CORE OPERATING LIMITS REPORT

FOR

LIMERICK GENERATING STATION UNIT 2

RELOAD 2, CYCLE 3

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INTRODUCTION AND SUMMARY

This report provides the cycle-specific parameter limits for: Average Planar Linear Heat Generation Rate (APLHGR); Minimum Critical Power Ratio (MCPR); Flow Adjustment Factor (K_f); Linear Heat Generation Rate (LHGR); Rod Block Monitor Flow Biased Upscale and High Flow Clamped Setpoints; and Turbine Bypass Valve parameters for Limerick Generating Station Unit 2, Cycle 3, Reload 2. These values have been determined using NRC-approved methodology and are established such that all applicable limits of the plant safety analysis are met.

This report is submitted in accordance with Technical Specification 6.9.1.9 of Reference (1). Preparation of this report was performed in accordance with PECo Fuel Management Section Procedure FM-105.

APLHGR LIMITS

The limiting APLHGR value for the most limiting lattice (excluding natural uranium) of each fuel type as a function of average planar exposure is given in Figures 1 through 8. These figures are used when hand calculations are required as specified in Technical Specification 3.2.1. The reduction factor for use during single recirculation loop operation is given in Table 1. The Qualification Fuel Bundles (QFBs) from ABB and SPC are modeled as GE9B fuel. Their APLHGR limits are represented by the curve in Figure 4.

MCPR LIMITS

The MCPR value for use in Technical Specification 3.2.3 for each fuel type is given in Figures 9 through 18. The K_f core flow adjustment factor for use in Technical Specification 3.2.3 is given in Figure 19.

The MCPR values shown in these figures are the bounding values for Increased Core flow (up to 105% of rated core flow), Rated Core Flow (100% of rated core flow), Extended Load Line (down to 87% of rated core flow), Feedwater Temperature Reduction (up to 60 degrees F), Power Coastdown, and a combination of all of these options. The curves labelled "Increased Core Flow and Feedwater Temperature Reduction" represent bounding operating limit MCPRs for the ELL, RCF, ICF, and ICF plus FWTR operating domains. Curves are also provided for inoperable Recirc Pump Trip or inoperable Steam Bypass System.

ROD BLOCK MONITOR SETPOINTS

The N value for the RBM flow biased upscale and high flow clamped setpoints for use in Technical Specification 3.3.6 is given in Table 2.

LINEAR HEAT GENERATION RATES

The LHGR value for use in Technical Specification 3.2.4 for each fuel type is given in Table 3.

STEAM BYPASS SYSTEM OPERABILITY

The operability requirements for the steam bypass system for use in Technical Specifications 3.7.8 and 4.7.8.C are found in Table 4. If these requirements cannot be met, the MCPR limits for inoperable Steam Bypass System must be used.

QUALIFICATION FUEL BUNDLES

LGS Unit 2 Cycle 3 will be the second cycle of irradiation for the Qualification Fuel Bundles (QFBs). The thermal limits for the ABB Atom Inc. and the Siemens Power Corporation (SPC) (formerly Advanced Nuclear Fuels (ANF)) QFBs are determined by comparison to the Cycle 2 reload bundle (Fuel Type P8CWB325-9GZ2, GE8X8NB) as specified in references 5 and 6, respectively. The results of these comparisons demonstrate that the QFBs are bounded by the GE8X8NB bundle thermal limits with the exception of Critical Power Ratio (CPR). Therefore, the thermal limits of the GE8X8NB bundle will be applied to the QFBs for all limits except the CPR. The Minimum CPR values for the QFBs are found in Figures 14 to 18. Specific values for all thermal limits are given for the GE11 QFBs (LUA304). The GE11 QFBs and GE11 Reload 2 bundles (GE11) have the same MCPR values throughout Cycle 3.

REFERENCES

1) "Technical Specifications and Bases for Limerick Generating Station Unit 2", Docket No. 50-353 Appendix A to License No. NPF-85.

2) "Supplemental Reload Licensing Report for Limerick Generating Station Unit 2, Reload 2, Cycle 3", General Electric Company Document No. 23A7200, Rev. 0.

3) "Basis of MAPLHGR Technical Specifications for Limerick 2", NEDC-31930-P, April 1991.

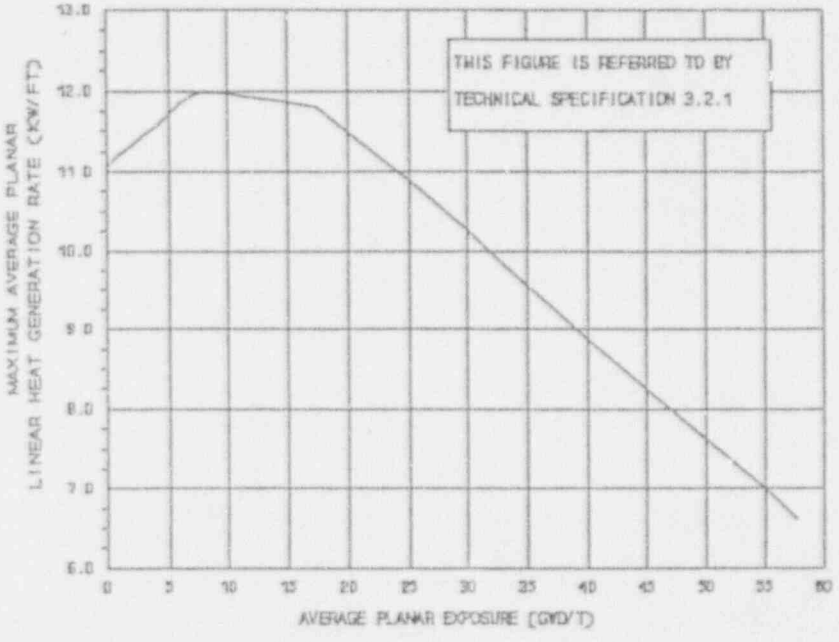
4) "Lattice-Dependent MAPLHGR Report for Limerick Generating Station Unit 2 Reload 2 Cycle 3", General Electric Company Document No. 23A7200AA, Rev. 0.

5) ABB Atom Report BR 91-042, "Supplemental Lead Fuel Assembly Licensing Report, SVEA-96 LFAs for Limerick-2, Summary", January 1991.

6) ANF-90-193(P), "Limerick-2 9x9-9X+ Qualification Fuel Assembly Safety Analysis Report", January 1991.

Figure 1

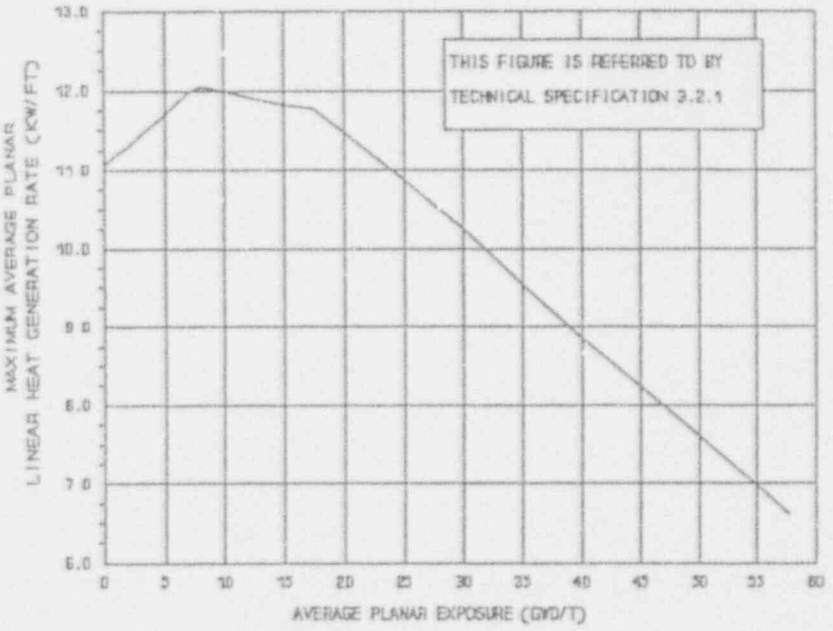
MAXIMUM AVERAGE PLANAR LINEAR HEAT
GENERATION RATE (MAPLHGR) VERSUS
AVERAGE PLANAR EXPOSURE
FUEL TYPE P9CUB354-12GZ2 (GE11)



