Fort Calhoun Station
Unit No. 1

TDB-VI

TECHNICAL DATA BOOK PROCEDURE

Title: CORE OPERATING LIMIT REPORT

Setpoint/Procedure Form Number (FC-68):	38746
Reason for Change:	Update Figures 3 and 5 and Item 6.0 Linear Heat Rate as noted in PED-FC-92-1395. (Memo)
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Fort Calhoun Station, Unit 1

Cycle 14 Core Operating Limits Report

Due to the critical aspects of the safety analysis inputs contained in this report, changes may not be made to this report without concurrence of the Production Engineering Division, Nuclear Engineering Department.

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Fort Calhoun Station, Unit 1

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CYCLE 14 CORE OPERATING LIMITS REPORT

1.0 INTRODUCTION

This report provides the cycle - specific limits for operation of the Fort Calhoun Station Unit 1 for Cycle 14 operation. It includes limits for:

1.1 TM/LP LSSS 4 Pump Operation (P_{VAR})

1.2 Core Inlet Temperature (T_{IN})

1.3 Power Dependent Insertion Limit (PDIL)

1.4 Allowable Peak Linear Heat Rate

1.5 Excore Monitoring of LHR

1.6 Planar Radial Peaking Factor (F_{xy}^T)

1.7 Integrated Radial Peaking Factor (F_R^T)

1.8 DNB Monitoring

1.9 F_R^T/F_{xy}^T versus Power Trade off curve

1.10 Refueling Boron Concentration

These limits are applicable for the duration of Cycle 14. For subsequent cycles the limits will be reviewed and revised as necessary. In addition, this report includes a number of cycle - specific coefficients used in the generation of certain reactor protective system trip setpoints or allowable increases in radial peaking factors.

This report has been prepared in accordance with the requirements of Technical Specification 5.9.5. The core operating limits have been developed using the NRC methodologies listed in Technical Specification 5.9.5.b.

2.0 CORE OPERATING LIMITS

The values and limits presented within this section have been derived using the NRC - approved methodologies listed in Technical Specification 5.9.5. All values and limits in this section apply to Cycle 14 operation. Cycle 14 must be operated within the bounds of these limits and all others specified in the Technical Specifications.

3.0 TM/LP LIMIT

The TM/LP coefficients for Cycle 14 are shown below:

Table 1

Coefficient	Value
α	29.73
β	18.44
γ	-.1325

The TM/LP setpoint is calculated by the P_{VAR} equation, shown below and in Figure 1:

$$P_{VAR} = 29.73\ PF(B)A1(Y)B + 18.44T_{IN} - 11325$$

$$PF(B) = \begin{cases} 1.0 & B \geq 100\% \\ -0.008B + 1.8 & 50\% < B < 100\% \\ 1.4 & B \leq 50\% \end{cases}$$

$$A1(Y) = \begin{cases} -0.35294Y_1 + 1.08824 & Y_1 \leq 0.25 \\ 0.57143Y_1 + 0.875 & Y_1 > 0.25 \end{cases}$$

Where:
B = High Auctioneered thermal (ΔT) or Nuclear Power, % of rated power
Y = Axial Shape Index, asiu
T_{IN} = Core Inlet Temperature, °F
P_{VAR} = Reactor Coolant System Pressure, psia

4.0 MAXIMUM CORE INLET TEMPERATURE

The maximum core inlet temperature (T_{IN}) for Cycle 14 shall not exceed **543°F**.

This limit is not applicable during either a thermal power ramp in excess of 5% of rated thermal power per minute or a thermal power step greater than 10% of rated thermal power.

5.0 POWER DEPENDENT INSERTION LIMIT

The power dependent insertion limit is defined in Figure 2 for Cycle 14 operation.

6.0 LINEAR HEAT RATE

The allowable peak linear heat rate vs. burnup is **14.2 kw/ft** for Cycle 14 for all burnup points as shown on Figure 3.

7.0 EXCORE MONITORING OF LHR

The allowable operation for power versus axial shape index for monitoring of LHR with excore detectors for Cycle 14 is shown in Figure 4.

8.0 PEAKING FACTOR LIMITS

The maximum full power values for the unrodded planar radial peaking factor (F_{XY}^T) and integrated radial peaking factor F_R^T) are shown in Table 2.

