Docket No. 50-336

Millstone Unit No. 2

Cycle 11

Core Operating Limits Report

Revision 1

November, 1990

1. CORE OPERATING LIMITS REPORT

This Core Operating Limits Report for Millstone 2 has been prepared in accordance with the requirements of Technical Specification 6.9.1.7. The Technical Specifications affected by this report are listed below:

Section	Specification	
2.1	3/4.1.1.1	SHUTDOWN MARGIN - T_{avg} > 200°F
2.2	3/4.1.1.2	SHUTDOWN MARGIN - $T_{avg} \leq$ 200°F
2.3	3/4.1.1.4	Moderator Temperature Coefficient
2.4	3/4.1.3.6	Regulating CEA Insertion Limits
2.5	3/4.2.1	Linear Heat Rate
2.6	3/4.2.3	Total Integrated Radial Peaking Factor - F_r^T
2.7	3/4.2.6	DNB Margin

Terms appearing in capitalized type are DEFINED TERMS as defined in Section 1.0 of the Technical Specifications.

2. OPERATING LIMITS

The cycle-specific parameter limits for the specifications listed in Section 1.0 are presented in the following subsections. These limits have been developed using the NRC-approved methodoligies specified in Technical Specification 6.9.1.7.

2.1 SHUTDOWN MARGIN - T_{avg} > 200°F (Specification 3/4.1.1.1)

The SHUTDOWN MARGIN shall be $\geq$ 3.6% ΔK/K

2.2 SHUTDOWN MARGIN - $T_{avg} \leq$ 200°F (Specification 3/4.1.1.2)

The SHUTDOWN MARGIN shall be $\geq$ 2.0% ΔK/K

2.3 Moderator Temperature Coefficient (Specification 3/4.1.1.4)

The moderator temperature coefficient shall be:

a. Less positive than 0.7×10^{-4} ΔK/K/°F whenever THERMAL POWER is $\leq$ 70% of RATED THERMAL POWER,

b. Less positive than 0.4×10^{-4} ΔK/K/°F whenever THERMAL POWER is > 70% of RATED THERMAL POWER,

c. Less negative than -2.8×10^{-4} ΔK/K/°F at RATED THERMAL POWER.

2.4 Regulating CEA Insertion Limits (Specification 3/4.1.3.6)

The regulating CEA groups shall be limited to the withdrawal sequence and to the insertion limits shown in Figure 2.4-1. CEA insertion between the Long Term Steady State Insertion Limits and the Transient Insertion Limits is restricted to:

a. ≤ 4 hours per 24 hour interval,

b. ≤ 5 Effective Full Power Days per 30 Effective Full Power Day interval, and

c. ≤ 14 Effective Full Power Days per calendar year.

2.5 Linear Heat Rate (Specification 3/4.2.1)

The Linear heat rate, including heat generated in the fuel, clad and moderator, shall not exceed:

a. 15.1 kw/ft when the reactor coolant flow rate measured per Specification 4.2.6.1 ≥ 340,000 gpm.

b. 14.5 kw/ft when the reactor coolant flow rate measured per Specification 4.2.6.1 ≥ 325,000 gpm and < 340,000 gpm.

During operation with the linear heat rate being monitored by the Excore Detector Monitoring System, the AXIAL SHAPE INDEX shall remain within the limits of Figure 2.5-1.

During operation with the linear heat rate being monitored by the Incore Detector Monitor System, the alarm setpoints shall be adjusted to less than or equal to the limit when the following factors are appropriately included in the setting of the alarms:

1.* Flux peaking augmentation factors as shown in Figure 2.5-2,

2. A measurement-calculational uncertainty factor of 1.07,

3. An engineering uncertainty factor of 1.03,

4.* A linear heat rate uncertainty factor of 1.01 due to axial fuel densification and thermal expansion, and

5. A THERMAL POWER measurement uncertainty factor of 1.02.

*These factors are only appropriate to fuel batches "A" through "L".