Avg Plan Exposure (GWd/ST)	MAPLHGR (kW/ft)	Avg Plan Exposure (GWd/ST)	MAPLHGR (kW/ft)	Avg Plan Exposure (GWd/ST)	MAPLHGR (kW/ft)
0.0	11.05	7.0	11.95	25.0	10.89
0.2	11.09	8.0	11.97	30.0	10.27
1.0	11.19	9.0	11.97	35.0	9.55
2.0	11.31	10.0	11.96	40.0	8.87
3.0	11.44	12.5	11.91	45.0	8.24
4.0	11.56	15.0	11.87	50.0	7.62
5.0	11.70	17.5	11.79	55.0	7.00
6.0	11.84	20.0	11.49	57.7	6.62

Figure 2

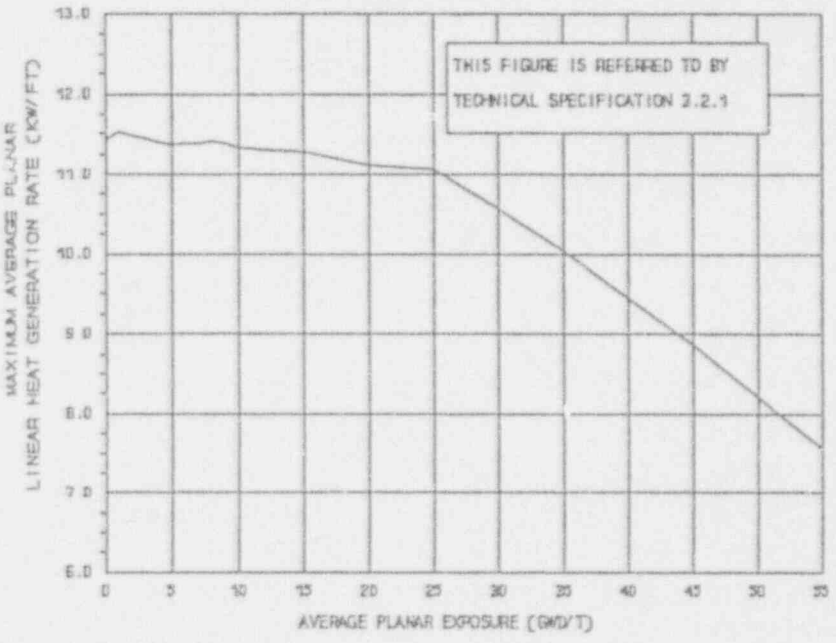
MAXIMUM AVERAGE PLANAR LINEAR HEAT
GENERATION RATE (MAPLHGR) VERSUS
AVERAGE PLANAR EXPOSURE
FUEL TYPE P9CUB354-13GZ2 (GE11)



Avg Plan Exposure (GWd/ST)	MAPLHGR (kW/ft)	Avg Plan Exposure (GWd/ST)	MAPLHGR (kW/ft)	Avg Plan Exposure (GWd/ST)	MAPLHGR (kW/ft)
0.0	11.04	7.0	11.97	25.0	10.87
0.2	11.08	8.0	12.05	30.0	10.25
1.0	11.18	9.0	12.02	35.0	9.54
2.0	11.30	10.0	11.99	40.0	8.86
3.0	11.43	12.5	11.89	45.0	8.22
4.0	11.56	15.0	11.82	50.0	7.60
5.0	11.69	17.5	11.77	55.0	6.99
6.0	11.83	20.0	11.47	57.7	6.61

Figure 3

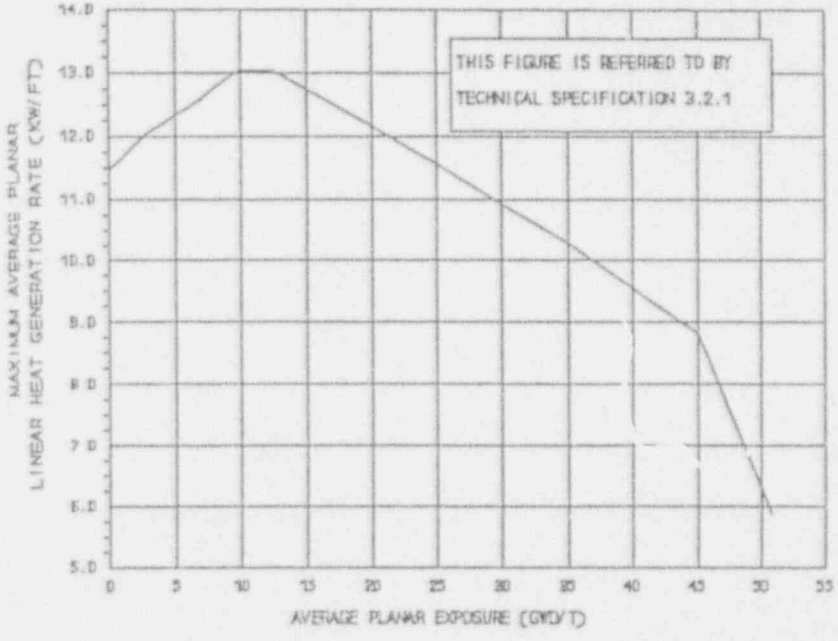
MAXIMUM AVERAGE PLANAR LINEAR HEAT
GENERATION RATE (MAPLHGR) VERSUS
AVERAGE PLANAR EXPCSURE
FUEL TYPE P9CUB304-LUA (GE11)



Avg Plan Exposure (GWd/ST)	MAPLHGR (kW/ft)	Avg Plan Exposure (GWd/ST)	MAPLHGR (kW/ft)	Avg Plan Exposure (GWd/ST)	MAPLHGR (kW/ft)
0.0	11.42	7.0	11.38	25.0	11.07
0.2	11.44	8.0	11.40	30.0	10.56
1.0	11.52	9.0	11.37	35.0	10.05
2.0	11.48	10.0	11.33	40.0	9.45
3.0	11.44	12.5	11.30	45.0	8.85
4.0	11.39	15.0	11.27	50.0	8.21
5.0	11.35	17.5	11.20	55.0	7.56
6.0	11.37	20.0	11.12		

Figure 4

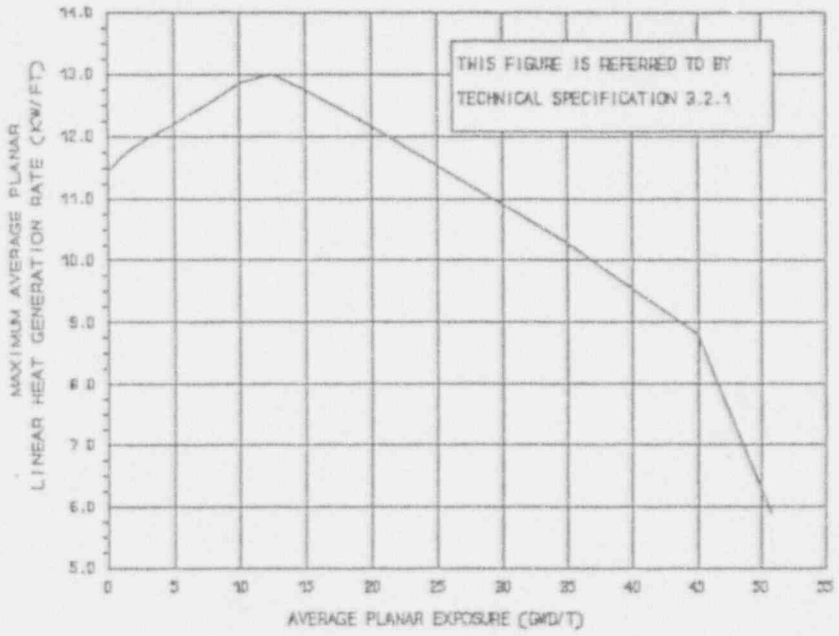
MAXIMUM AVERAGE PLANAR LINEAR HEAT
GENERATION RATE (MAPLHGR) VERSUS
AVERAGE PLANAR EXPOSURE
FUEL TYPE P8CWB325-9GZ2 (GE9B)



Avg Plan Exposure (GWd/ST)	MAPLHGR (kW/ft)	Avg Plan Exposure (GWd/ST)	MAPLHGR (kW/ft)	Avg Plan Exposure (GWd/ST)	MAPLHGR (kW/ft)
0.0	11.43	6.0	12.46	20.0	12.16
0.2	11.50	7.0	12.61	25.0	11.55
1.0	11.65	8.0	12.76	35.0	10.29
2.0	11.87	9.0	12.91	45.0	8.82
3.0	12.05	10.0	13.04	50.9	5.88
4.0	12.18	12.5	13.04		
5.0	12.32	15.0	12.75		