Table 2

Maximum Full Power F_R and F_{XY} Limits

Peaking Factor	Limits
F_{XY}^T	1.85
F_R^T	1.79

9.0 DNB MONITORING

The limits for DNB as a function of axial shape index and core power is shown in Figure 5.

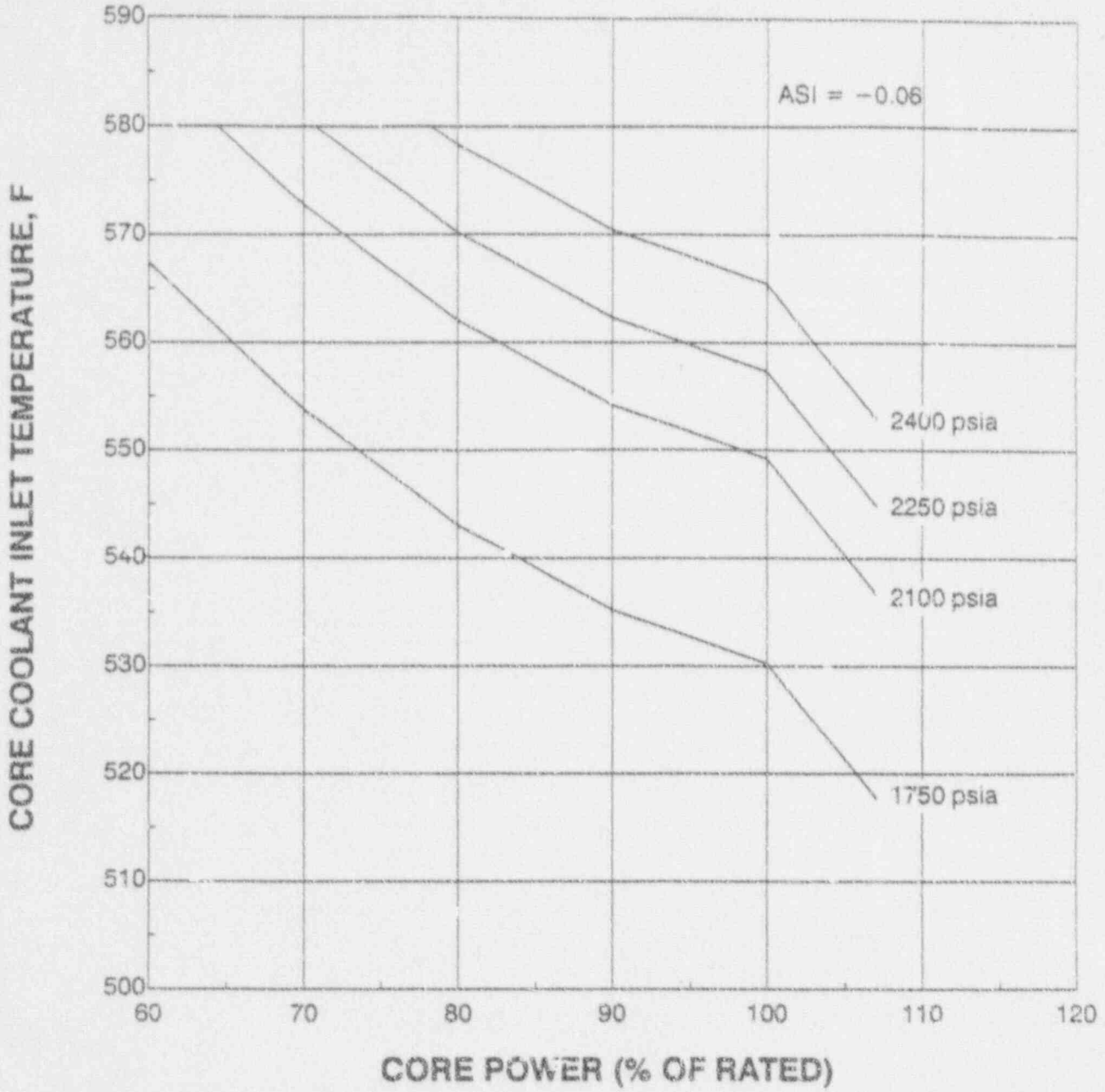
Core power shall be maintained within the limits established by the Better Axial Shape Selection System (BASSS) for CEA insertion of the lead bank of <65% (i.e., greater than or equal to 44.1 inches withdrawn) when BASSS is operable, or within the limits of Figure 5.

