Nebraska Public Power District
Nebraska's Energy Leader

NLS2000046
April 18, 2000

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

Subject: Core Operating Limits Report
Cooper Nuclear Station
NRC Docket No. 50-298, DPR-46

Gentlemen:

Cooper Nuclear Station Technical Specification 5.6.5 requires that core operating limits be documented in the Core Operating Limits Report (COLR) and submitted to the Nuclear Regulatory Commission prior to each reload cycle for changes to the following cycle specific parameters:

1. The Average Planar Linear Heat Generation Rate (APLHGR)

2. The Minimum Critical Power Ratio (MCPR)

3. The Rod Block Monitor Upscale Allowable Values

4. The power/flow map defining the Stability Exclusion Region

For Cycle 20 operations, changes have been made to the operating limits for APLHGR and MCPR. Consequently, the COLR has been updated and it is being submitted as an attachment. In accordance with 10 CFR 50.4 (b) (1), we are also transmitting a copy of this COLR to the Regional Office and to the NRC Senior Resident Inspector.

Should you have any questions regarding this matter, please contact Sharon Mahler at (402) 825-5236.

Sincerely,

John H. Swailes
Vice President of Nuclear Energy

/nr

Attachment

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A001

cc: Regional Administrator w/attachment
USNRC Region IV

Senior Project Manager w/attachment
USNRC - NRR Project Directorate IV-1

Senior Resident Inspector w/attachment
USNRC

NPG Distribution w/o attachment

Correspondence Number: NLS2000046

The following table identifies those actions committed to by the District in this document. Any other actions discussed in the submittal represent intended or planned actions by the District. They are described to the NRC for the NRC's information and are not regulatory commitments. Please notify the NL&S Manager at Cooper Nuclear Station of any questions regarding this document or any associated regulatory commitments.

COMMITMENT	COMMITTED DATE OR OUTAGE
None	

COOPER NUCLEAR STATION

CORE OPERATING LIMITS REPORT

Cycle 20
Revision 0

CORE OPERATING LIMITS REPORT

Table of Contents

CORE OPERATING LIMITS REPORT

List of Figures

Signature Page

Revision 0

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3/20/00
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20 March 00
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1.0 INTRODUCTION

The Core Operating Limits Report provides the limits for operation of the Cooper Nuclear Station for Cycle 20. It includes the limits for the Rod Block Monitor Upscale Set Point, Average Planar Linear Heat Generation Rate (APLHGR), and Minimum Critical Power Ratio (MCPR). If any of these limits are exceeded, action will be taken as defined in the Technical Specifications.

The core operating limit values have been determined using the NRC-approved methodologies given in References 1, 2, 10, and 11 and have been established such that all applicable plant safety analysis limits are met.

2.0 CORE OPERATING LIMITS

Cooper Nuclear Station shall operate within the bounds of the below limits/values. The applicable Technical Specifications are referenced in each subsection.

2.1 Rod Block Monitor Upscale Set Point

The Technical Specifications reflect a reference to Allowable Values for the Rod Block Monitor (RBM) upscale (power referenced) trip level setting, found in Reference 9, are as follows:

Lowest Rated MCPR Limit	Low Trip Set Point (LTSP) (LPSP≤P≤IPSP)	Intermed Trip Set Point (ITSP) (IPSP<P≤HPSP)	High Trip Set Point (HTSP) (HPSP<P)
≥1.20	≤114.0/125	≤108.5/125	≤104.5/125
≥1.25	≤117.0/125	≤112.5/125	≤107.5/125
≥1.30	≤120.0/125	≤115.0/125	≤110.5/125

LPSP, IPSP, and HPSP are the Low Power Set Point, Intermediate Power Set Point, and High Power Set Point, respectively.

The trip level settings associated with this MCPR limit have been generically calculated and verified to bound the Rod Withdrawal Error Analysis for Cycle 20 operation.

Technical Specification Reference: 3.3.2.1

2.2 Average Planar Linear Heat Generation Limits

The most limiting lattice APLHGR value (excluding natural uranium) for each fuel bundle as a function of Planar Average Exposure, core power, and core flow is calculated by multiplying the value from Figures 1, 2, 3, and 4 by the smaller of the MAPLHGR Flow Factor, $MAPFAC_F$ (Figure 5) or the Power-Dependent MAPLHGR Factor, $MAPFAC_P$, (Figure 6). APLHGR values determined with the SAFER/GESTR-LOCA methodology are given in References 2, 3, and 5 while $MAPFAC_F$ and $MAPFAC_P$ were determined in Reference 8.

The calculated maximum APLHGR (MAPLHGR) limits in Figures 1, 2, 3, and 4 are conservative values bounding all fuel lattice types (excluding natural uranium) in a given fuel bundle design. MAPLHGR limits for each individual fuel lattice design in a bundle design, as a function of axial location and average planar exposure, are determined based on the approved methodology referenced in Technical Specification 5.6.5 and loaded in the process computer for use in core monitoring calculations. The MAPLHGR values for these lattices, along with the axial location of each lattice in the bundle, are considered proprietary information by General Electric and are given in Reference 3 as a function of planar average exposure.

The MAPLHGR limits referred to above are for two recirculation loop operations. For single loop operation, the limiting APLHGR value is multiplied by 0.77 for GE8x8 NB fuel (as can be found in Reference 5) and by 0.85 for GE14 fuel (as can be found in Reference 5).

Technical Specification Reference: 3.2.1 and 3.4.1

2.3 Linear Heat Generation Rate Limit

The limiting power density and maximum allowable Linear Heat Generation Rate (LHGR) referred to in Technical Requirements Manual Section T 3.2.1 is the design LHGR. The design LHGR for fuel type GE 8x8 NB is 14.4 kW/ft as found in Reference 12. The design LHGR for fuel type GE14 is 13.4 kW/ft as found in Reference 13.

2.4 Minimum Critical Power Ratio Limits

The operating limit MCPR (OLMCPR) values are a function of core thermal power, core flow, fuel bundle, scram time (τ), and fuel exposure. The scram time (τ) is determined from CNS Procedure 10.9, Control Rod Scram Time Evaluation. The OLMCPR values are as follows:

For core thermal power ≥ 25 percent and <30 percent of rated power, the OLMCPR is the power dependent MCPR ($MCPR_P$) from Figure 7.

For core thermal power ≥ 30 percent of rated power, the OLMCPR is the greater of either:

The applicable flow dependent MCPR ($MCPR_F$) determined from Figure 8, or

The appropriate scram time (τ) dependent MCPR at rated power from Figures 9-11, 13, and 14, multiplied by the applicable power dependent MCPR multiplier (K_P) from Figure 7.

The appropriate scram time (τ) dependent MCPR at rated power with One Turbine Bypass Valve Unavailable is shown in Figures 12 and 15.

The system response time for the Turbine Bypass System to be at 80% of rated bypass flow is 0.3 seconds.

For single recirculation loop operation, the OLMCPR is 0.01 greater than the two recirculation loop operation OLMCPR.

Technical Specification References: 3.2.2, 3.4.1 and 3.7.7

2.5 Power/Flow Map

The power/flow map defining the Stability Exclusion Region can be found as Figure 16. Other lines on Figure 16 are provided for information only. References 5 and 6 reflect the documents describing the current Cooper Nuclear Station power/flow map. The Stability Exclusion Region boundary is given by the equation

$$P = P_B\left(\frac{P_A}{P_B}\right)^{\frac{1}{2}\left[\frac{W-W_B}{W_A-W_B}+\left(\frac{W-W_B}{W_A-W_B}\right)^2\right]}$$

where,

P = a core thermal power value on the region boundary (% of rated),
W = the core flow rate corresponding to power, P, on the region boundary (% of rated),
P_A = core thermal power at point A (% of rated),
P_B = core thermal power at point B (% of rated),
W_A = core flow rate at point A (% of rated), and
W_B = core flow rate at point B (% of rated).