Figure 5

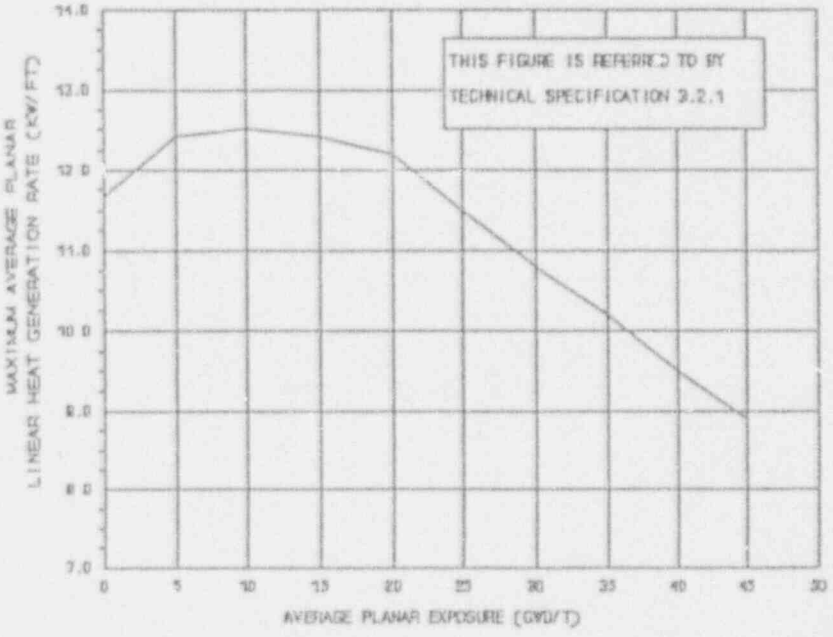
MAXIMUM AVERAGE PLANAR LINEAR HEAT
GENERATION RATE (MAPLHGR) VERSUS
AVERAGE PLANAR EXPOSURE
FUEL TYPE P8CWB325-9GZ1 (GE9B)



Avg Plan Exposure (GWd/ST)	MAPLHGR (kW/ft)	Avg Plan Exposure (GWd/ST)	MAPLHGR (kW/ft)	Avg Plan Exposure (GWd/ST)	MAPLHGR (kW/ft)
0.0	11.42	6.0	12.31	20.0	12.16
0.2	11.48	7.0	12.43	25.0	11.54
1.0	11.63	8.0	12.56	35.0	10.29
2.0	11.83	9.0	12.70	45.0	8.79
3.0	11.95	10.0	12.86	50.8	5.89
4.0	12.07	12.5	12.99		
5.0	12.19	15.0	12.75		

Figure 6

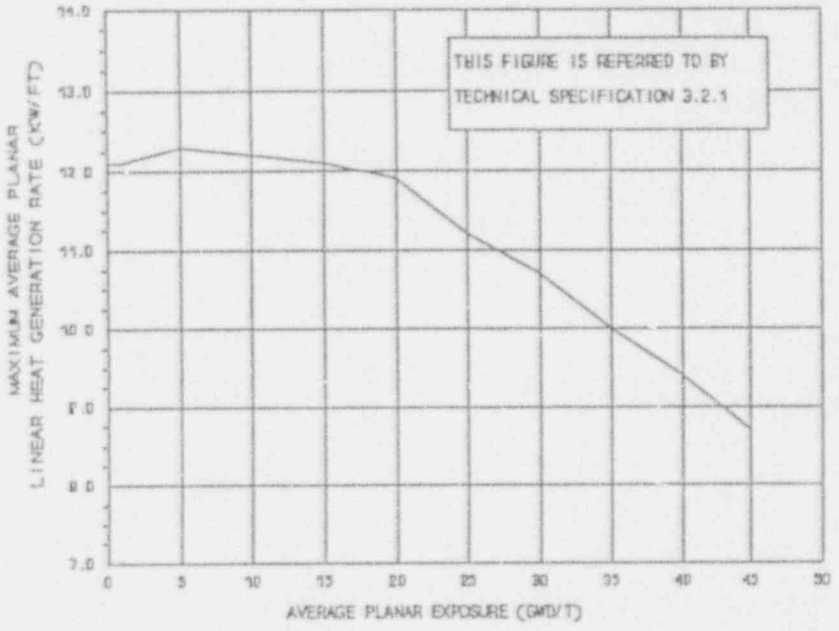
MAXIMUM AVERAGE PLANAR LINEAR HEAT
GENERATION RATE (MAPLHGR) VERSUS
AVERAGE PLANAR EXPOSURE
FUEL TYPE P8CIB278 (GE7B)



Avg Plan Exposure (GWd/ST)	MAPLHGR (kW/ft)	Avg Plan Exposure (GWd/ST)	MAPLHGR (kW/ft)	Avg Plan Exposure (GWd/ST)	MAPLHGR (kW/ft)
0.2	11.7	15.0	12.4	35.0	10.2
1.0	11.8	20.0	12.2	40.0	9.5
5.0	12.4	25.0	11.5	45.0	8.9
10.0	12.5	30.0	10.8		

Figure 7

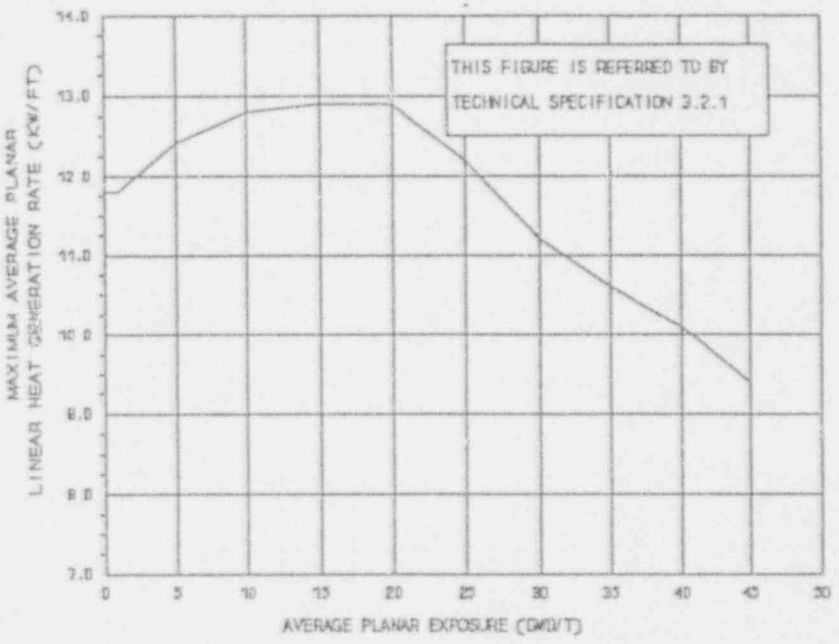
MAXIMUM AVERAGE PLANAR LINEAR HEAT
GENERATION RATE (MAPLHGR) VERSUS
AVERAGE PLANAR EXPOSURE
FUEL TYPE P8CIB248 (GE7B)



Avg Plan Exposure (GWd/ST)	MAPLHGR (kW/ft)	Avg Plan Exposure (GWd/ST)	MAPLHGR (kW/ft)	Avg Plan Exposure (GWd/ST)	MAPLHGR (kW/ft)
0.2	12.1	15.0	12.1	35.0	10.0
1.0	12.1	20.0	11.9	40.0	9.4
5.0	12.3	25.0	11.2	45.0	8.7
10.0	12.2	30.0	10.7		

Figure 8

MAXIMUM AVERAGE PLANAR LINEAR HEAT
GENERATION RATE (MAPLHGR) VERSUS
AVERAGE PLANAR EXPOSURE
FUEL TYPE P8CIB163 (GE7B)



Avg Plan Exposure (GWd/ST)	MAPLHGR (kW/ft)	Avg Plan Exposure (GWd/ST)	MAPLHGR (kW/ft)	Avg Plan Exposure (GWd/ST)	MAPLHGR (kW/ft)
0.2	11.8	15.0	12.9	35.0	10.6
1.0	11.8	20.0	12.9	40.0	10.1
5.0	12.4	25.0	12.2	45.0	9.4
10.0	12.8	30.0	11.2		

FIGURE 9

MCPR vs. TAU
FUEL TYPE GE11/LUA304
(INCREASED CORE FLOW AND FEEDWATER TEMPERATURE REDUCTION)