10.0 F_{XY}^T, F_R^T AND CORE POWER LIMITATIONS

Core power limitations versus F_R^T and F_{XY}^T are shown in Figure 6.

11.0 REFUELING BORON CONCENTRATION

The refueling boron concentration must be maintained with a boron concentration of at least **1700 ppm** in the Reactor Coolant System to ensure a shutdown margin of not less than 5% with all CEAs withdrawn.



$$P_{VAR} = 29.73PF(B)A1(Y)B + 18.44T_{IN} - 11325$$

$$PF(B) = 1.0 \qquad B \geq 100\%$$
$$= -.008B + 1.8 \qquad 50\% < B < 100\%$$
$$= 1.4 \qquad B \leq 50\%$$

$$A1(Y) = -0.35294Y_I + 1.08824 \qquad Y_I \leq .25$$
$$= 0.57143Y_I + 0.875 \qquad Y_I > .25$$

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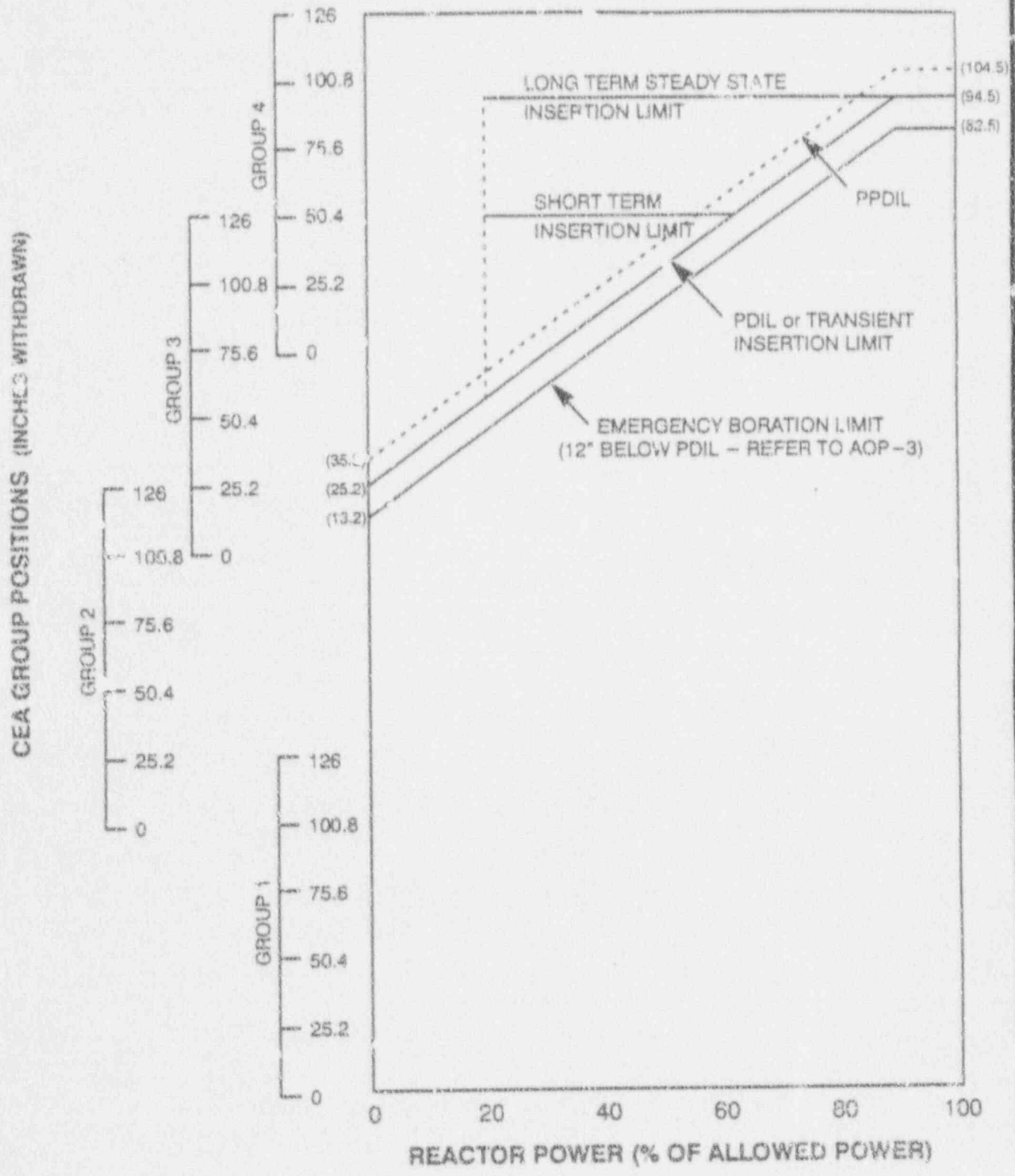
CYCLE 14 COLR	THERMAL MARGIN/ LOW PRESSURE 4 PUMP OPERATION	FIGURE 1