Technical Specification Reference: 3.4.1

3.0 REFERENCES

1. NEDE-24011-P-A-13-US, August 1996, General Electric Standard Application for Reactor Fuel. (The approved revision at the time the reload analyses were performed.)

2. NEDC-32687P, Revision 1, March 1997, Cooper Nuclear Station SAFER/GESTR-LOCA Loss-of-Coolant Accident Analysis.

3. Lattice Dependent MAPLHGR Report for Cooper Nuclear Station Reload 19, Cycle 20, J11-03650-10M, Revision 0.

4. Letter (with attachment), R.H. Buckholz (GE) to P.S. Check (NRC) dated September 5, 1980, Response to NRC Request for Information on ODYN Computer Model.

5. Supplemental Reload Licensing Report for Cooper Nuclear Station Reload 19, Cycle 20, J11-03650-10, Revision 1.

6. GENE-A13-00395-01, Class I, November, 1996, Application of the "Regional Exclusion with Flow-Biased APRM Neutron Flux Scram" Stability Solution (Option 1-D) to the Cooper Nuclear Station, Licensing Topical Report.

7. Letter from James R. Hall (NRC) to G. R. Horn (NPPD) dated September 23, 1997, Approval of SAFER/GESTAR LOCA Analysis for Cooper Nuclear Station (TAC NO. M98293.)

8. GE-NE-L12-00867-12, Cooper Nuclear Station MIG Project Task 900: Transient Analysis, Revision 0.

9. NEDC 98-024, Revision 2, December 1999, APRM - RBM Setpoint Calculation.

10. NEDO-31960-A and NEDO-31960-A Supplement 1, BWR Owner's Group Long-Term Stability Solutions Licensing Methodology.
(The approved revision at the time the reload analysis is performed.)

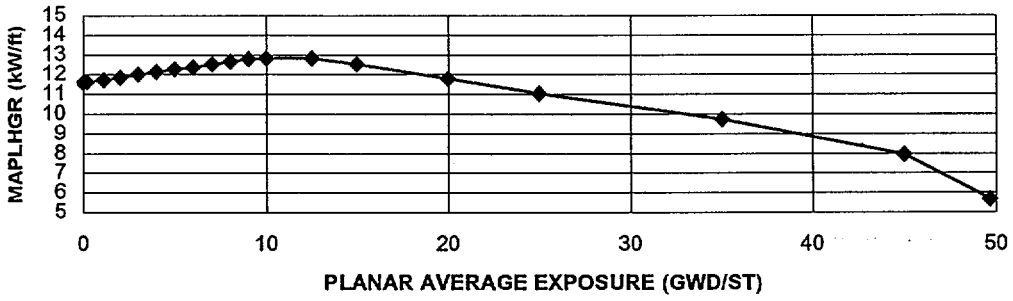
11. NEDE-23785-1-P-A, The GESTR-LOCA and SAFER Models for the Evaluation of the Loss-of-Coolant Accident, Volume III, Revision 1, October 1984.

12. Nuclear Design Report for Cooper Nuclear Station Reload, 18, J11-03354-03, July 1998.

13. GE-NE-L12-00867-09-01, Cooper Nuclear Station MIG Project Task 407: SAFER/GESTR-LOCA Analysis, Revision 1.

Figure 1

Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) versus Exposure with LPCI Modification and Bypass Holes Plugged, 3.50 w/o with 10GZ GE8x8NB Fuel

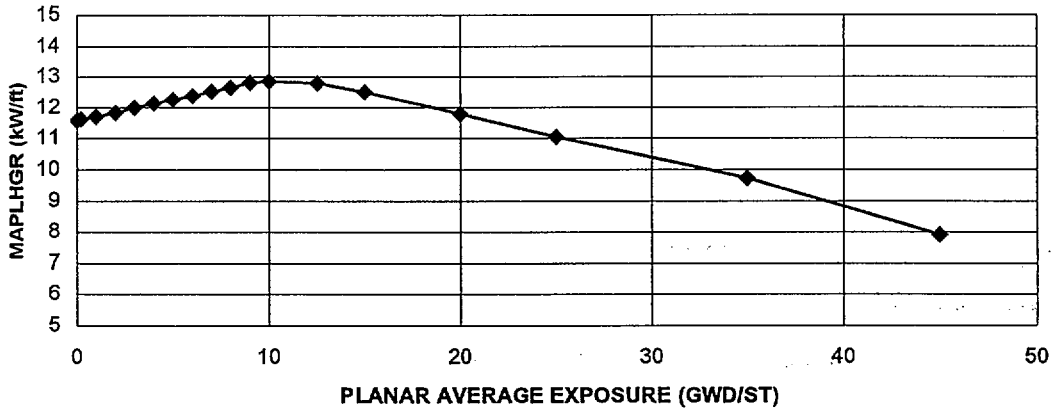


DATA COORDINATES (Reference 3)

Planar Average Exposure (GWD/ST)	MAPLHGR (kW/ft)
0.0	11.59
0.2	11.63
1.0	11.71
2.0	11.85
3.0	12.00
4.0	12.13
5.0	12.26
6.0	12.38
7.0	12.52
8.0	12.65
9.0	12.80
10.0	12.84
12.5	12.81
15.0	12.52
20.0	11.78
25.0	11.05
35.0	9.75
45.0	7.96
49.69	5.67

Figure 2

Maximum Average Linear Heat Generation Rate (MAPLHGR) versus Exposure with LPCI Modification and Bypass Holes Plugged, 3.50 w/o with 10GZ1 GE8x8NB Fuel

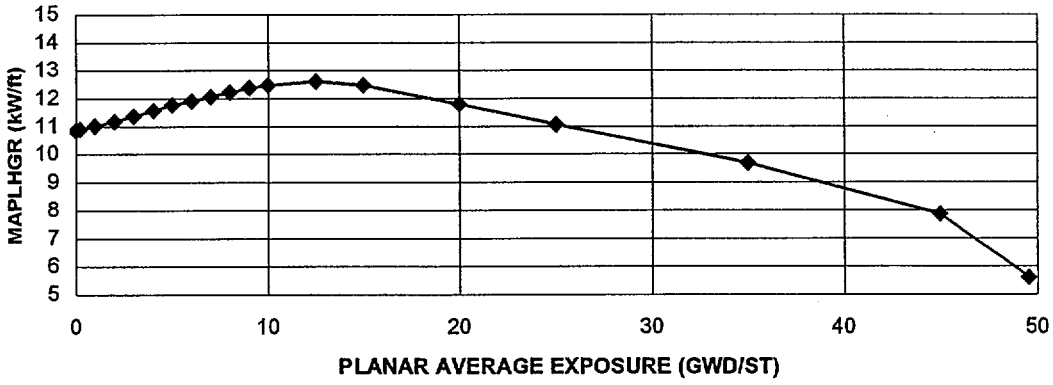


DATA COORDINATES (Reference 3)

Planar Average Exposure (GWD/ST)	MAPLHGR (kW/ft)
0.0	11.59
0.2	11.63
1.0	11.71
2.0	11.84
3.0	11.99
4.0	12.14
5.0	12.26
6.0	12.39
7.0	12.53
8.0	12.66
9.0	12.81
10.0	12.85
12.5	12.79
15.0	12.51
20.0	11.78
25.0	11.05
35.0	9.74
45.0	7.92
49.61	5.66