2.6 Total Integrated Radial Peaking Factor - F_r^T (Specification 3/4.2.3)

The calculated value of F_r^T, defined as $F_r^T = F_r(1+T_q)$, shall be limited to:

a. $0.90 < PF \leq 1.00$ $\quad F_r^T \leq 1.790 - (0.15 \times PF)$

b. $0.80 < PF \leq 0.90$ $\quad F_r^T \leq 1.925 - (0.30 \times PF)$

c. $0.70 < PF \leq 0.80$ $\quad F_r^T \leq 2.205 - (0.65 \times PF)$

d. $PF \leq 0.70$ $\quad F_r^T \leq 1.750$

where,

PF = THERMAL POWER divided by RATED THERMAL POWER

2.7 DNB Margin (Specification 3/4.2.6)

The DNB margin shall be preserved by maintaining the cold leg temperature, pressurizer pressure, reactor coolant flow rate, and AXIAL SHAPE INDEX within the following limits:

Parameter	Limits
	Four Reactor Coolant Pumps Operations
a. Cold Leg Temperature	≤ 549°F
b. Pressurizer Pressure	≥ 2225 psia*
c. Reactor Coolant Flow Rate	≥ 325,000 gpm
d. AXIAL SHAPE INDEX	FIGURE 2.7-1

* Limit not applicable during either a THERMAL POWER ramp increase in excess of 5% of RATED THERMAL POWER per minute or a THERMAL POWER step increase of greater than 10% of RATED THERMAL POWER.

FIGURE 2.4-1 CEA Insertion Limit vs. THERMAL POWER with Four Reactor Coolant Pumps Operating

