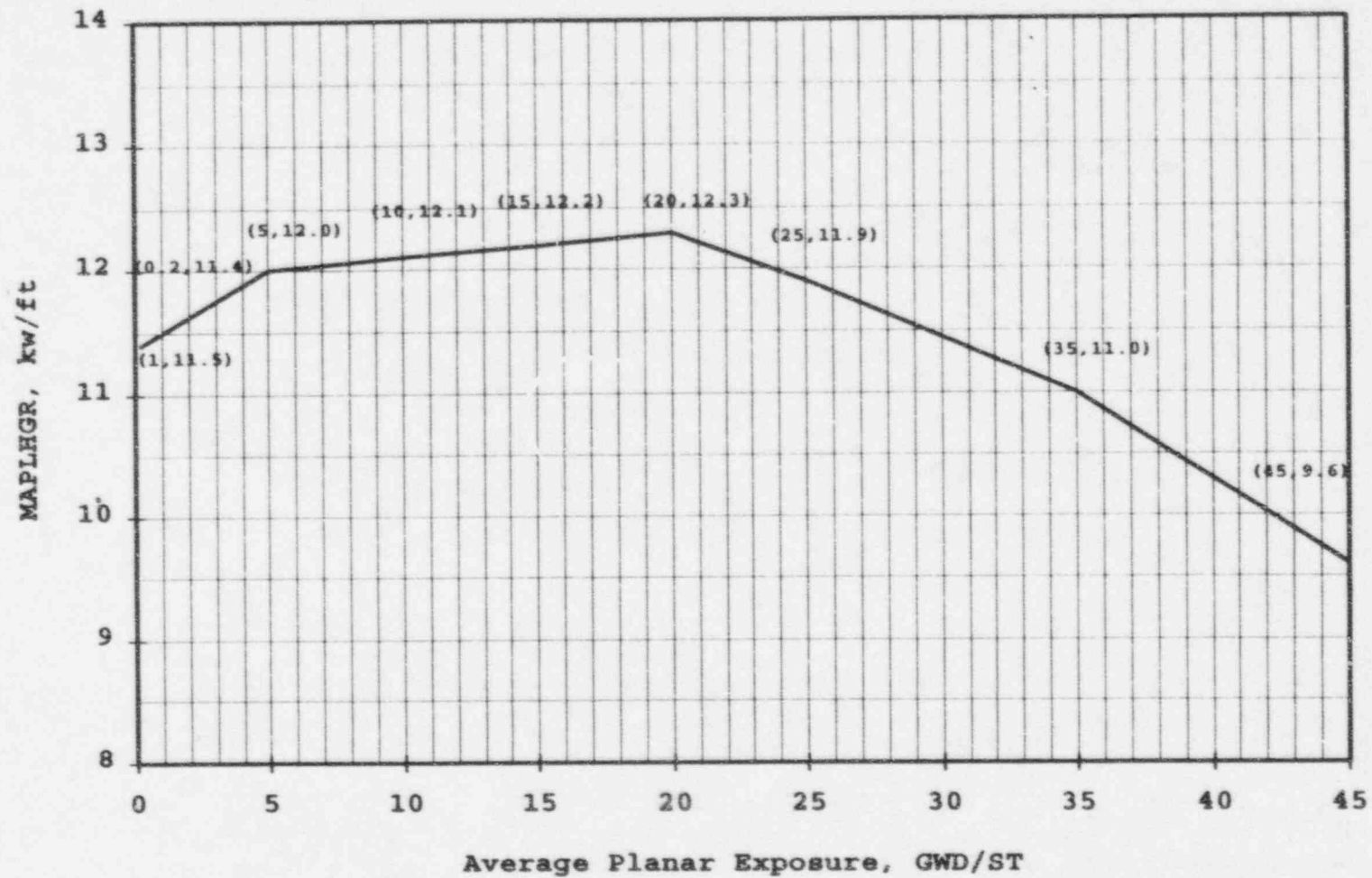


Fig. 2-1 MAPLHGR Vs Exposure for Fuel Bundle Type P8CRB300L