Figure 3

Maximum Average Linear Heat Generation Rate (MAPLHGR) versus Exposure with LPCI Modification and Bypass Holes Plugged, 3.48 w/o with 11GZ GE8x8NB Fuel

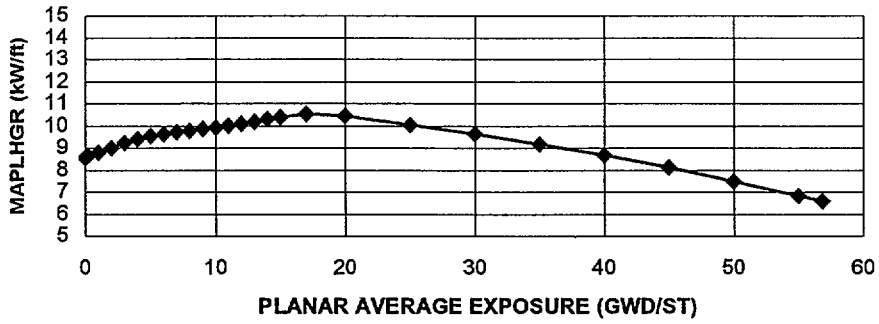


DATA COORDINATES (Reference 3)

Planar Average Exposure (GWD/ST)	MAPLHGR (kW/ft)
0.0	10.85
0.2	10.90
1.0	11.01
2.0	11.17
3.0	11.36
4.0	11.56
5.0	11.76
6.0	11.91
7.0	12.07
8.0	12.23
9.0	12.38
10.0	12.48
12.5	12.61
15.0	12.47
20.0	11.79
25.0	11.05
35.0	9.69
45.0	7.86
49.56	5.62

Figure 4

Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) versus Exposure with LPCI Modification and Bypass Holes Plugged, 3.85 w/o with 14GZ GE14 Fuel



DATA COORDINATES (Reference 3)

Planar Average Exposure (GWD/ST)	MAPLHGR (kW/ft)
0.0	8.57
0.2	8.65
1.0	8.79
2.0	9.01
3.0	9.22
4.0	9.42
5.0	9.54
6.0	9.65
7.0	9.72
8.0	9.79
9.0	9.86
10.0	9.93
11.0	10.01
12.0	10.10
13.0	10.20
14.0	10.30
15.0	10.39
17.0	10.54
20.0	10.45
25.0	10.05
30.0	9.63
35.0	9.18
40.0	8.69
45.0	8.13
50.0	7.50
55.0	6.84
56.86	6.58

Figure 5

Reference 8

Figure 3-11
Cooper Nuclear Station
Flow-Dependent MAPLHGR Factor, MAPFAC(f)

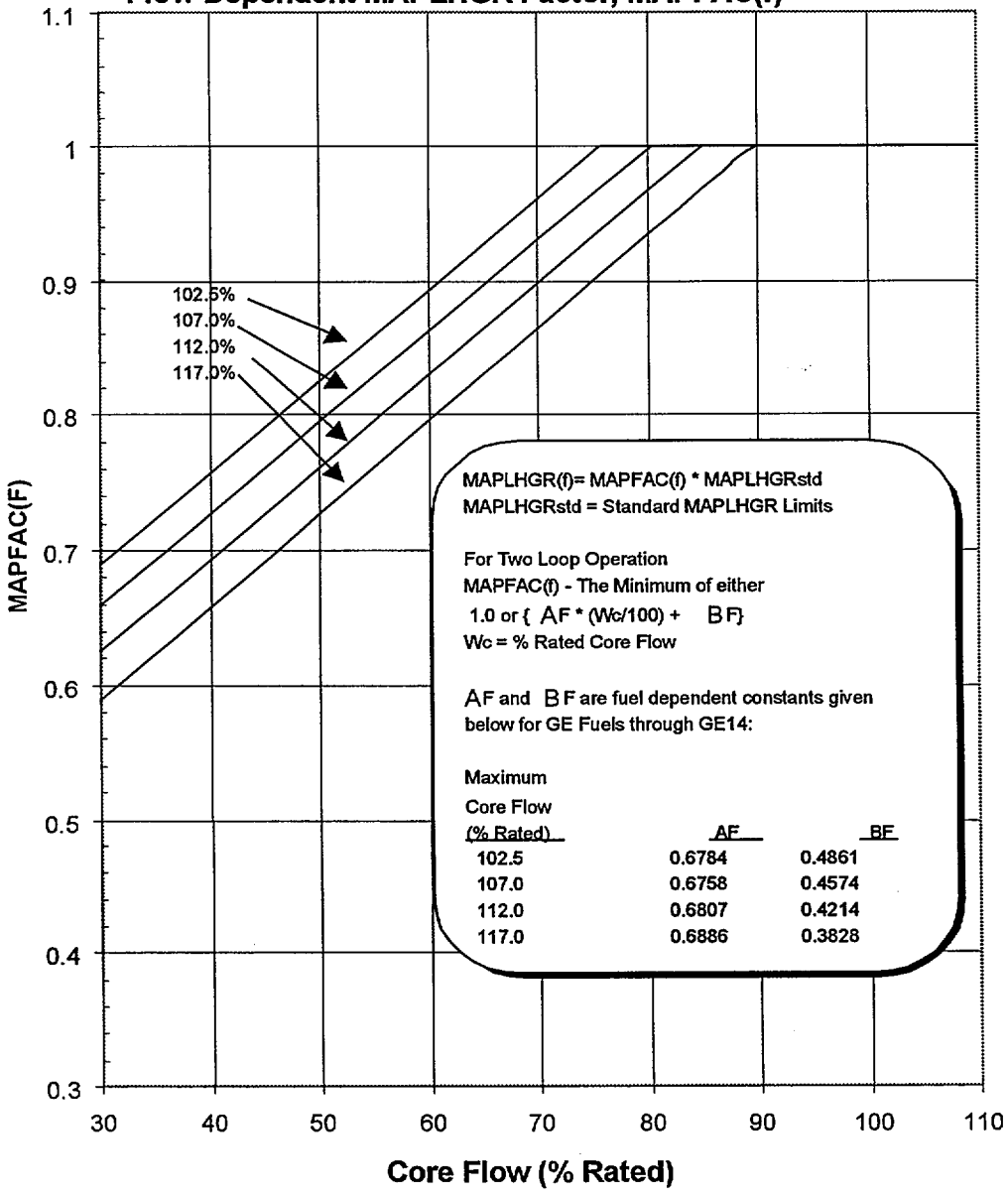


Figure 6

Reference 8

Figure 3-9
Cooper Nuclear Station
Power-Dependent MAPLHGR Factor MAPFAC(p)