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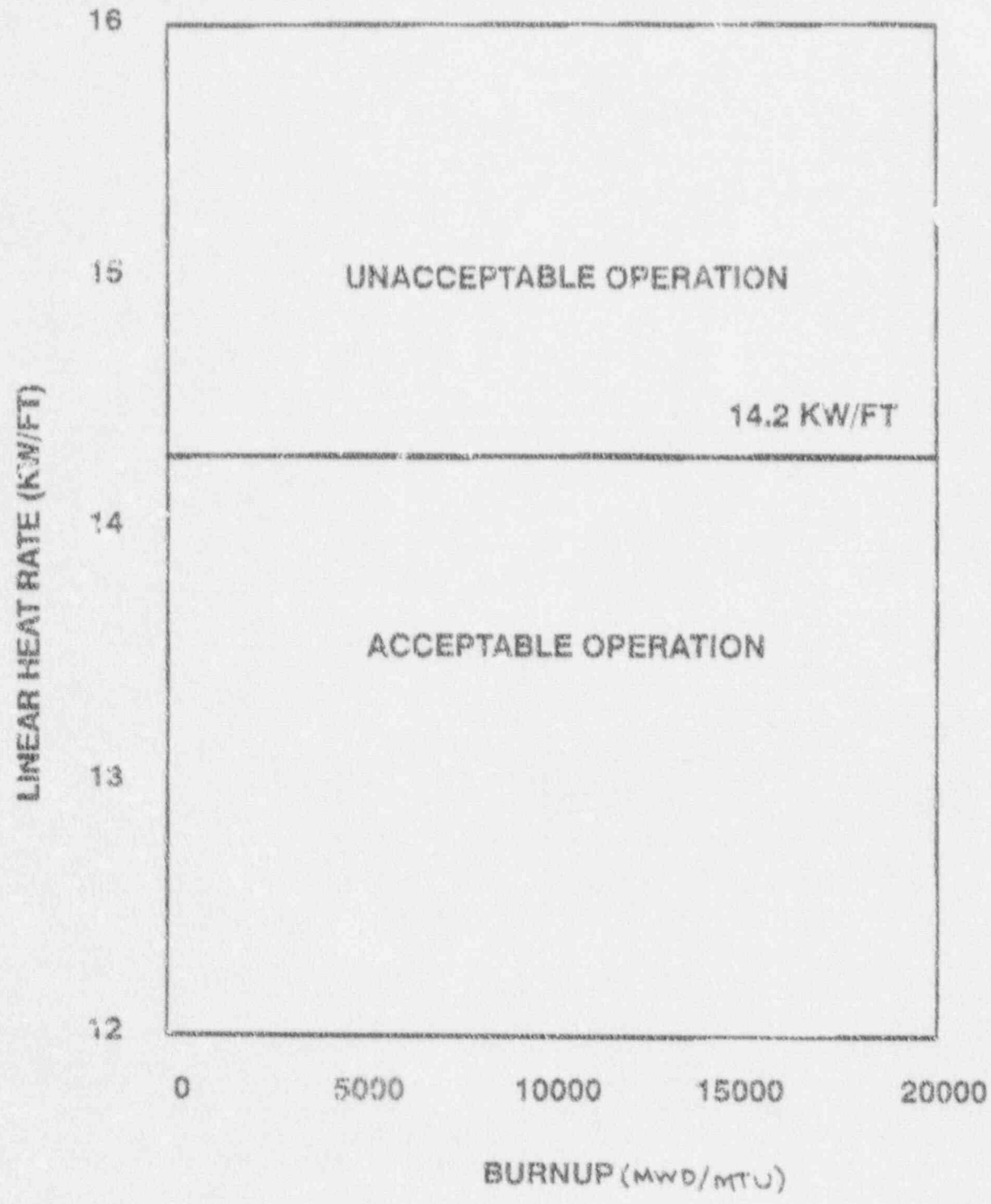
CYCLE 14 COLR	POWER DEPENDENT INSERTION LIMIT	FIGURE 2



