

Docket No. 50-336  
B13664

Attachment 1  
Millstone Unit No. 2  
Cycle 11  
Core Operating Limits Reports  
Revision 0

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## CORE OPERATING LIMITS REPORT

### 1.0 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 associated with this report are listed below:

<u>Section</u>	<u>Specification</u>
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2.1	3/4.1.1.1	SHUTDOWN MARGIN - $T_{avg} > 200^{\circ}\text{F}$
2.2	3/4.1.1.2	SHUTDOWN MARGIN - $T_{avg} \leq 200^{\circ}\text{F}$
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.

### 2.0 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 methodologies specified in Technical Specification 6.9.1.7.

#### 2.1 SHUTDOWN MARGIN - $T_{avg} > 200^{\circ}\text{F}$ (Specification 3/4.1.1.1)

The SHUTDOWN MARGIN shall be  $\geq 3.6\% \Delta\text{K/K}$

#### 2.2 SHUTDOWN MARGIN - $T_{avg} \leq 200^{\circ}\text{F}$ (Specification 3/4.1.1.2)

The SHUTDOWN MARGIN shall be  $\geq 2.0\% \Delta\text{K/K}$

#### 2.3 Moderator Temperature Coefficient (Specification 3/4.1.1.4)

The moderator temperature coefficient shall be:

- Less positive than  $0.7 \times 10^{-4} \Delta\text{K/K}/^{\circ}\text{F}$  whenever THERMAL POWER is  $\leq 70\%$  of RATED THERMAL POWER,
- Less positive than  $0.4 \times 10^{-4} \Delta\text{K/K}/^{\circ}\text{F}$  whenever THERMAL POWER is  $> 70\%$  of RATED THERMAL POWER,
- Less negative than  $-2.8 \times 10^{-4} \Delta\text{K/K}/^{\circ}\text{F}$  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.  $\leq 4$  hours per 24 hour interval,
- b.  $\leq 5$  Effective Full Power Days per 30 Effective Full Power Day interval, and
- c.  $\leq 14$  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  $\geq 340,000$  gpm.
- b. 14.5 kw/ft when the reactor coolant flow rate measured per Specification 4.2.6.1  $\geq 325,000$  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 applicable 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.  $0.90 < PF \leq 1.00$        $F_r^T \leq (11.73 - PF)((1.24 \times 10^{-7} \times FL) + 0.108)$
- b.  $0.70 < PF \leq 0.90$        $F_r^T \leq (3.50 - PF)((5.18 \times 10^{-7} \times FL) + 0.449)$
- c.  $PF \leq 0.70$                $F_r^T \leq 1.75 ((8.28 \times 10^{-7} \times FL) + 0.718)$

where,

PF = THERMAL POWER divided by RATED THERMAL POWER

FL = The lesser of either:

- 1) The reactor coolant flow rate measured per Technical Specification 4.2.6.1 down to a minimum of 325,000 gpm, or
- 2) 340,000 gpm.

## 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:

<u>Parameter</u>	<u>Limits</u> <u>Four Reactor Coolant</u> <u>Pumps Operations</u>
a. Cold Leg Temperature	$\leq 549^\circ\text{F}$
b. Pressurizer Pressure	$\geq 2225 \text{ psia}^*$
c. Reactor Coolant Flow Rate	$\geq 340,000 \text{ gpm}^{**}$
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.

\*\* Flow reductions to 325,000 gpm are compensated for by reductions in the  $F_r^T$  limit (Technical Specification 3.2.3).