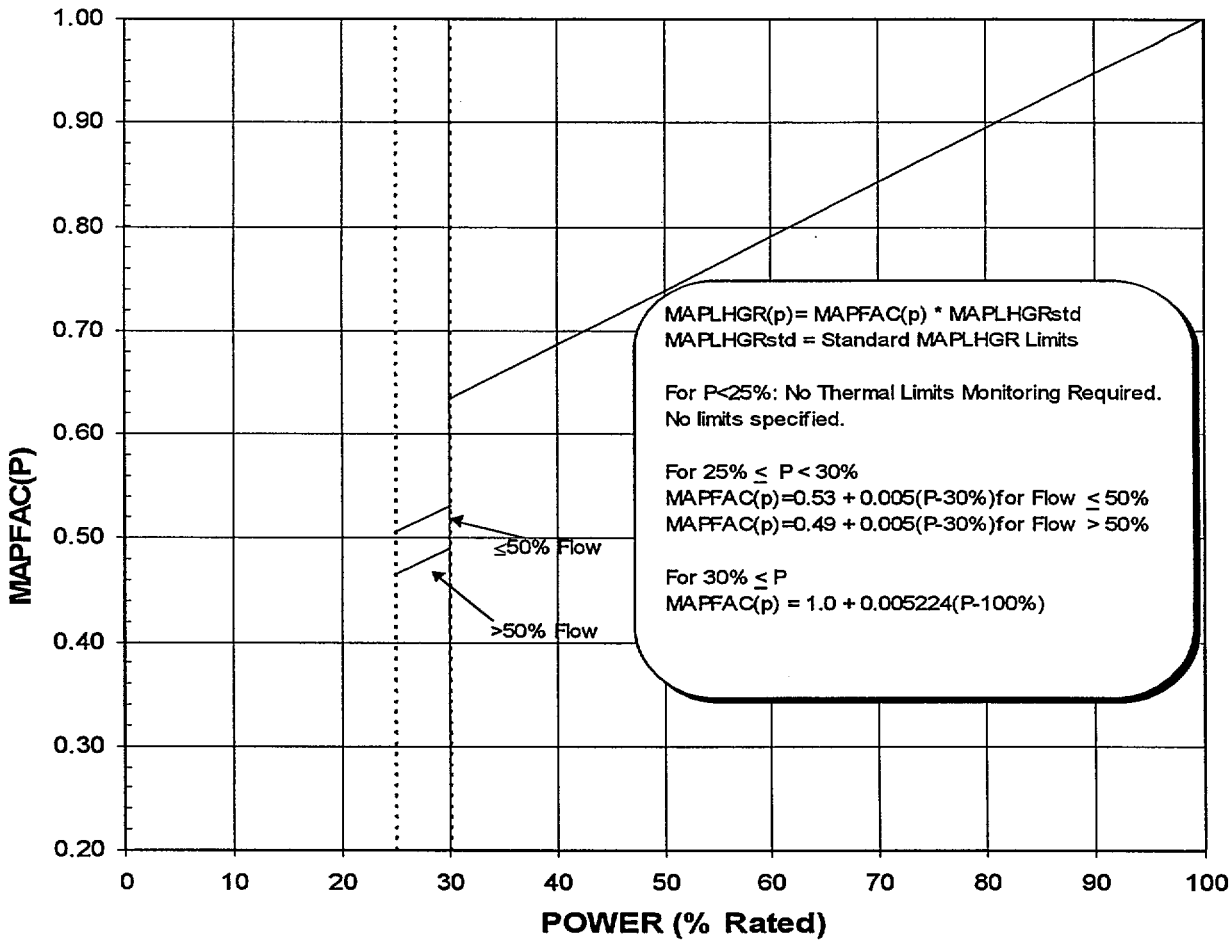


Figure 7

Reference 8

Figure 3-8
Cooper Nuclear Station
Power-Dependent MCPR Limits, Kp and MCPRp

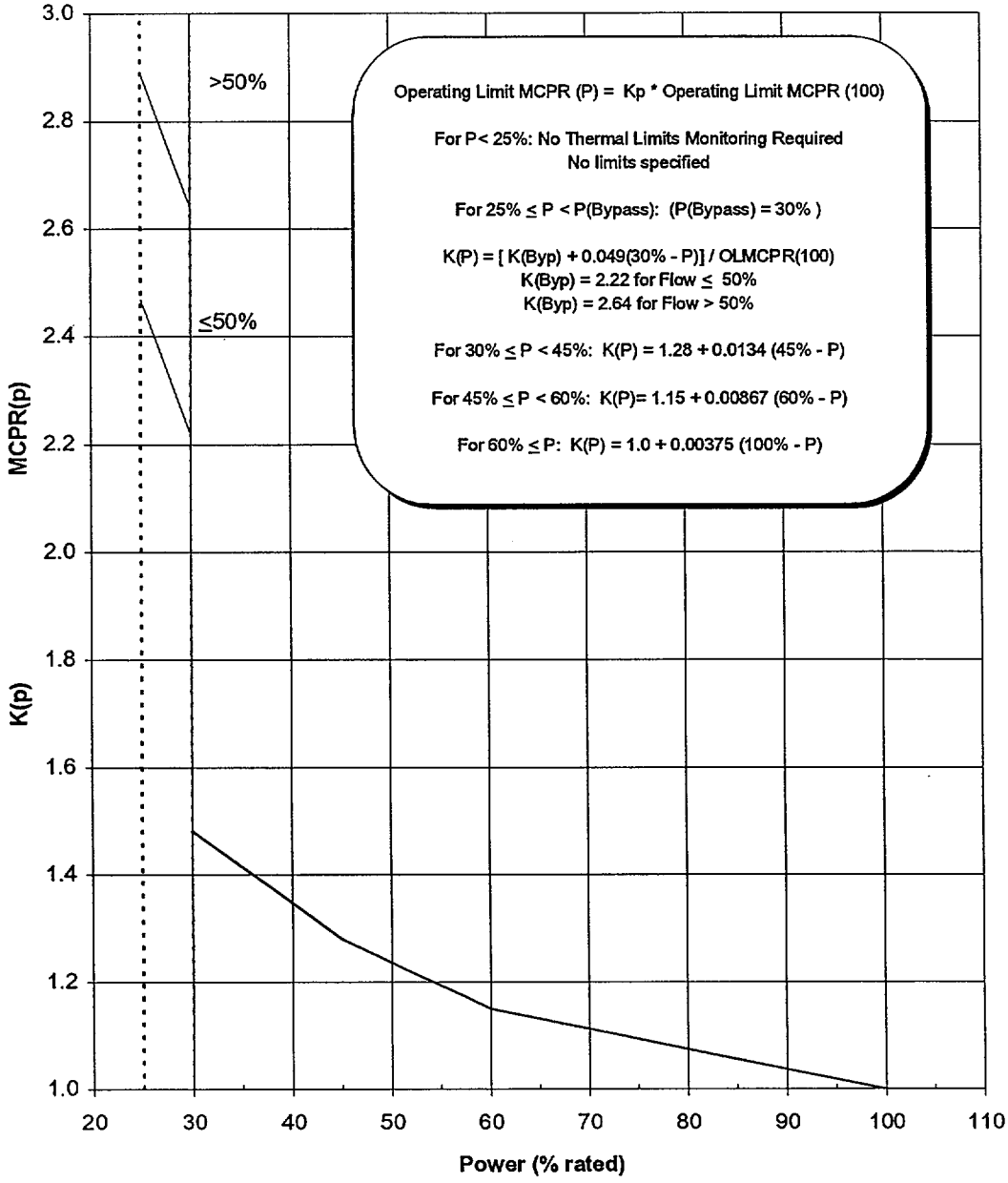


Figure 8

Reference 8

Figure 3-10
Cooper Nuclear Station
Flow-Dependent MCPR Limits, MCPR(f)