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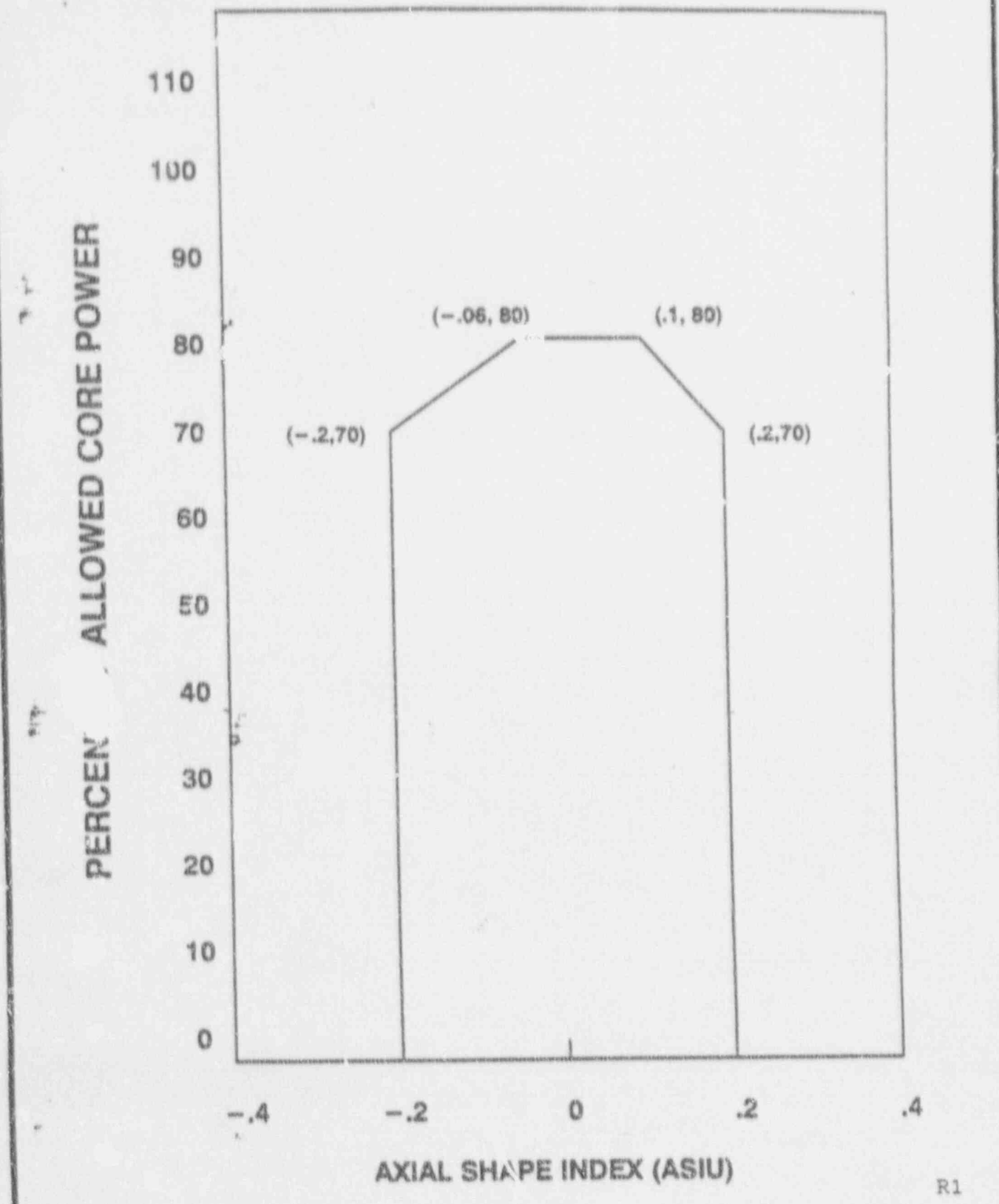
CYCLE 14 COLR	ALLOWABLE PEAK LINEAR HEAT RATE VS. BURNUP	FIGURE 3