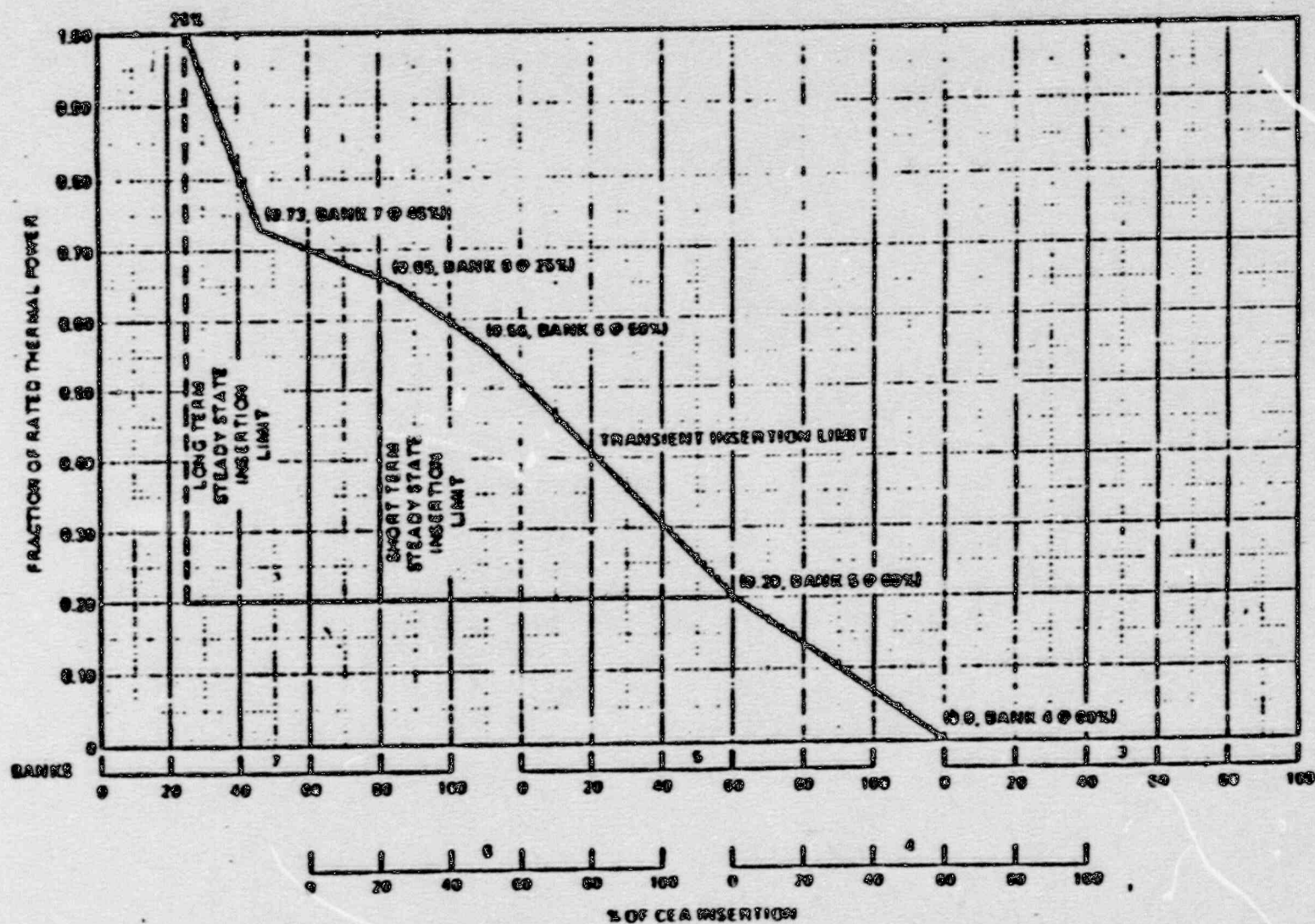


FIGURE 2.4-1 CEA Insertion Limit vs. THERMAL POWER with Four Reactor Coolant Pumps Operating