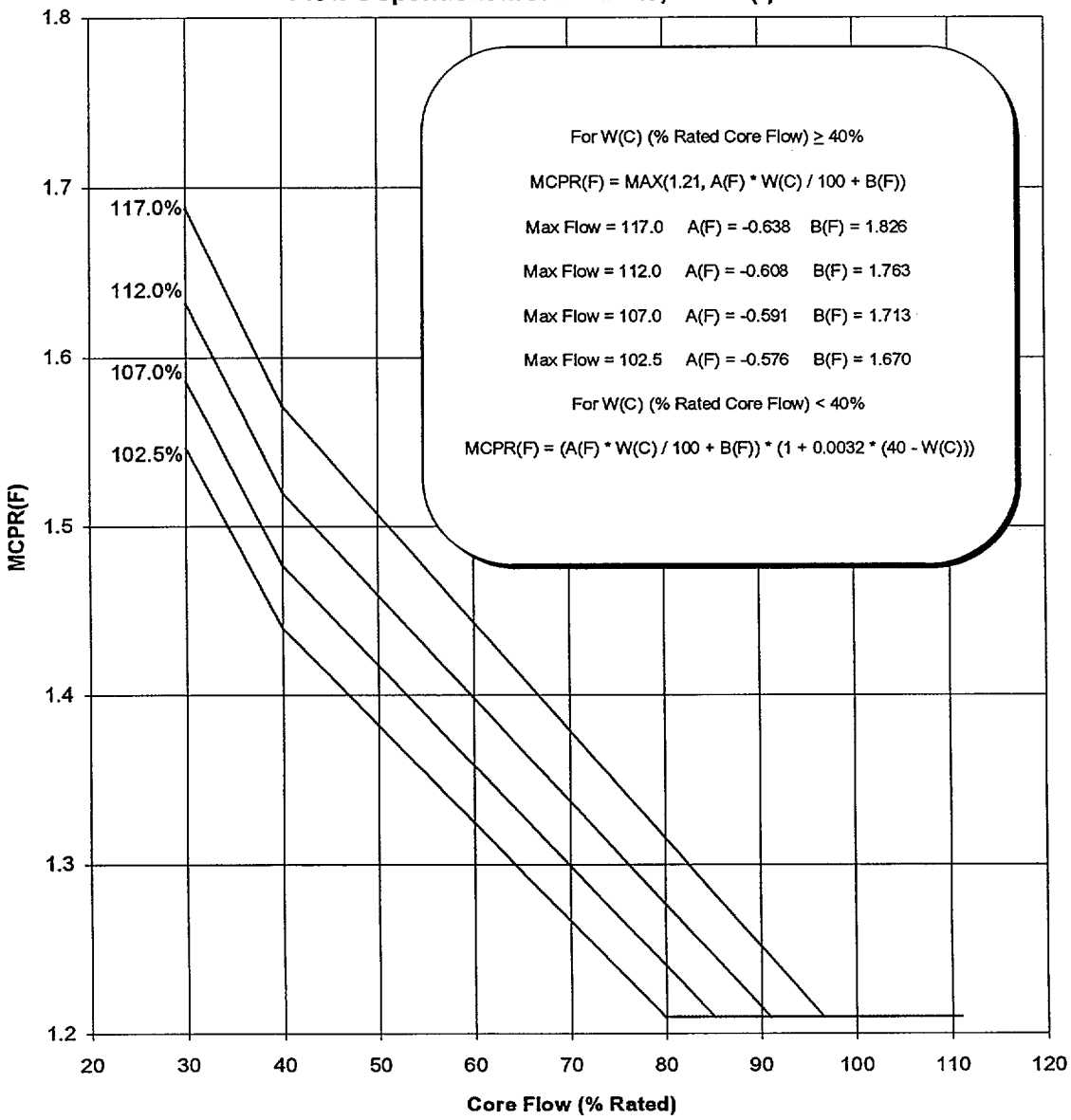
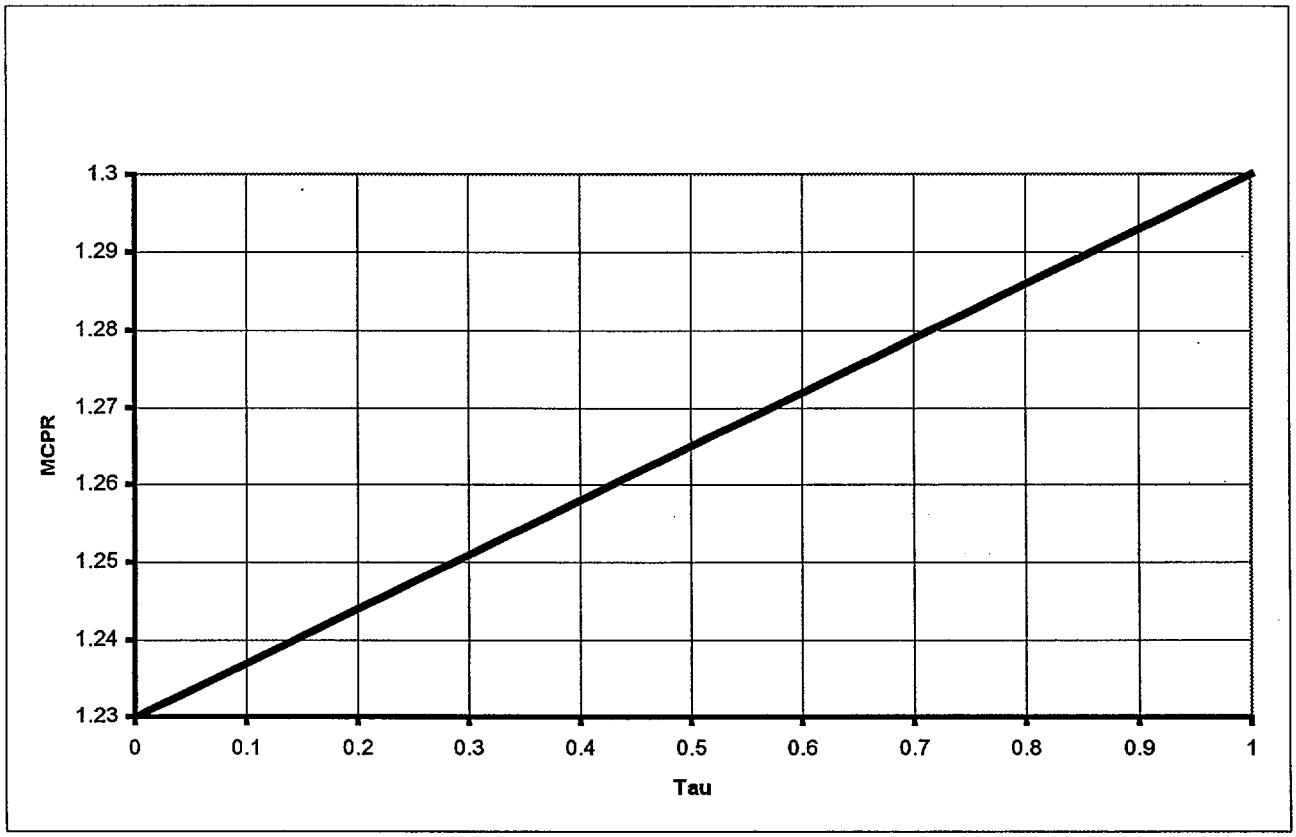