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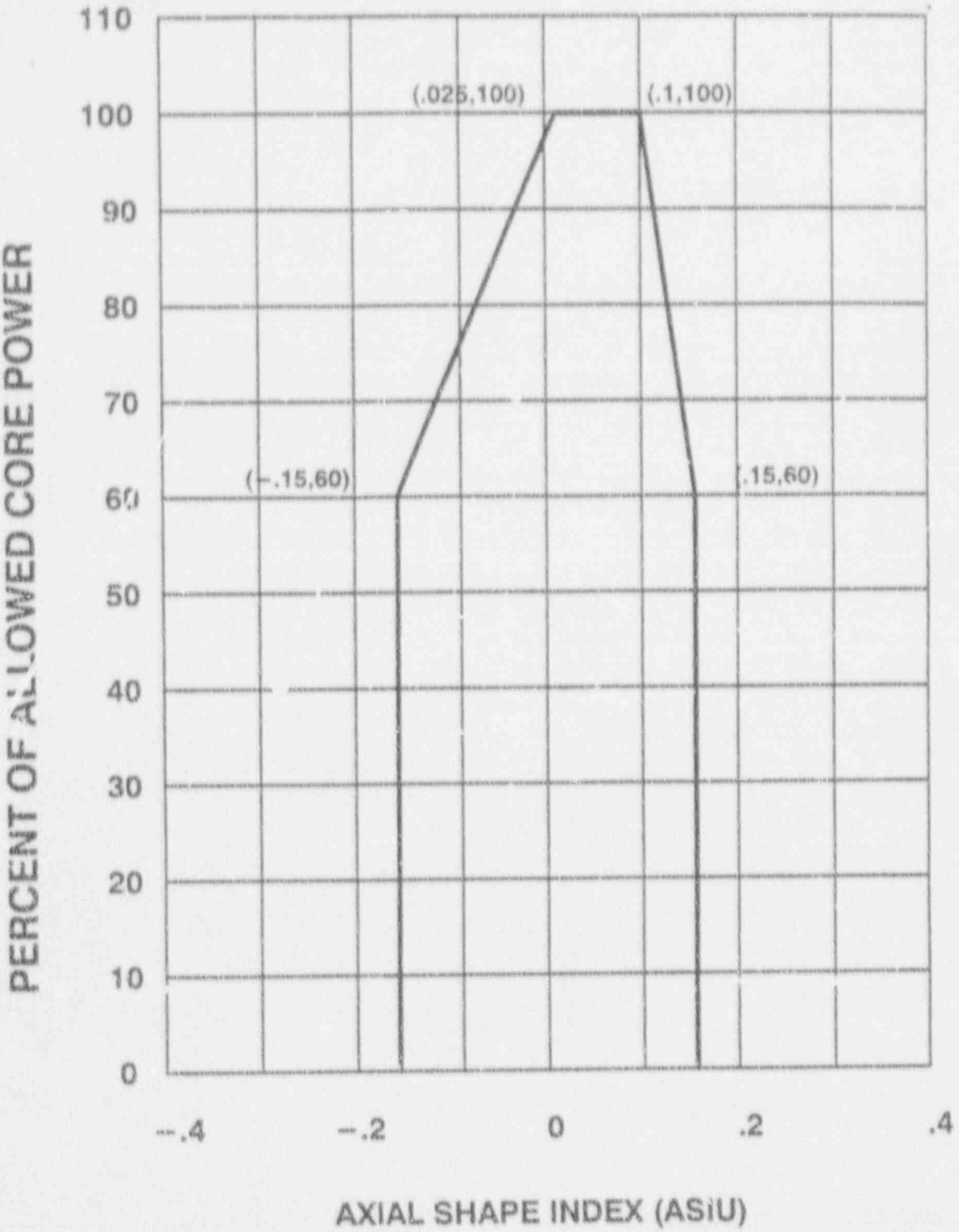
CYCLE 14 COLR	EXCORE MONITORING OF LHR	FIGURE 4