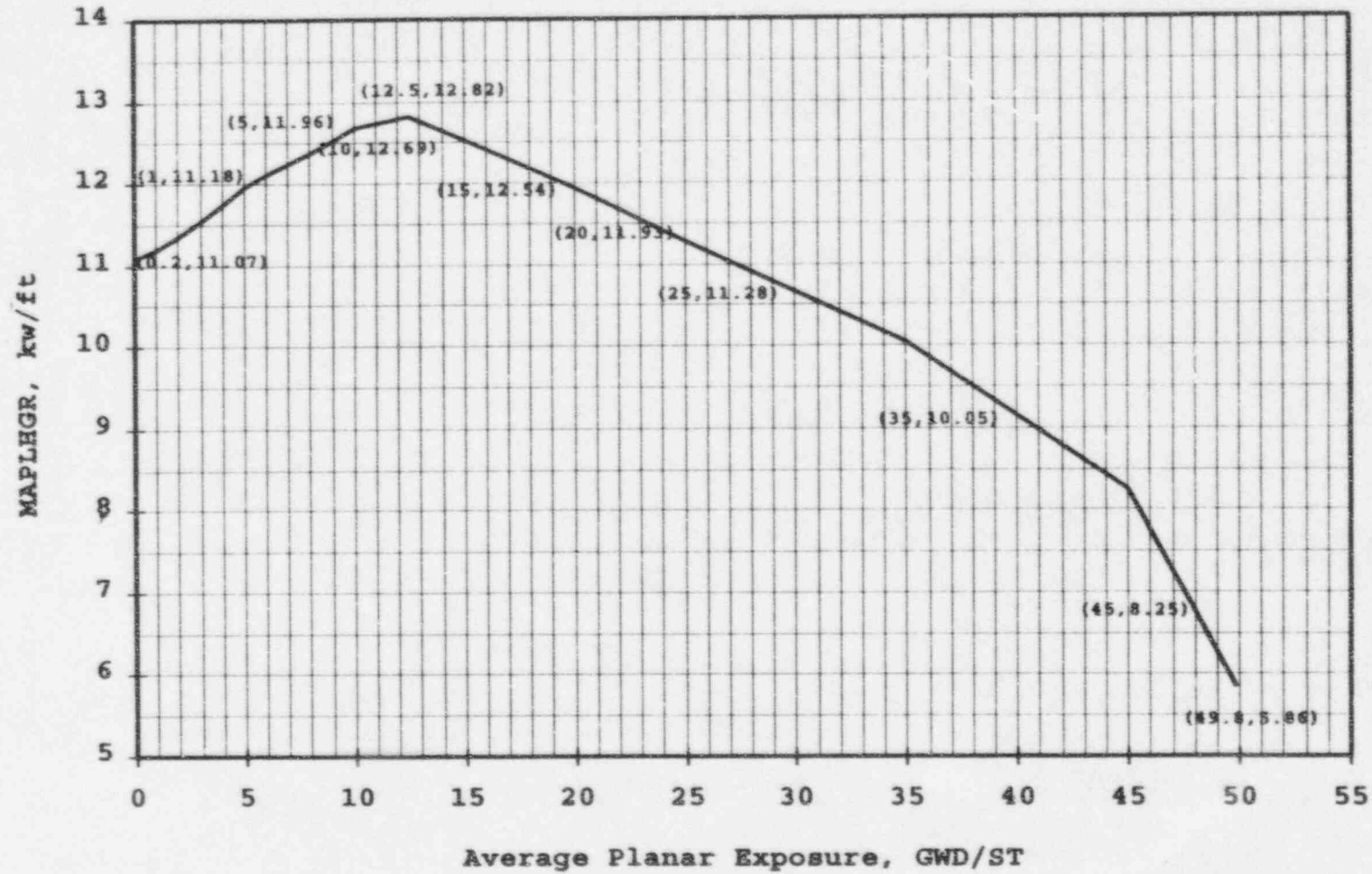


Fig. 2-2 MAPLHGR Vs Exposure for the Most Limiting Lattice
of Fuel Bundle Type P8CWB325-11GZ2