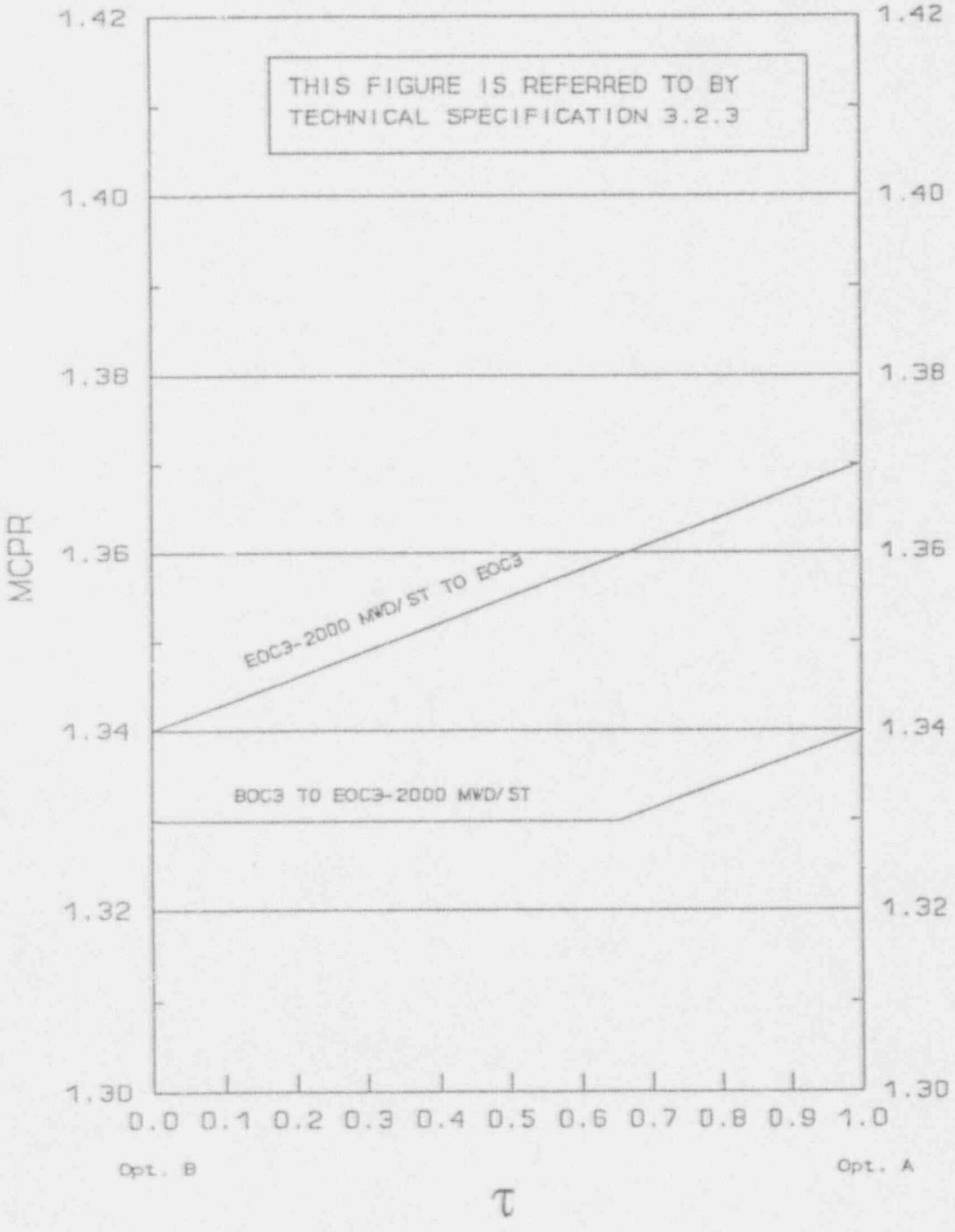


FIGURE 10

MCPR vs. TAU
FUEL TYPE GE11/LUA304
(TBVOOS)

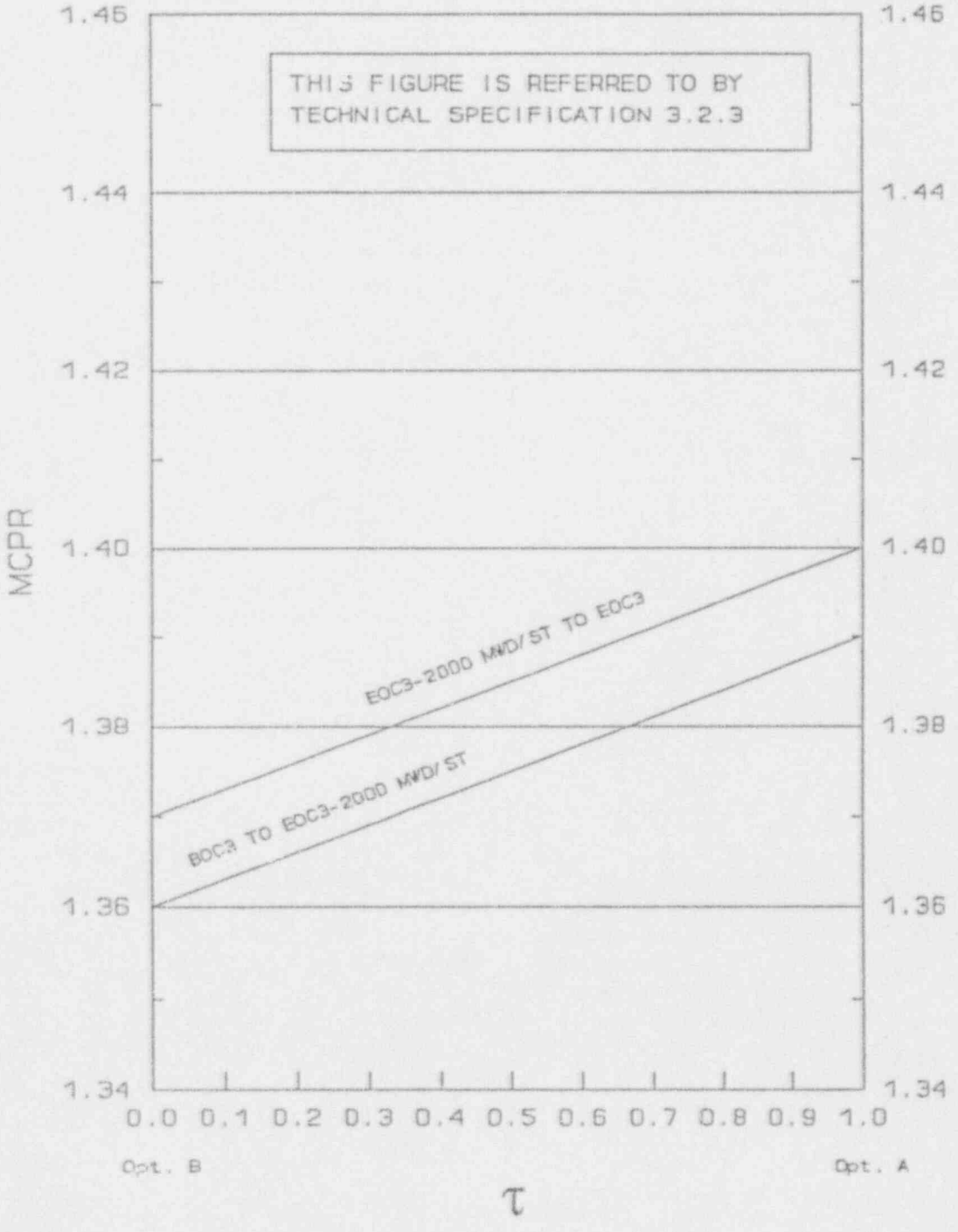


FIGURE 11

MCPR vs. TAU
FUEL TYPE GE11/LUA304
(WITHOUT RPT)