NOTE: WHEN BASSS IS OPERABLE THIS FIGURE IS SUPERSCEDED BY THE BASSS DNB ALLOWABLE POWER VALUE

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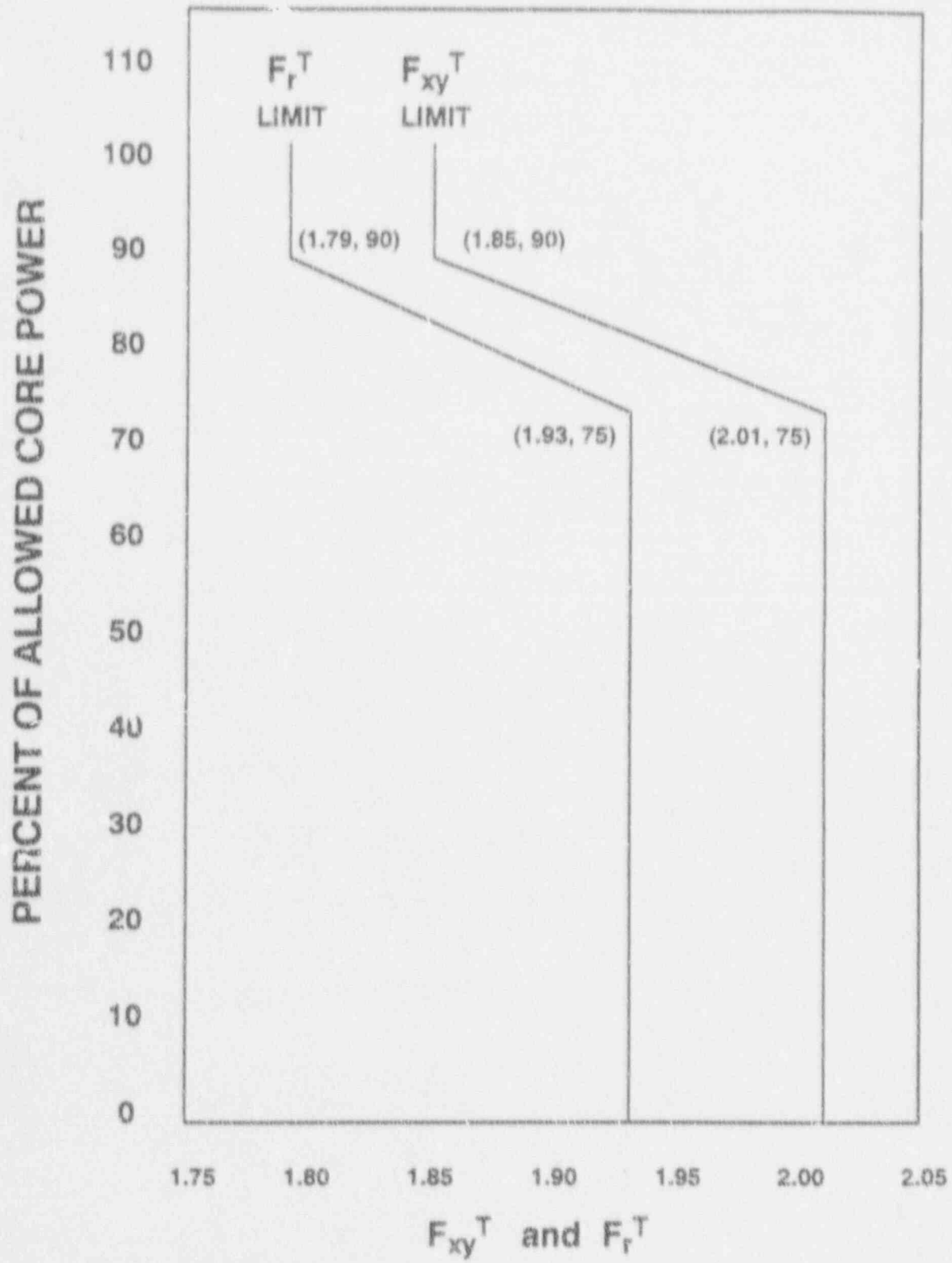
CYCLE 14 COLR	DNB MONITORING	FIGURE 5



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CYCLE 14 COLR	F_{xy}^T, F_r^T, AND CORE POWER LIMITATIONS	FIGURE 6