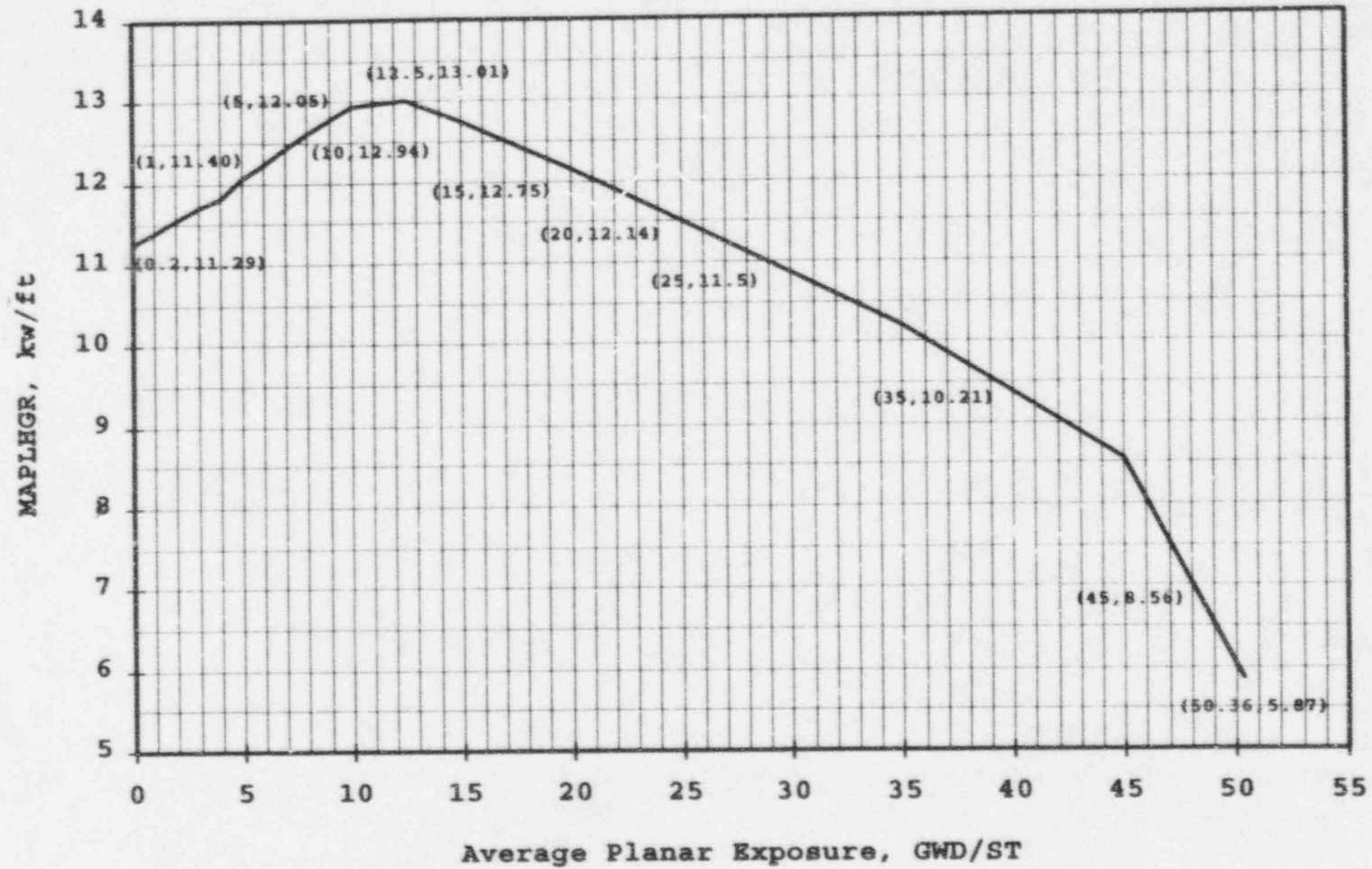


Fig. 2-3 MAPLHGR Vs Exposure for the Most Limiting Lattice
of Fuel Bundle Type P8CWB325-11GZ1