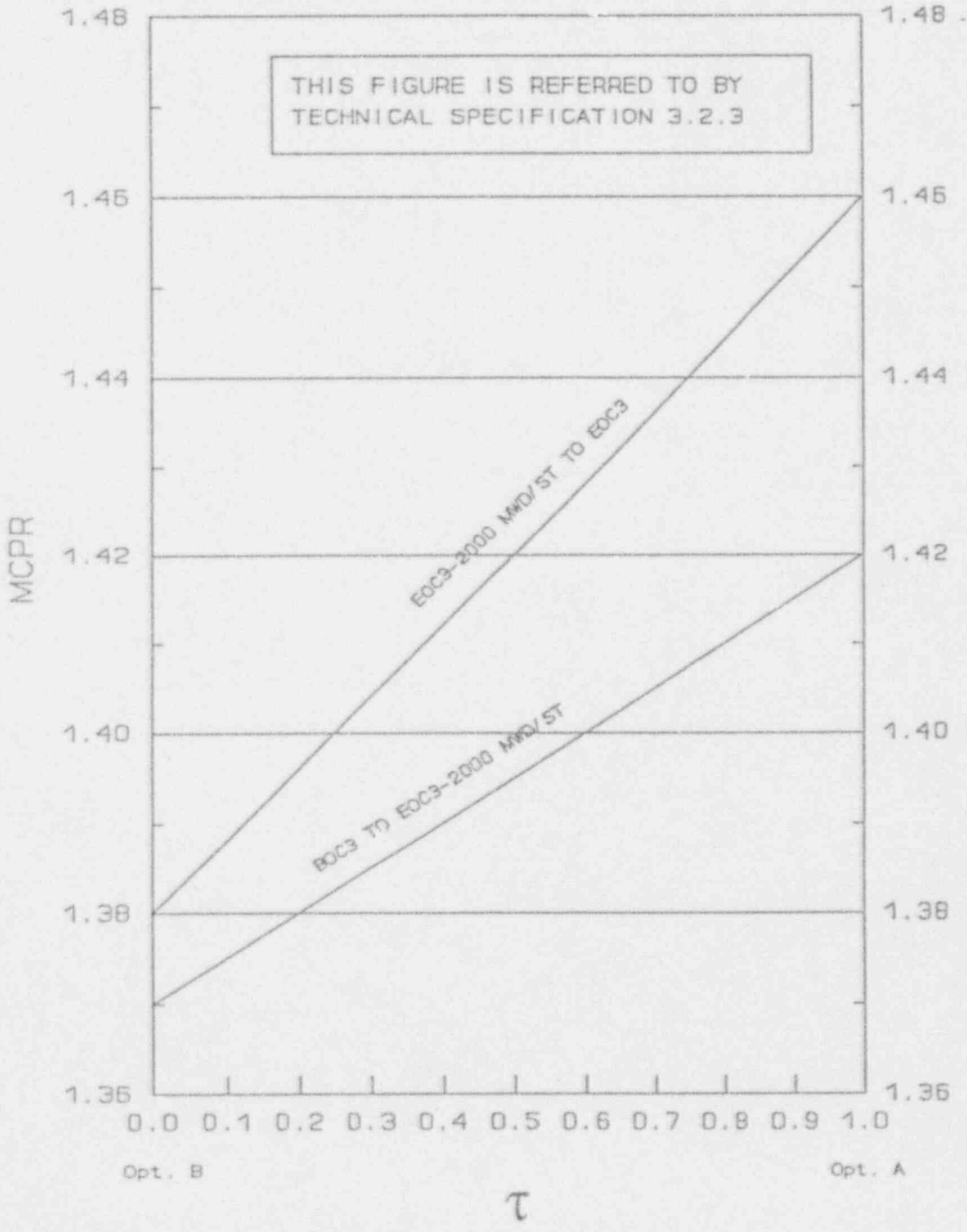


FIGURE 12

MCPR vs. TAU
FUEL TYPES GE8X8NB, BP8X8R
(INCREASED CORE FLOW AND FEEDWATER TEMPERATURE
REDUCTION, and TBVOOS, and WITHOUT RPT)

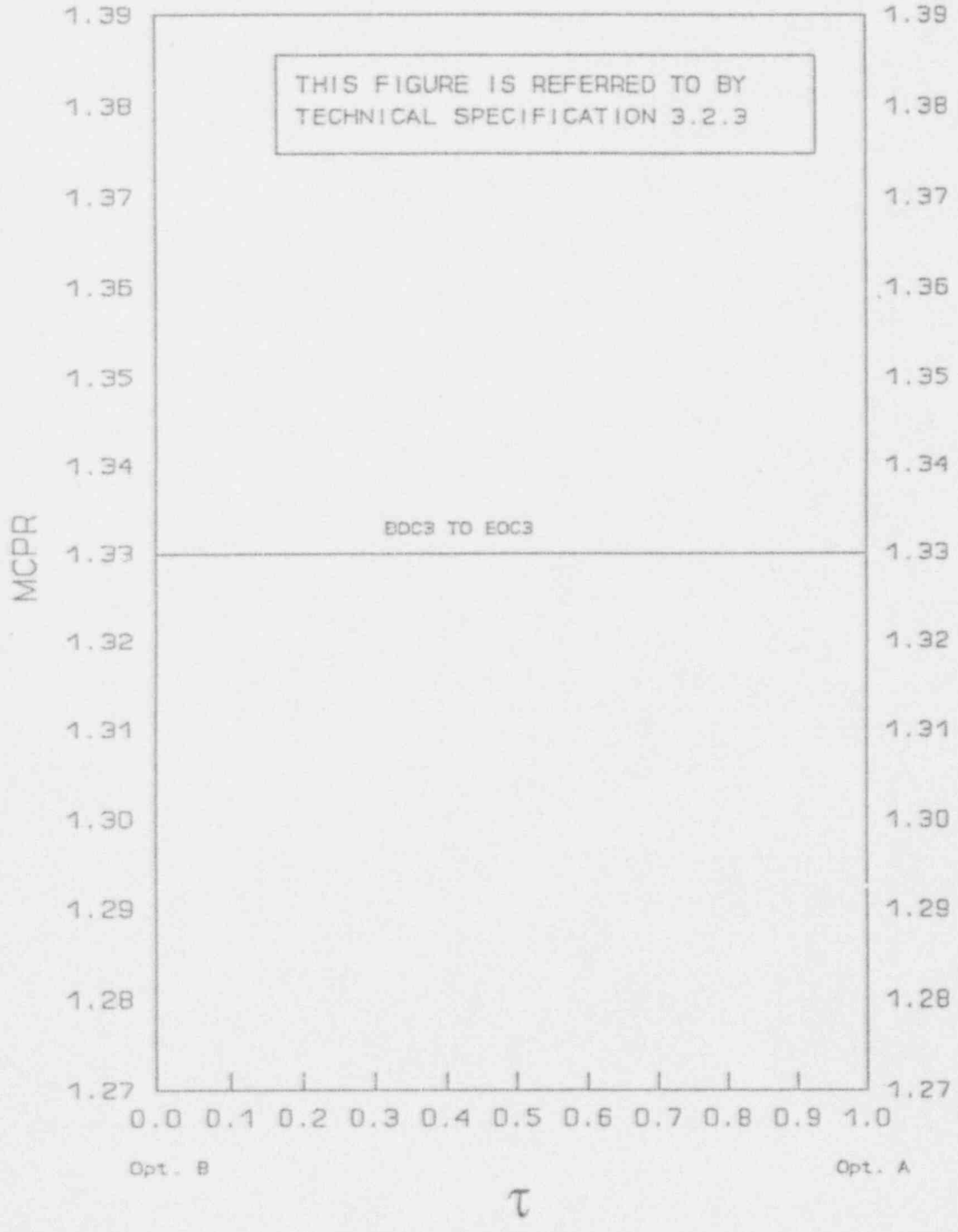


FIGURE 13

MCPR vs. TAU
FUEL TYPE ABB QFB
(INCREASED CORE FLOW AND FEEDWATER TEMPERATURE REDUCTION)