Figure 9

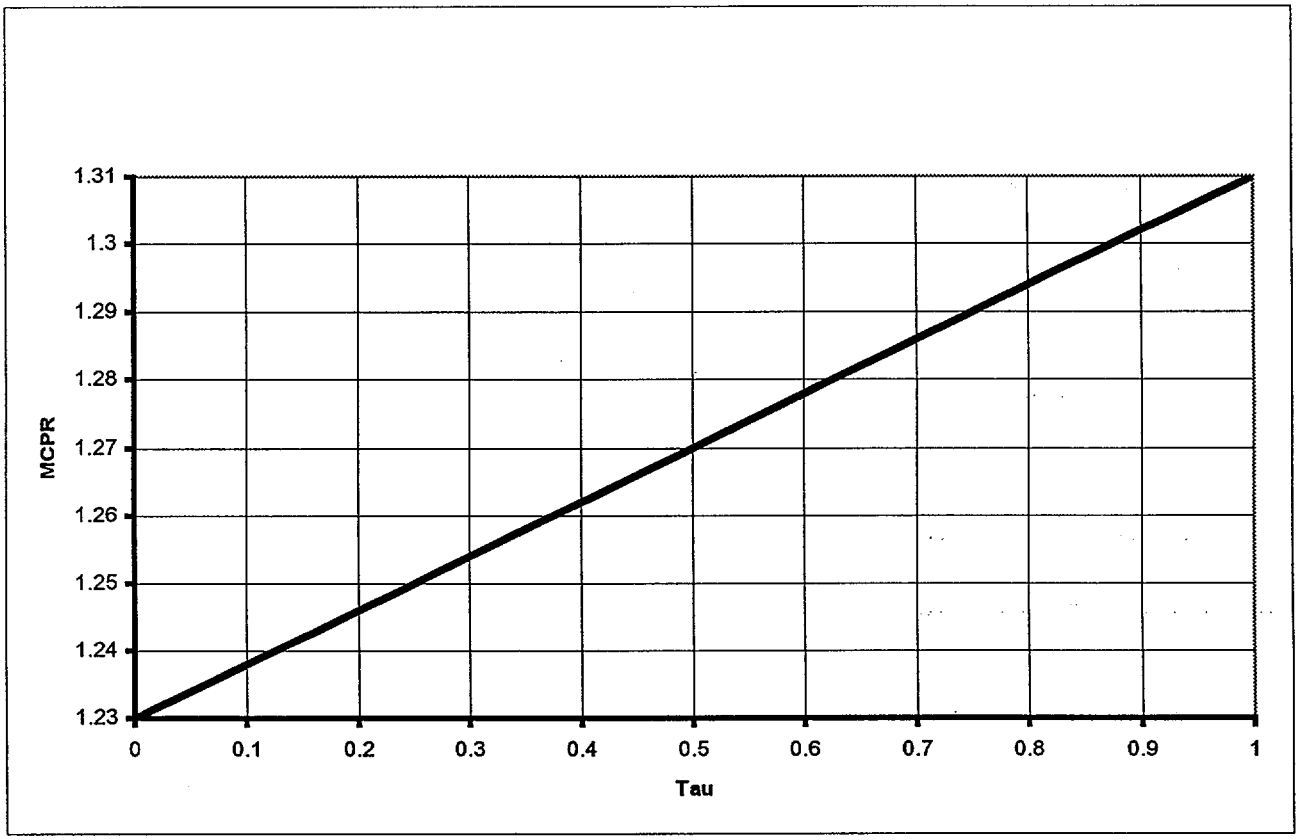
Minimum Critical Power Ratio (MCPR) versus Tau (based on tested measured scram time as defined in Reference 4), GE8X8NB Fuel



Exposure range: BOC20 to EHFP20 - 2205 MWd/MT

Figure 10

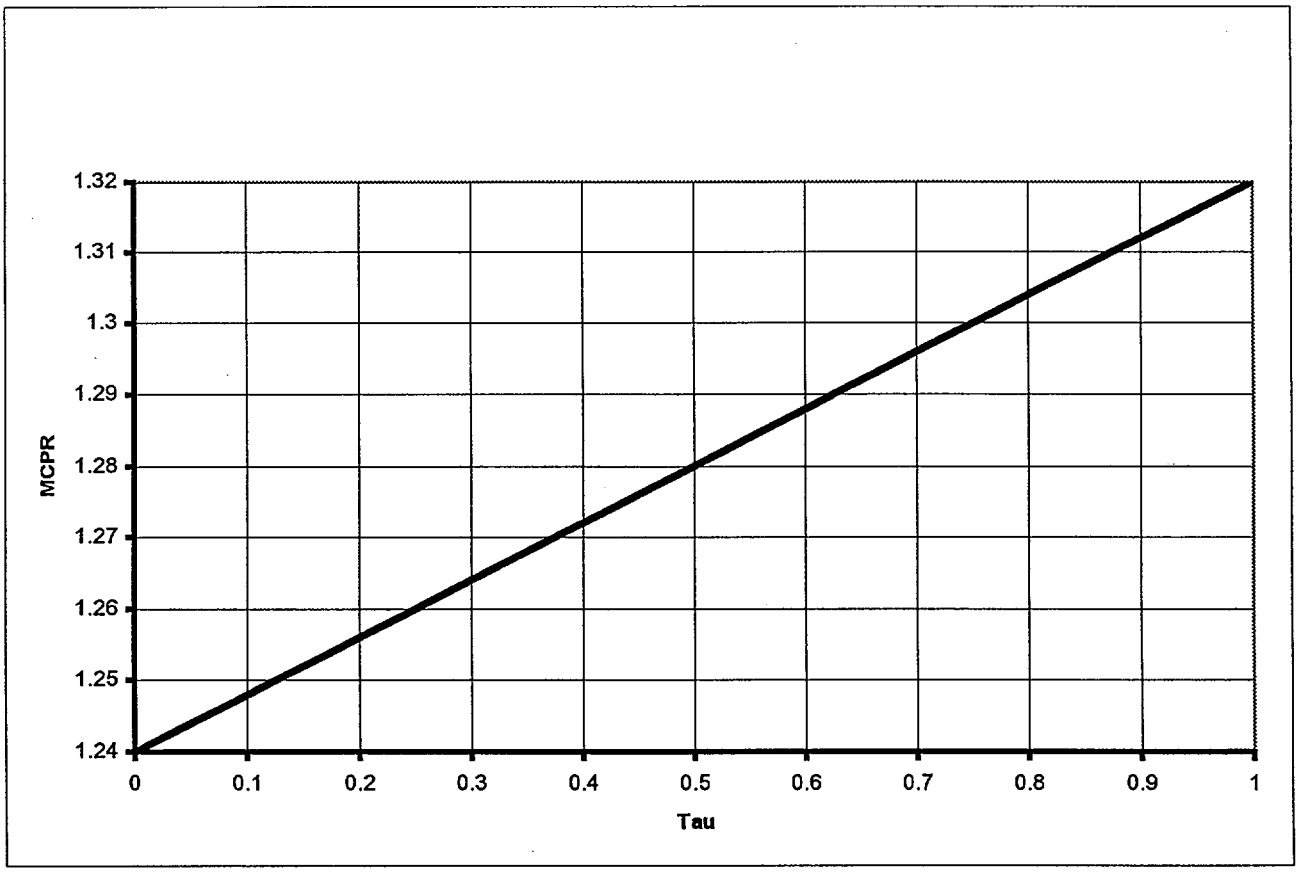
Minimum Critical Power Ratio (MCPR) versus Tau (based on tested measured scram time as defined in Reference 4), GE8X8NB Fuel