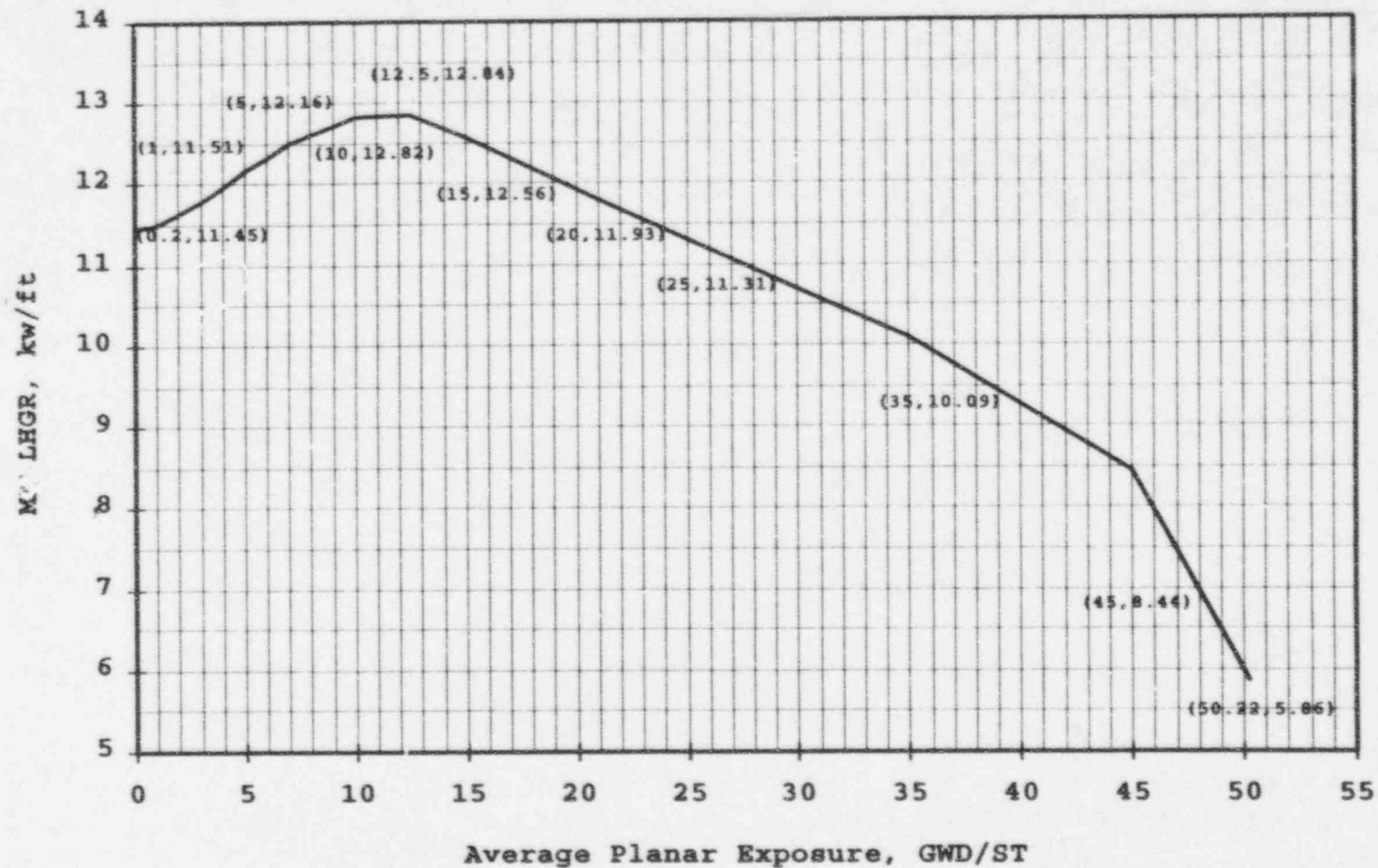


Fig. 2-4 MAPLHGR Vs Exposure for the Most Limiting Lattice
of Fuel Bundle Type P8CWB324-9GZ1

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.

The K_f curve requires an adjustment be made to the CPR limit for bundle flows below $0.4 \text{ Mlb/ft}^2\text{-hr}$, this adjustment is incorporated in Fig. 2-7.

Also the CPR limit must be increased by 3% if the 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.