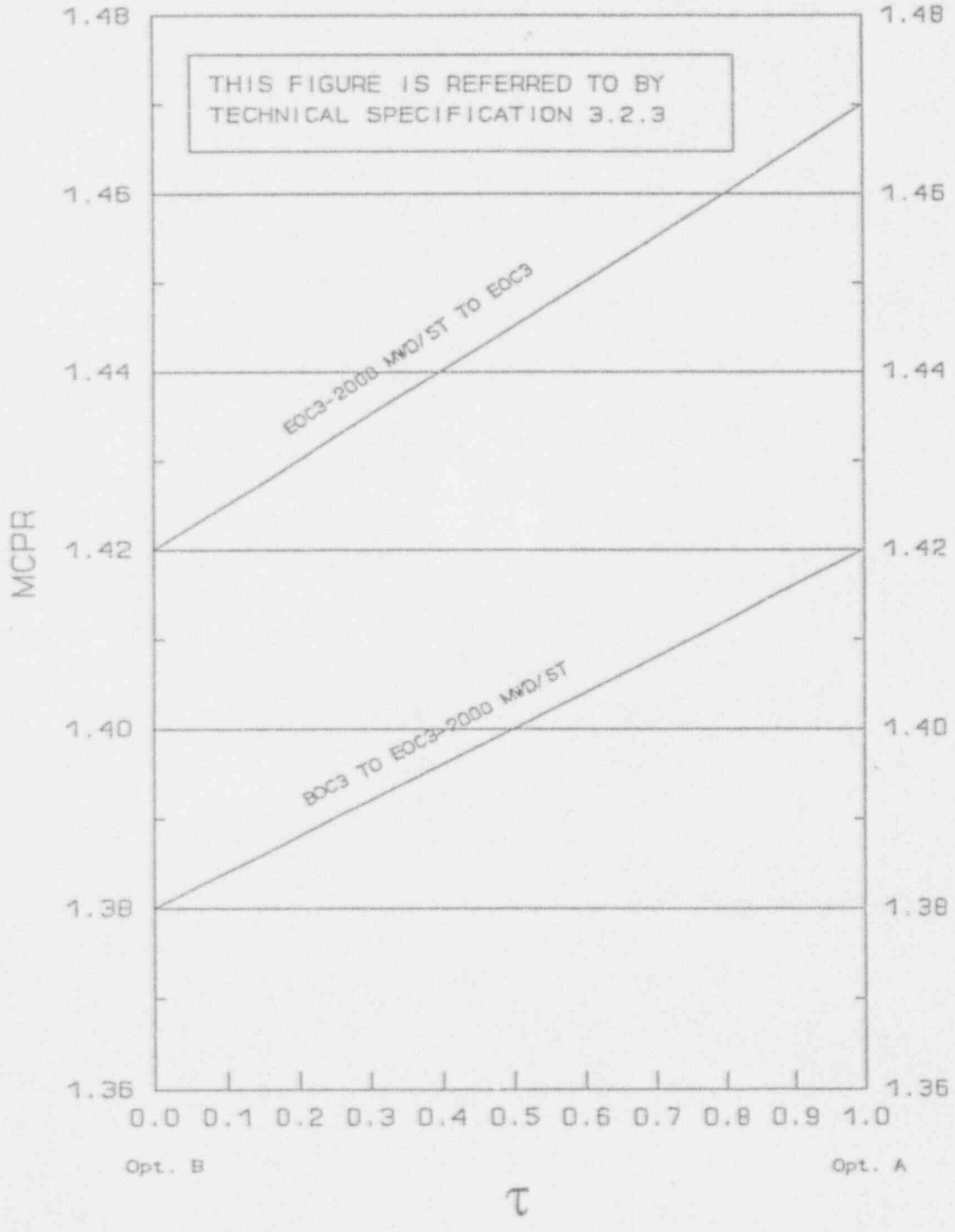


FIGURE 14

MCPR vs. TAU
FUEL TYPE ABB QFB
(without RPT)

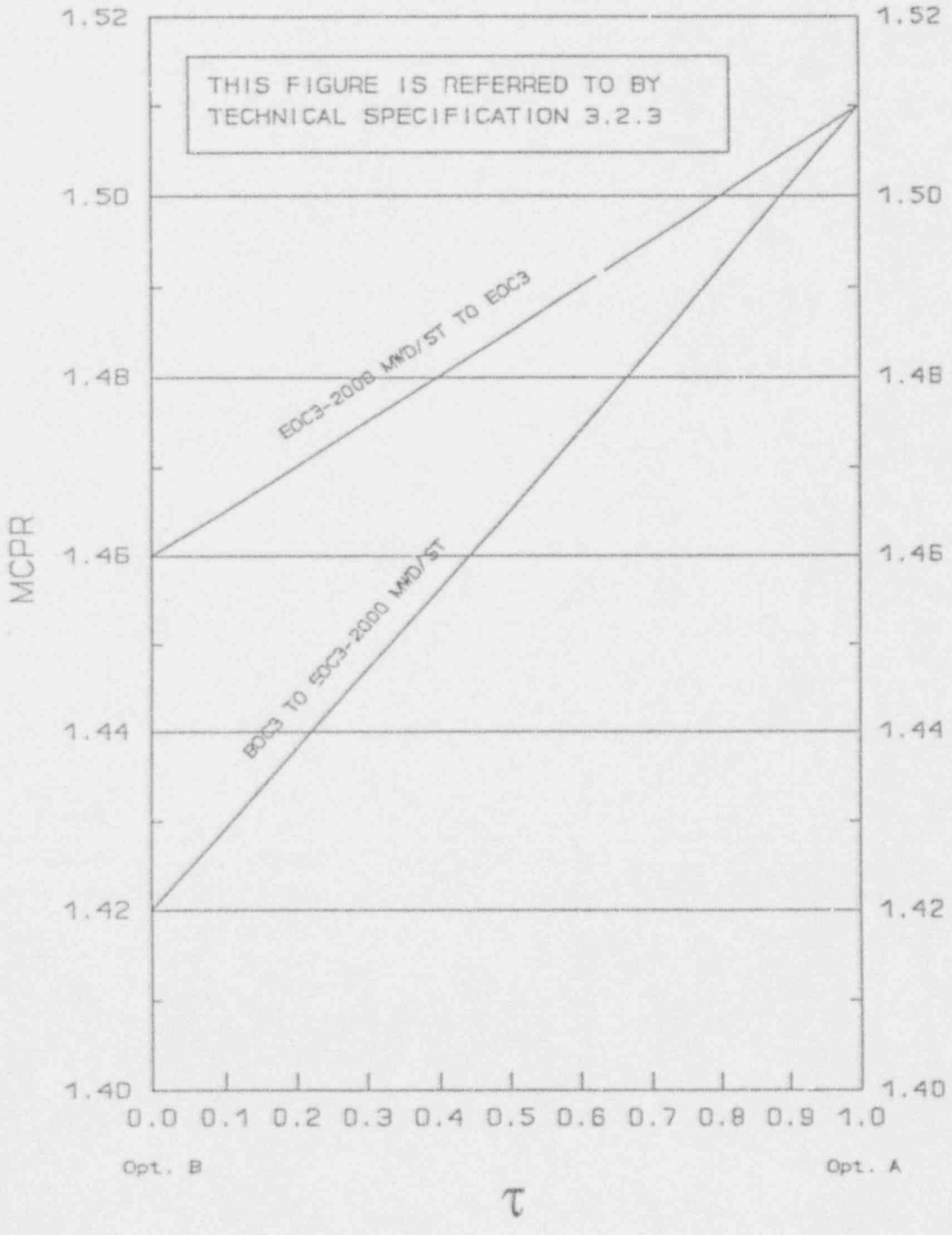


FIGURE 15

MCPR vs. TAU
FUEL TYPE ABB QFB
(TBVOOS)