Exposure range: EHFP20 - 2205 MWd/MT to EHFP20

Figure 11

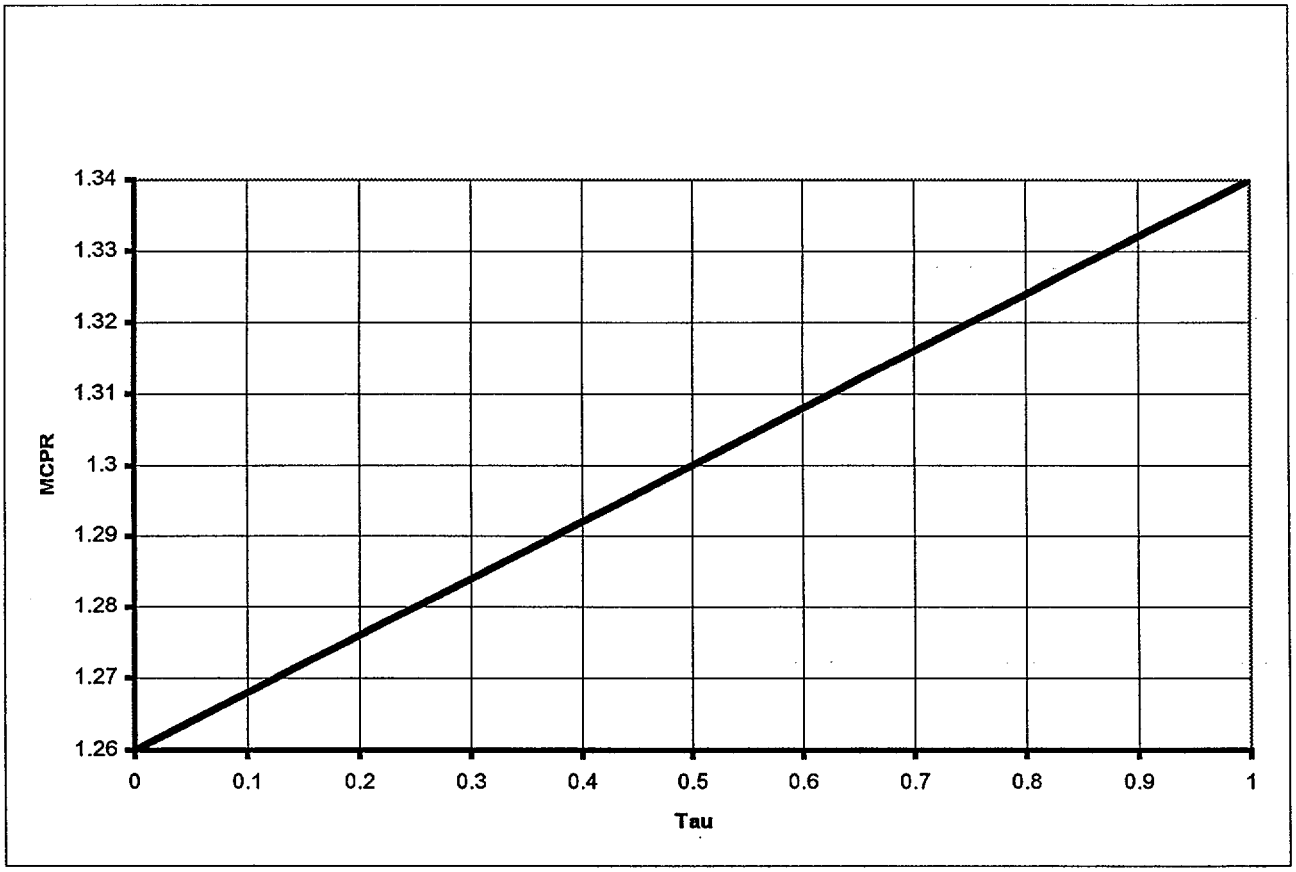
Minimum Critical Power Ratio (MCPR) versus Tau Increased Core Flow (based on tested measured scram time as defined in Reference 4), GE8X8NB Fuel



Exposure range: BOC20 to EOC20

Figure 12

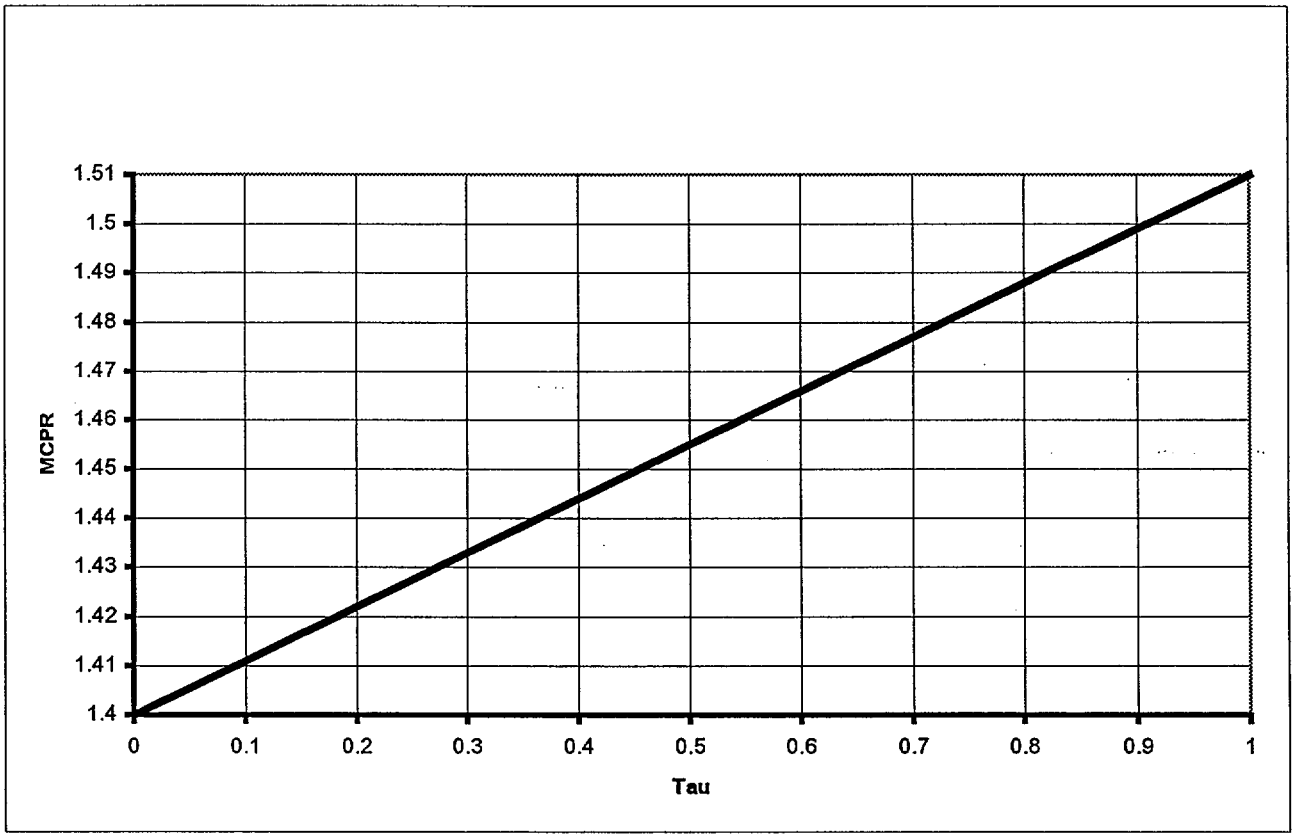
Minimum Critical Power Ratio (MCPR) versus Tau with One Turbine Bypass Valve Unavailable (based on tested measured scram time as defined in Reference 4), GE8X8NB Fuel