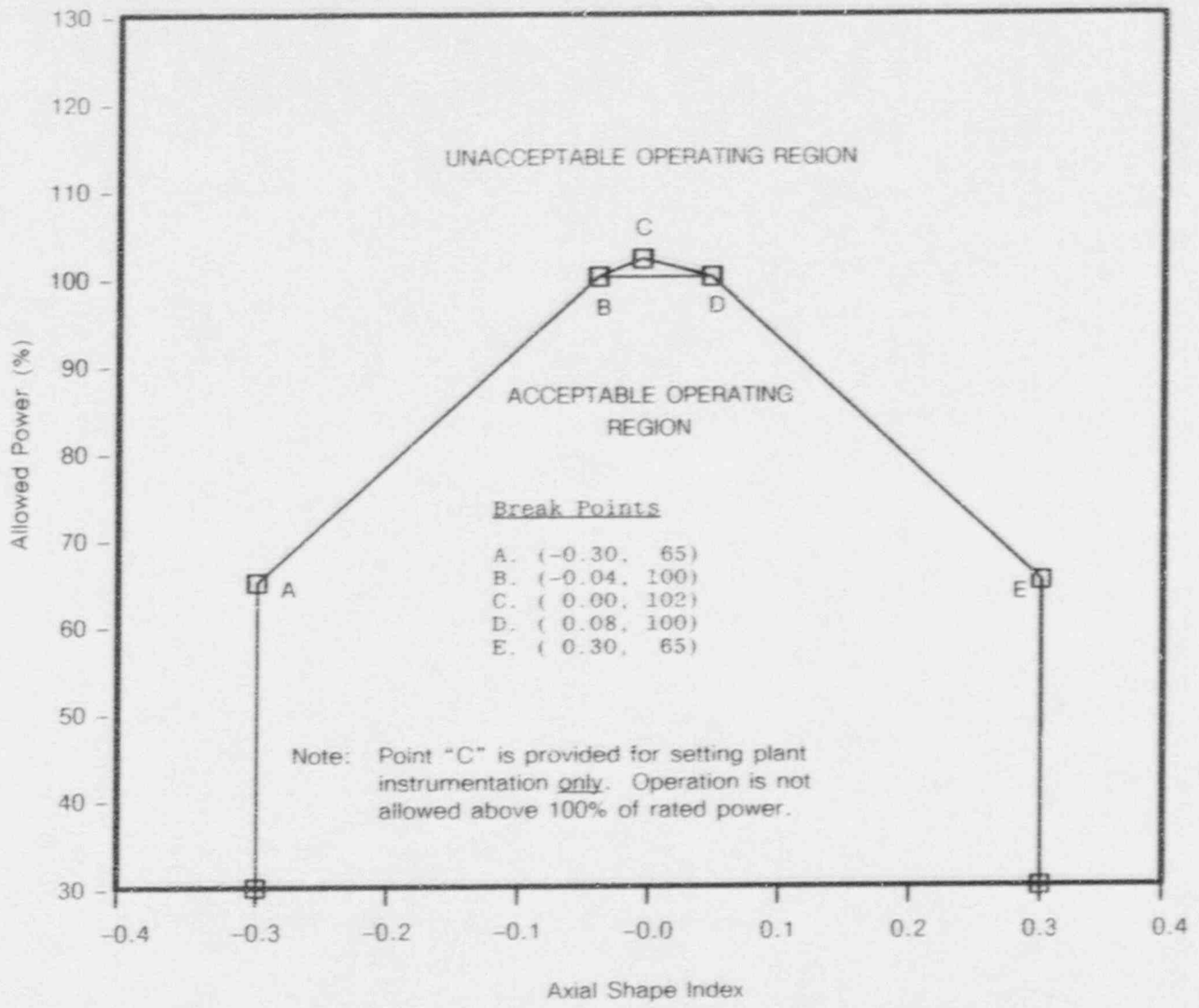

FIGURE 2.5-1 AXIAL SHAPE INDEX vs. PERCENT OF ALLOWABLE POWER LEVEL

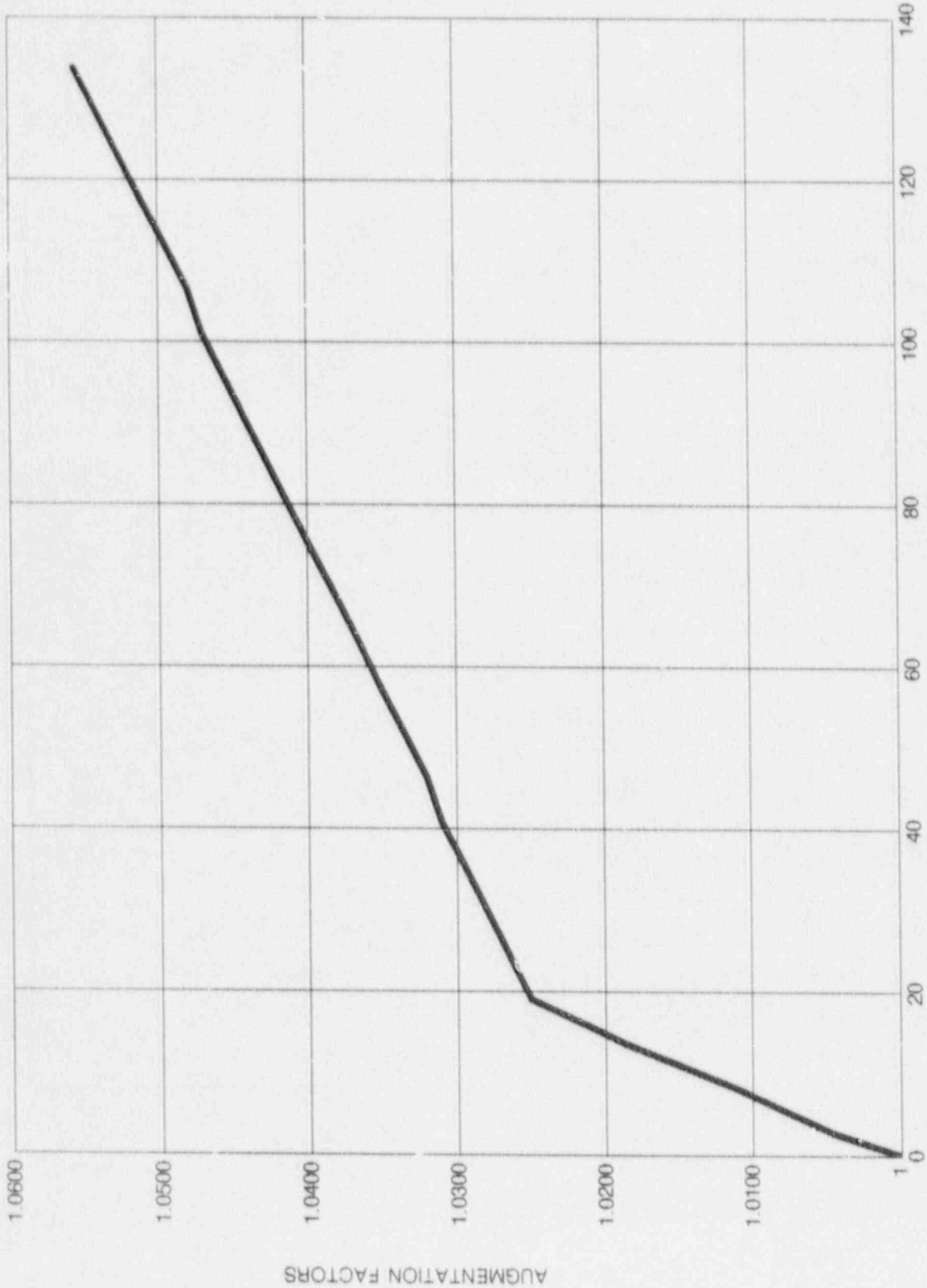

FIGURE 2.5-2 Augmentation Factor vs. Distance from Bottom of Core (only applicable to fuel batches "A" and "L")