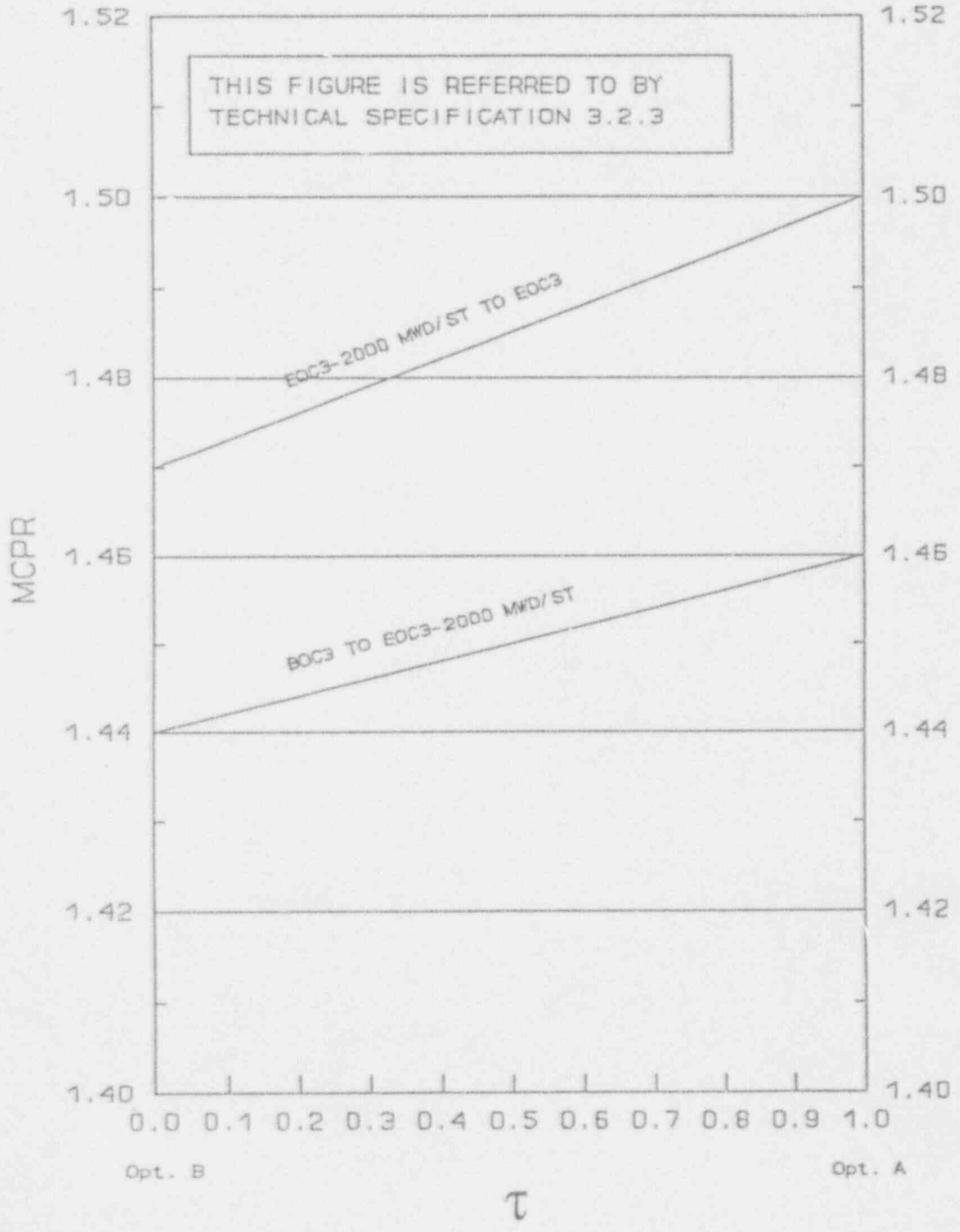


FIGURE 16

MCPR vs. TAU
FUEL TYPE SPC QFB
(INCREASED CORE FLOW AND FEEDWATER TEMPERATURE REDUCTION)

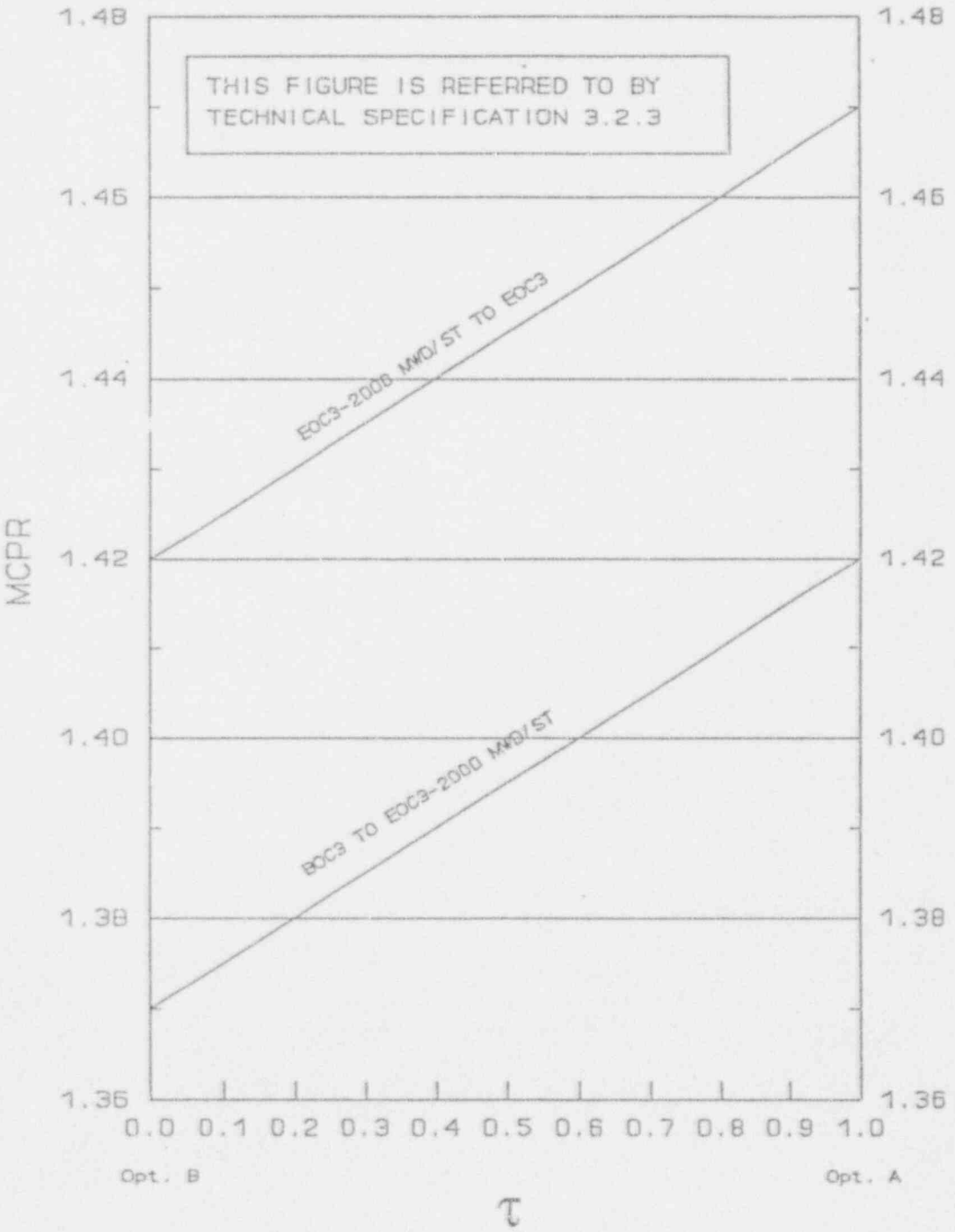


FIGURE 17

MCPR vs. TAU
FUEL TYPE SPC QFB
(WITHOUT RPT)

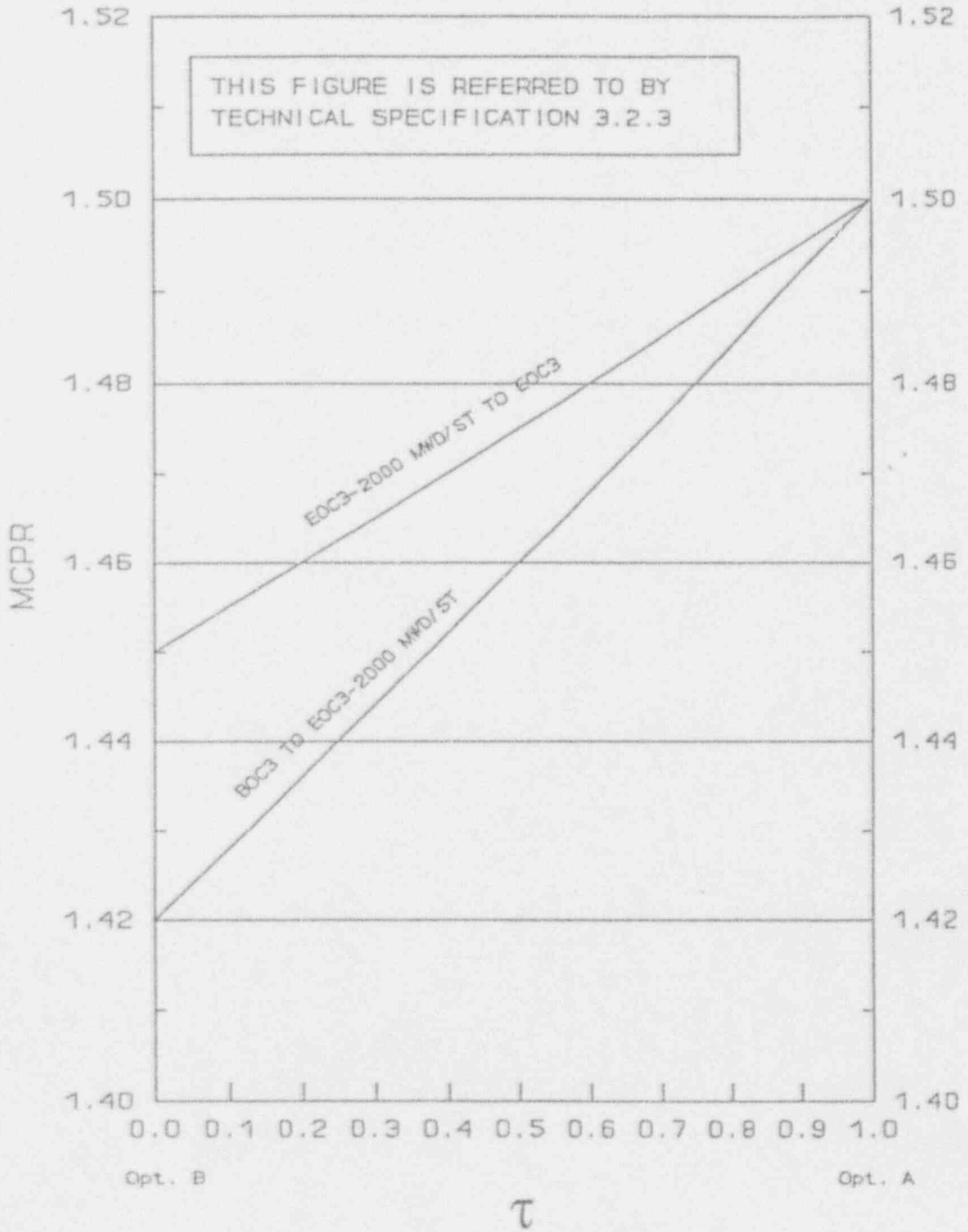


FIGURE 18

MCPR vs. TAU
FUEL TYPE SPC QFB
(TBVOOS)