Exposure range: BOC20 to EOC20

Figure 13

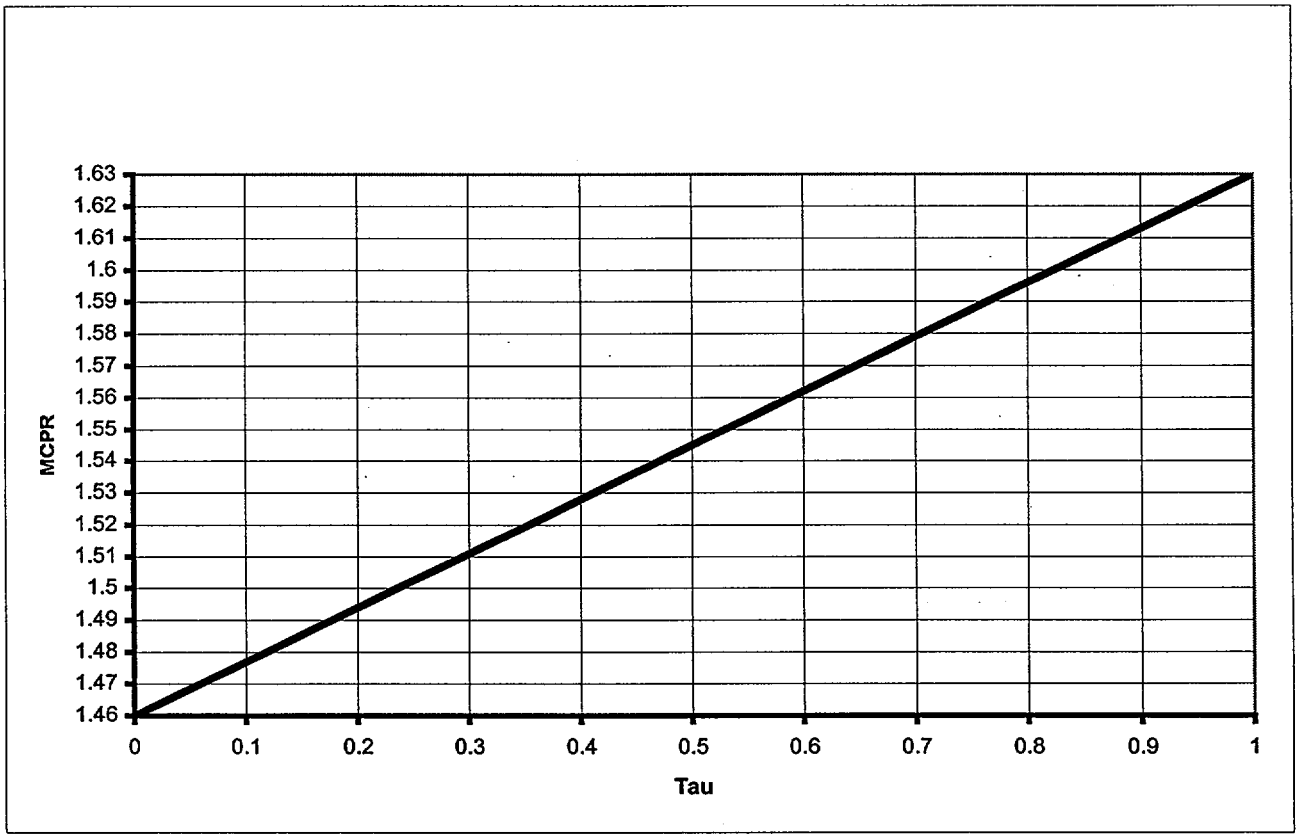
Minimum Critical Power Ratio (MCPR) versus Tau (based on tested measured scram time as defined in Reference 4), GE14 Fuel



Exposure range: BOC20 to EHFP20 - 2205 MWd/MT

Figure 14

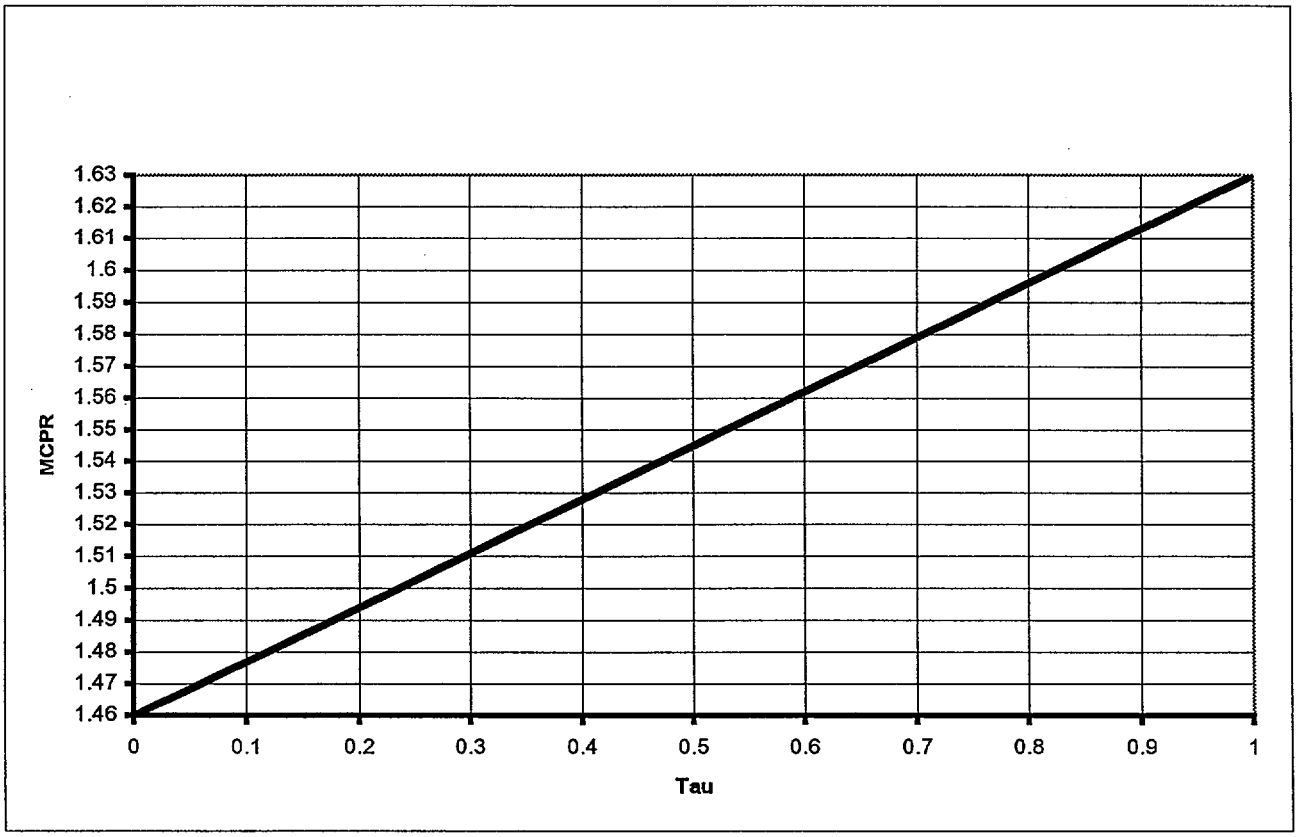
Minimum Critical Power Ratio (MCPR) versus Tau (based on tested measured scram time as defined in Reference 4), GE14 Fuel



Exposure range: EHFP20 - 2205 MWd/MT to EHFP20
BOC20 – EOC20 (For Increased Core Flow **Only**)

Figure 15

Minimum Critical Power Ratio (MCPR) versus Tau with One Turbine Bypass Valve Unavailable (based on tested measured scram time as defined in Reference 4), GE14 Fuel



Exposure range: BOC20 to EOC20

Figure 16

Power to Flow Map