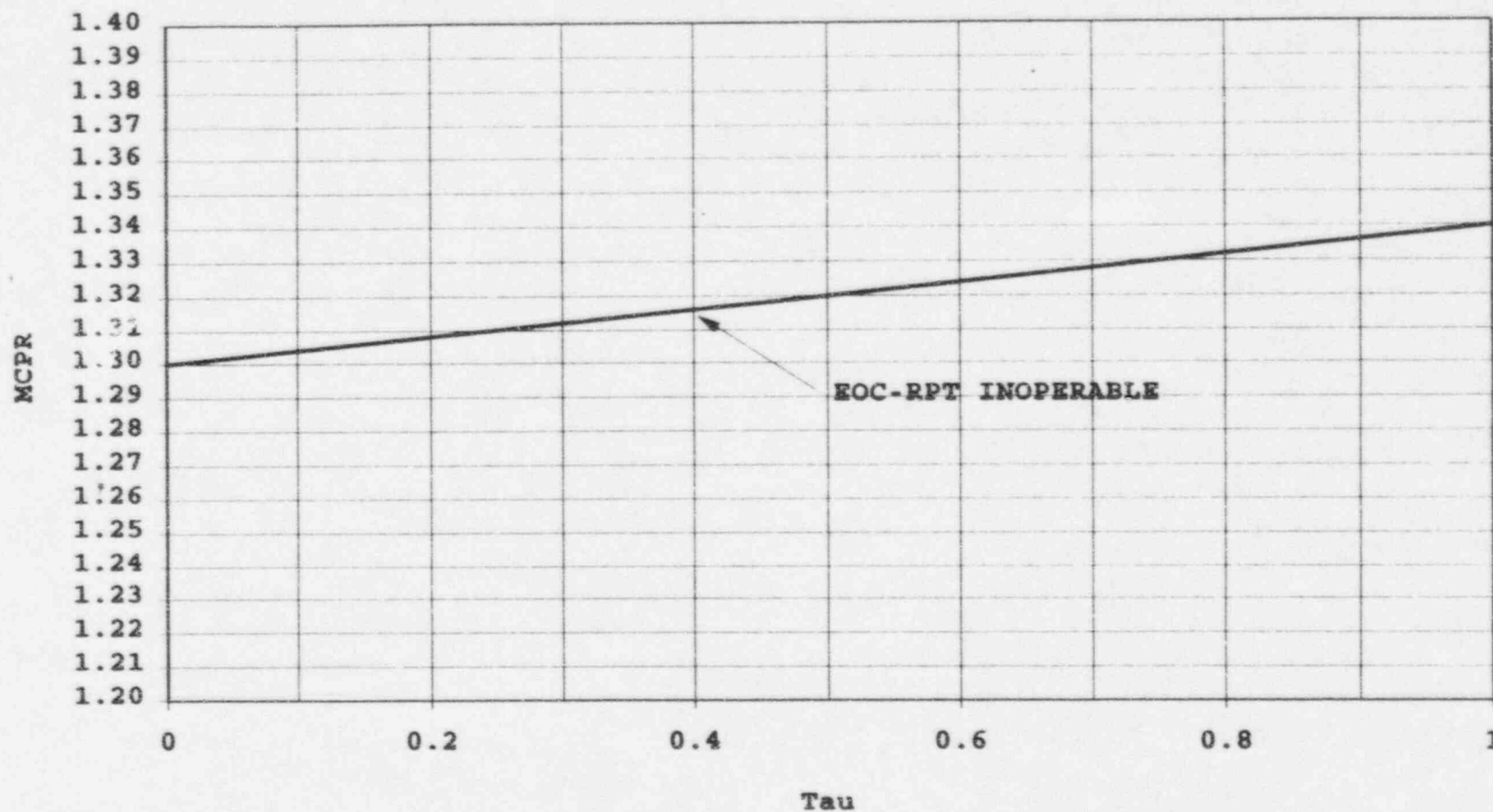


Fig. 2-5 MCPR Vs Tau at 105% Rated Flow for Fuel Bundle Type GE9B
From BOC to EOC