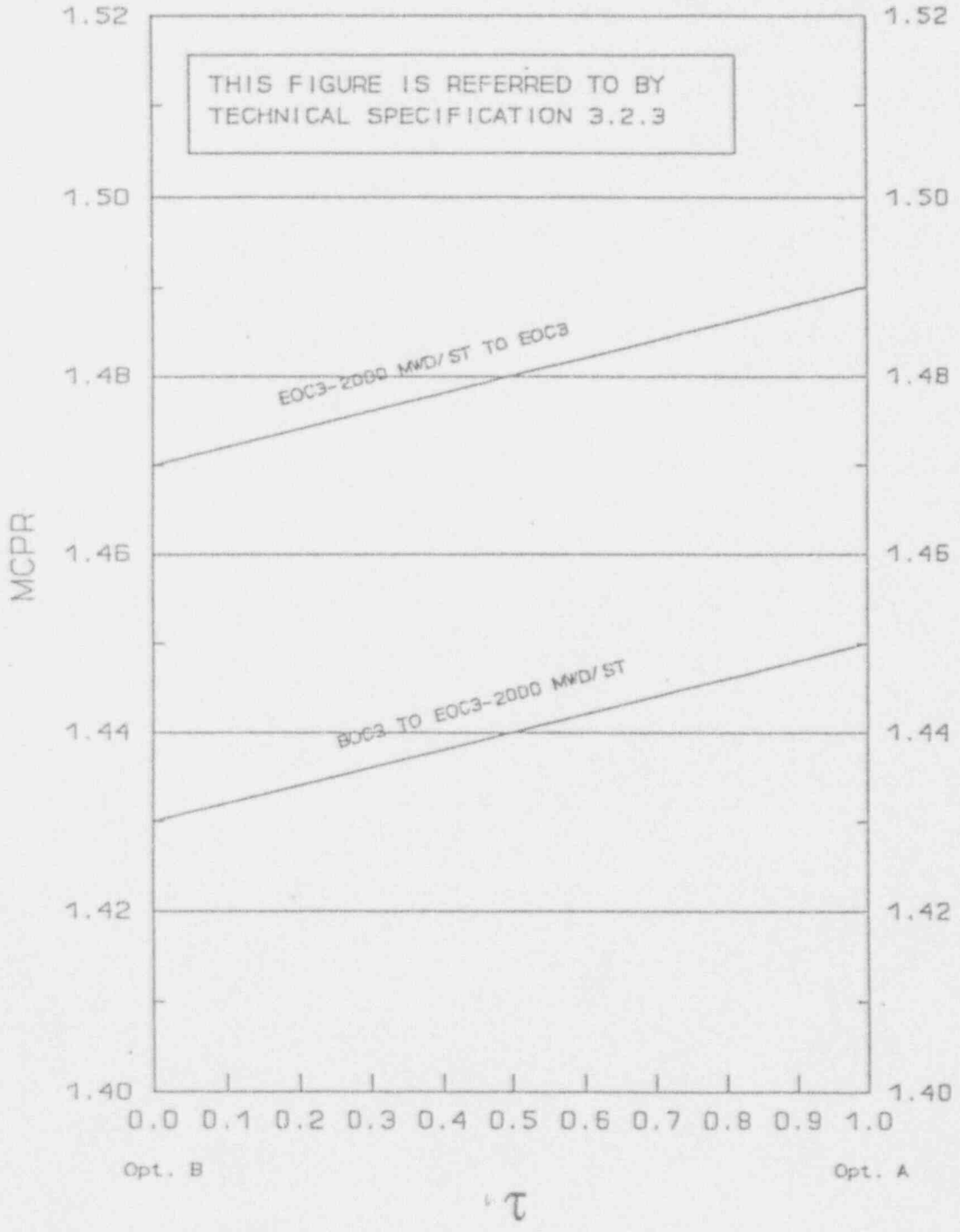


FIGURE 19

K_f Factor vs. Core Flow

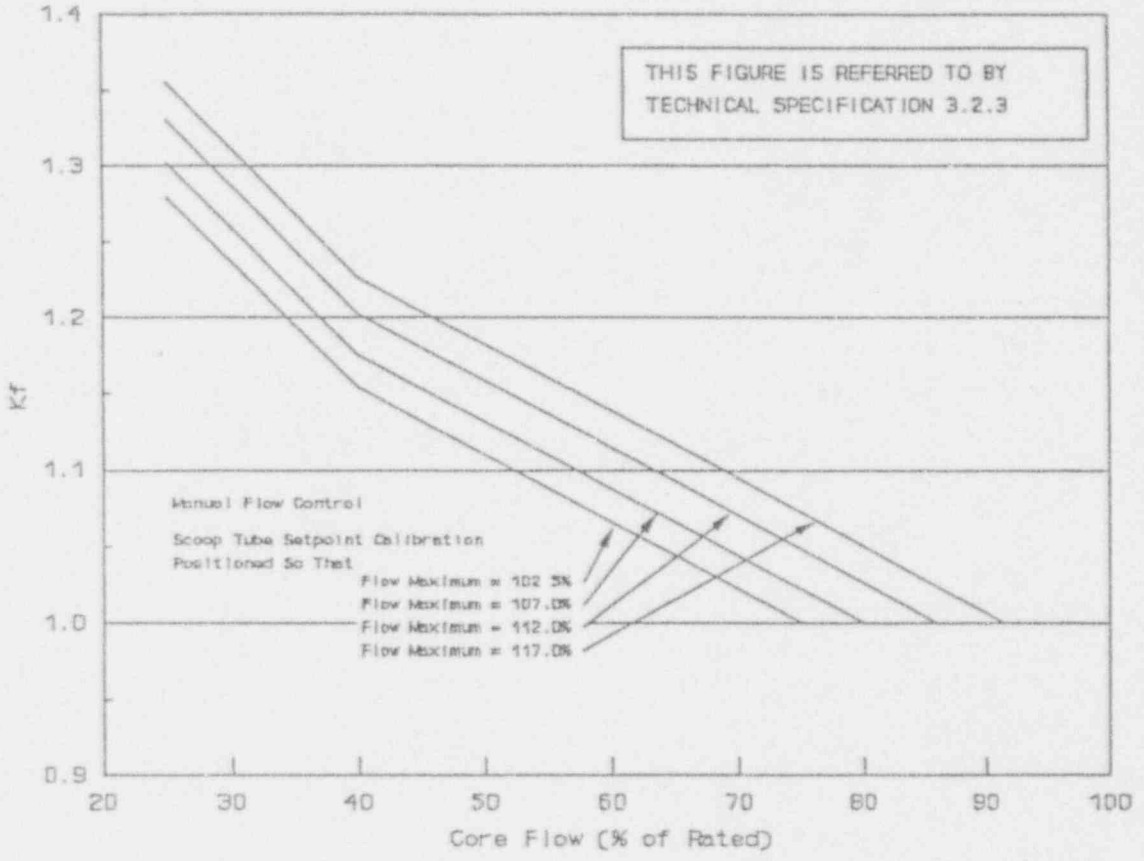


TABLE 1

SINGLE LOOP REDUCTION FACTORS	
0.82	GE11 fuel
0.89	GE7B fuel
0.88	all other fuel types

TABLE 2

ROD BLOCK MONITOR SETPOINT

N = 110

TABLE 3

LINEAR HEAT GENERATION RATE LIMITS

FUEL TYPE	MAXIMUM VALUE
GE7B	13.4 kW/ft
GE9B	14.4 kW/ft
GE11	14.4 kW/ft

TABLE 4

TURBINE BYPASS VALVE PARAMETERS

TURBINE BYPASS SYSTEM RESPONSE TIME

Maximum delay time before start of bypass valve opening following generation of the turbine bypass valve flow signal	0.1 sec
Maximum time after generation of a turbine bypass valve flow signal for bypass valve position to reach 80% of full stroke (includes the above delay time)	0.3 sec

MINIMUM REQUIRED BYPASS VALVES TO MAINTAIN SYSTEM OPERABILITY

Number of valves = 7