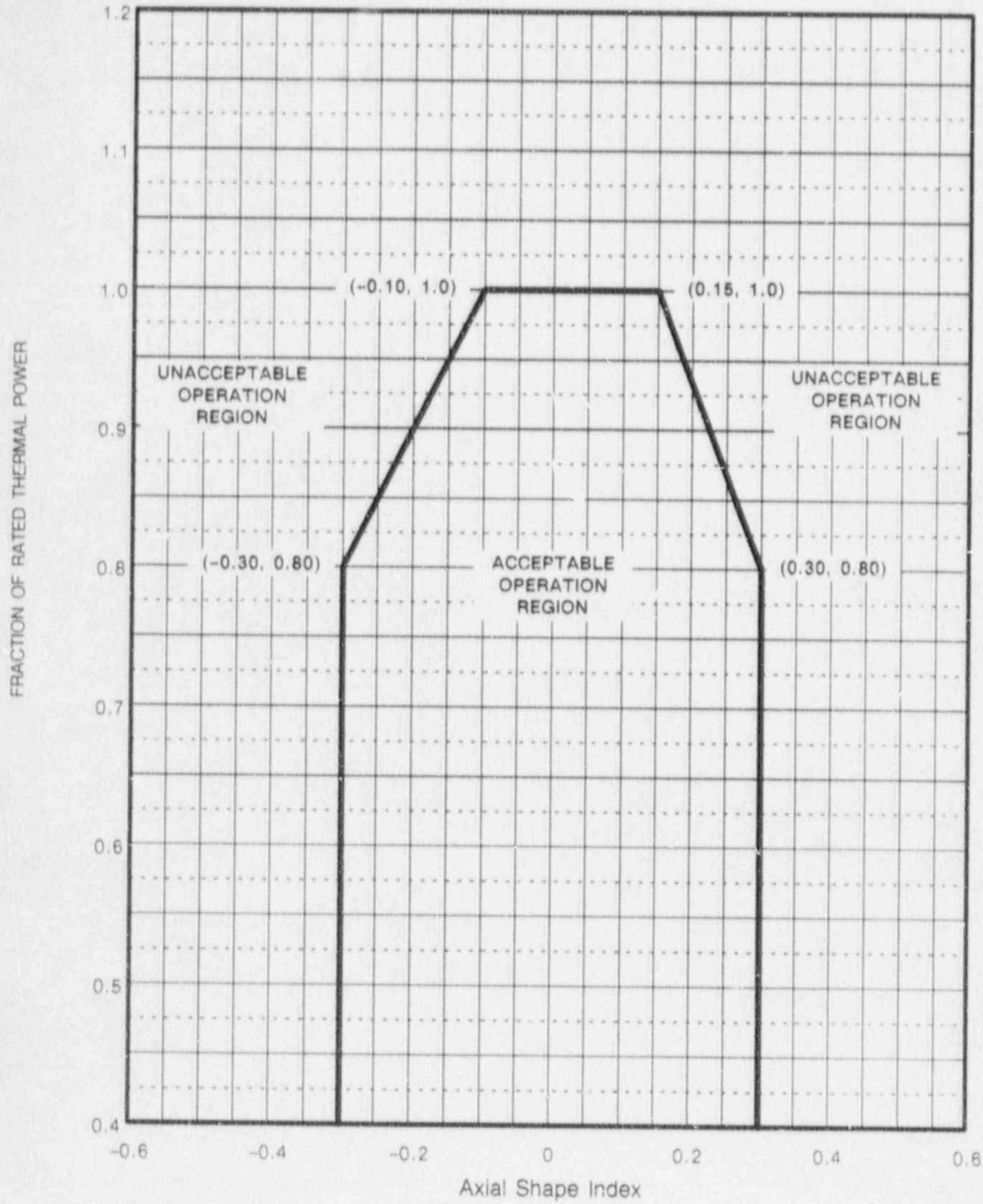

FIGURE 2.7-1 AXIAL SHAPE INDEX Operating Limits with Four Reactor Coolant Pumps Operating