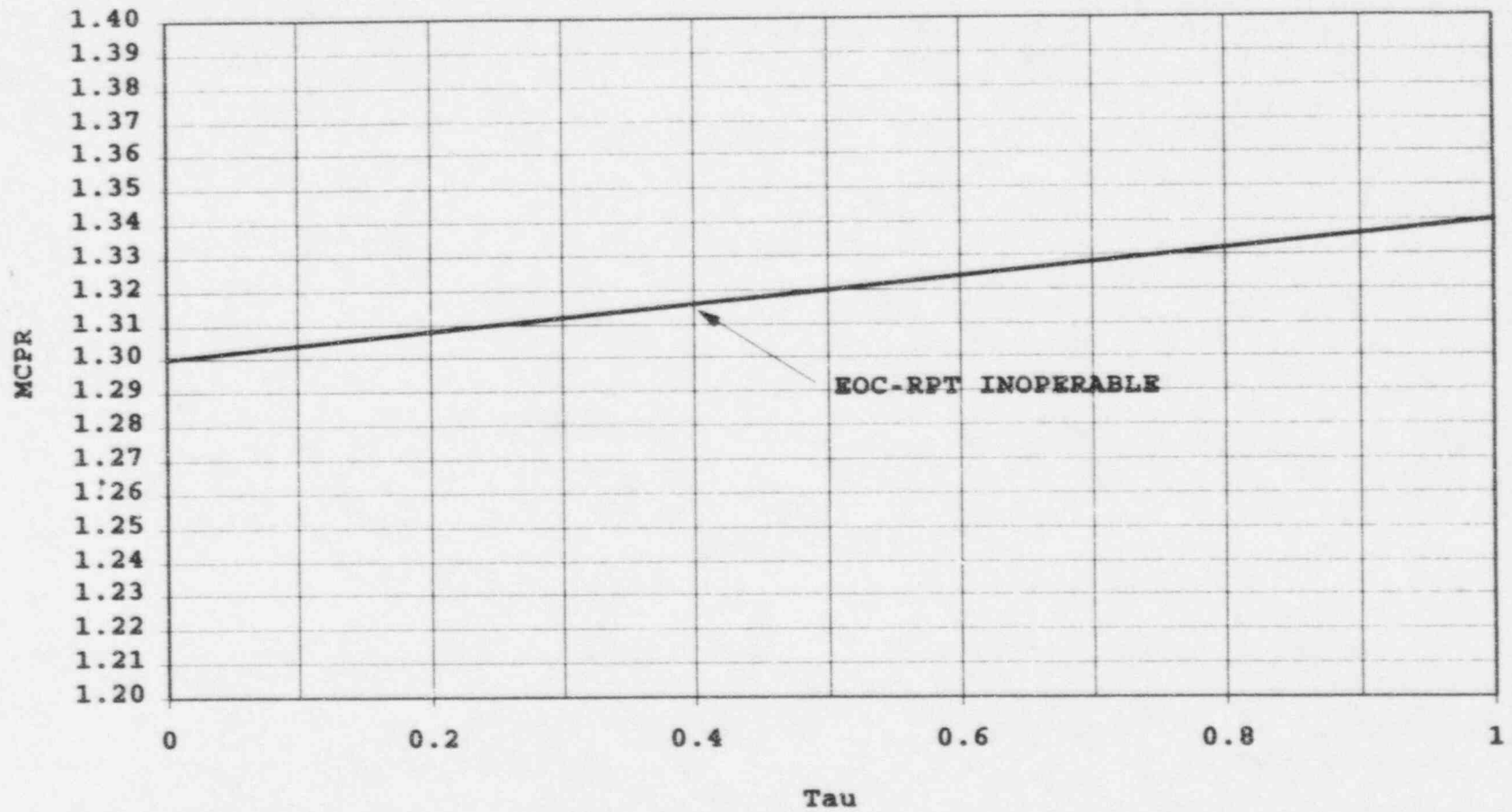


Fig. 2-6 MCPR Vs Tau at 105% Rated Flow for Fuel Bundle Type GE7B
From BOC to EOC

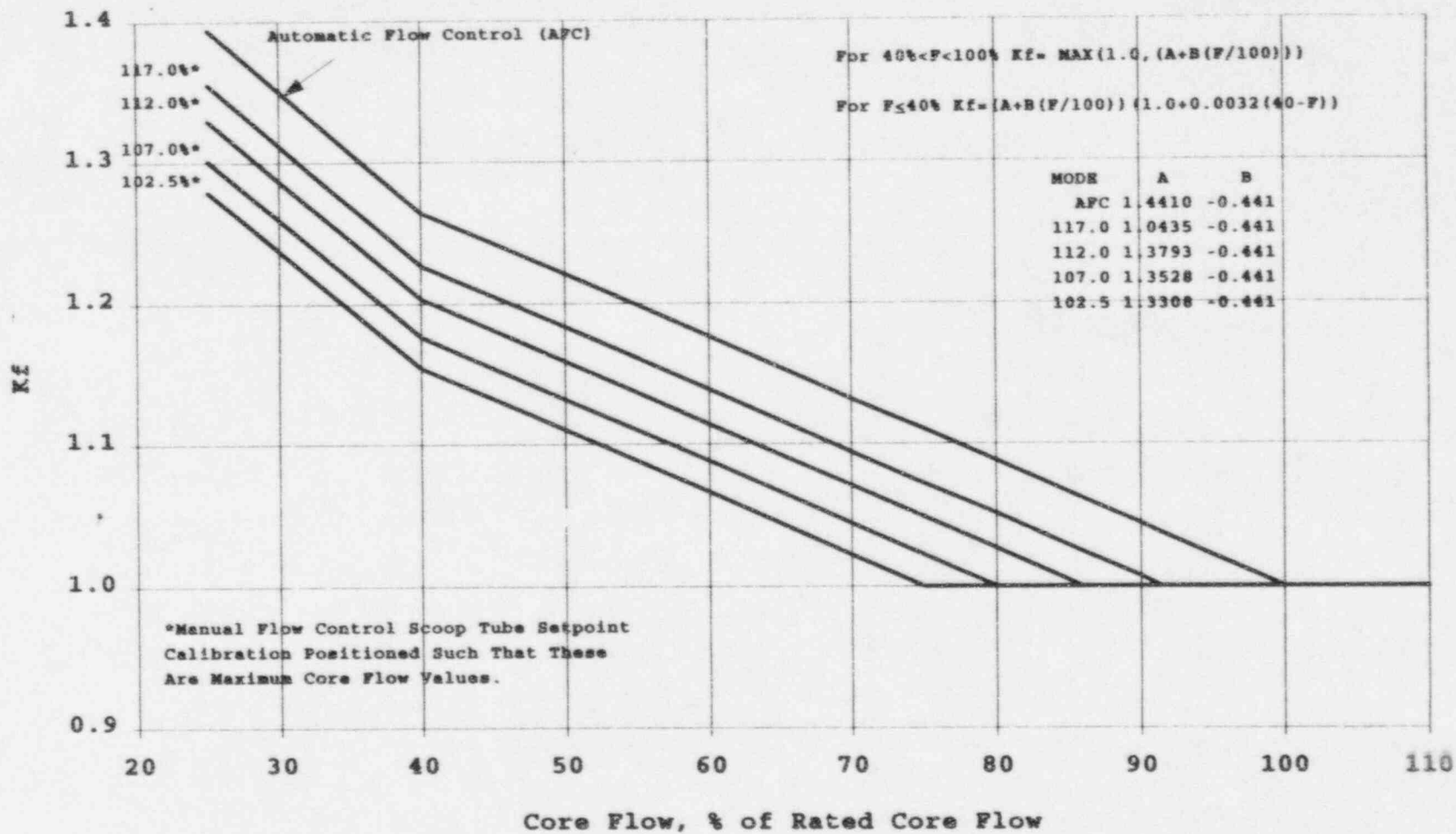


Fig. 2-7 Kf Versus Core Flow

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
9. NFU-VTDGE95-125-00, "Transmittal of Hope Creek Cycle 6 Extended Operation Analysis", July 31, 1995.
10. DEF # DEH 93-00183, "Resolution of the TVAPS issue"
11. 10CFR50.59 Safety Evaluation for Hope Creek Cycle 6 Extension, I.D. Number HCR.8-0001, September 1995.

LAST PAGE