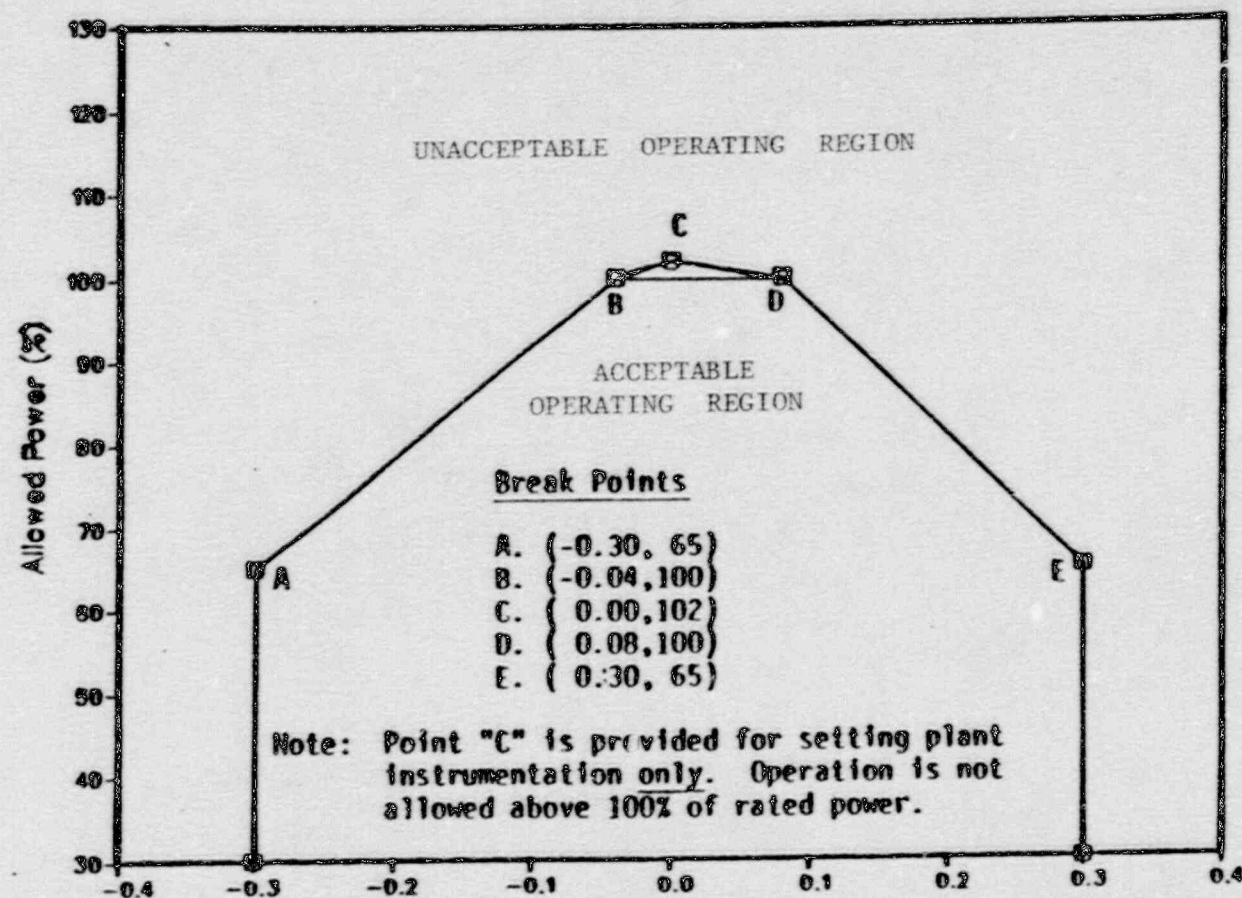


FIGURE 2.5-1 AXIAL SHAPE INDEX vs. PERCENT OF ALLOWABLE POWER LEVEL

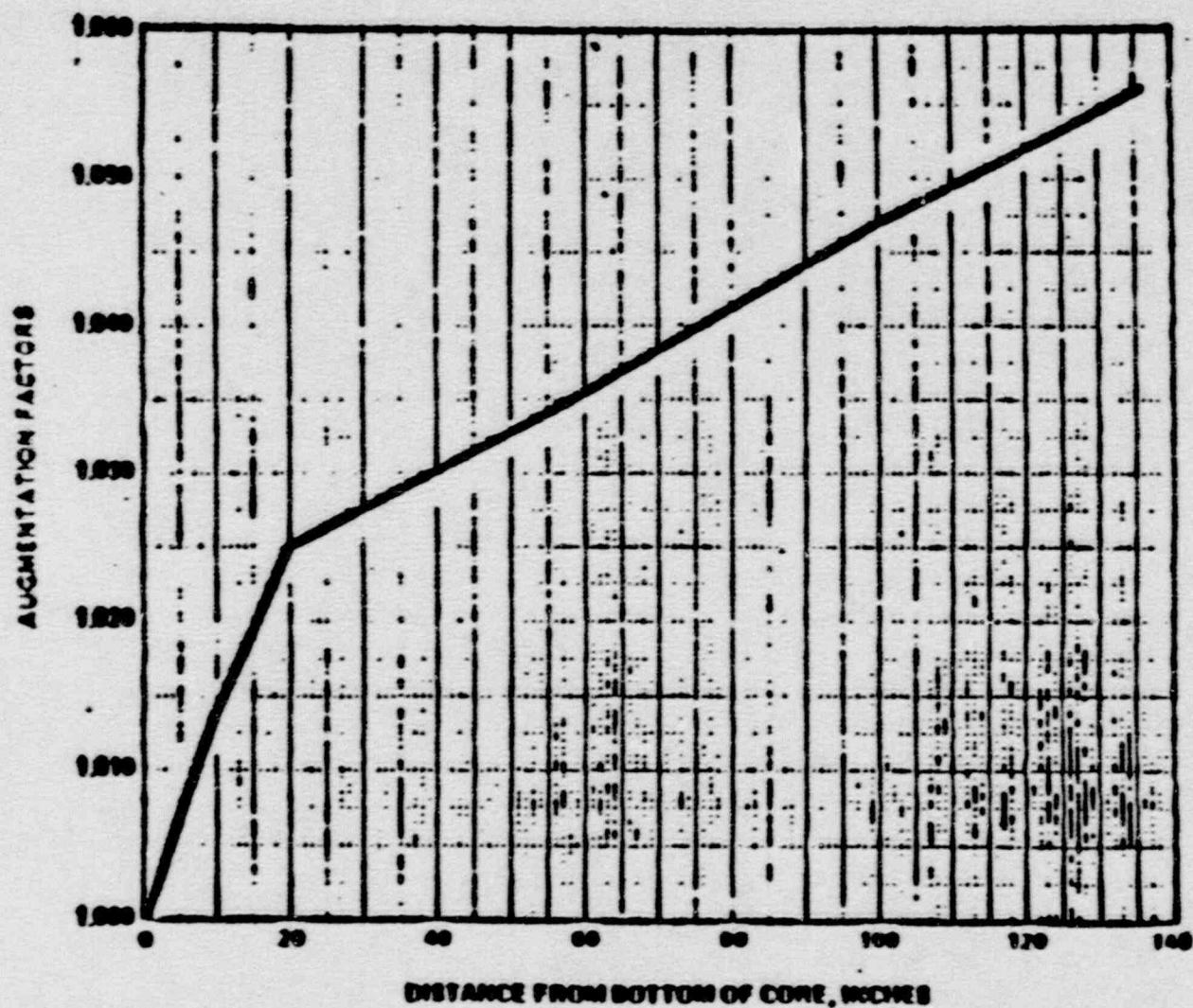


FIGURE 2.5-2 Augmentation Factor vs. Distance from Bottom of Core  
(only applicable to fuel batches "A" and "L")



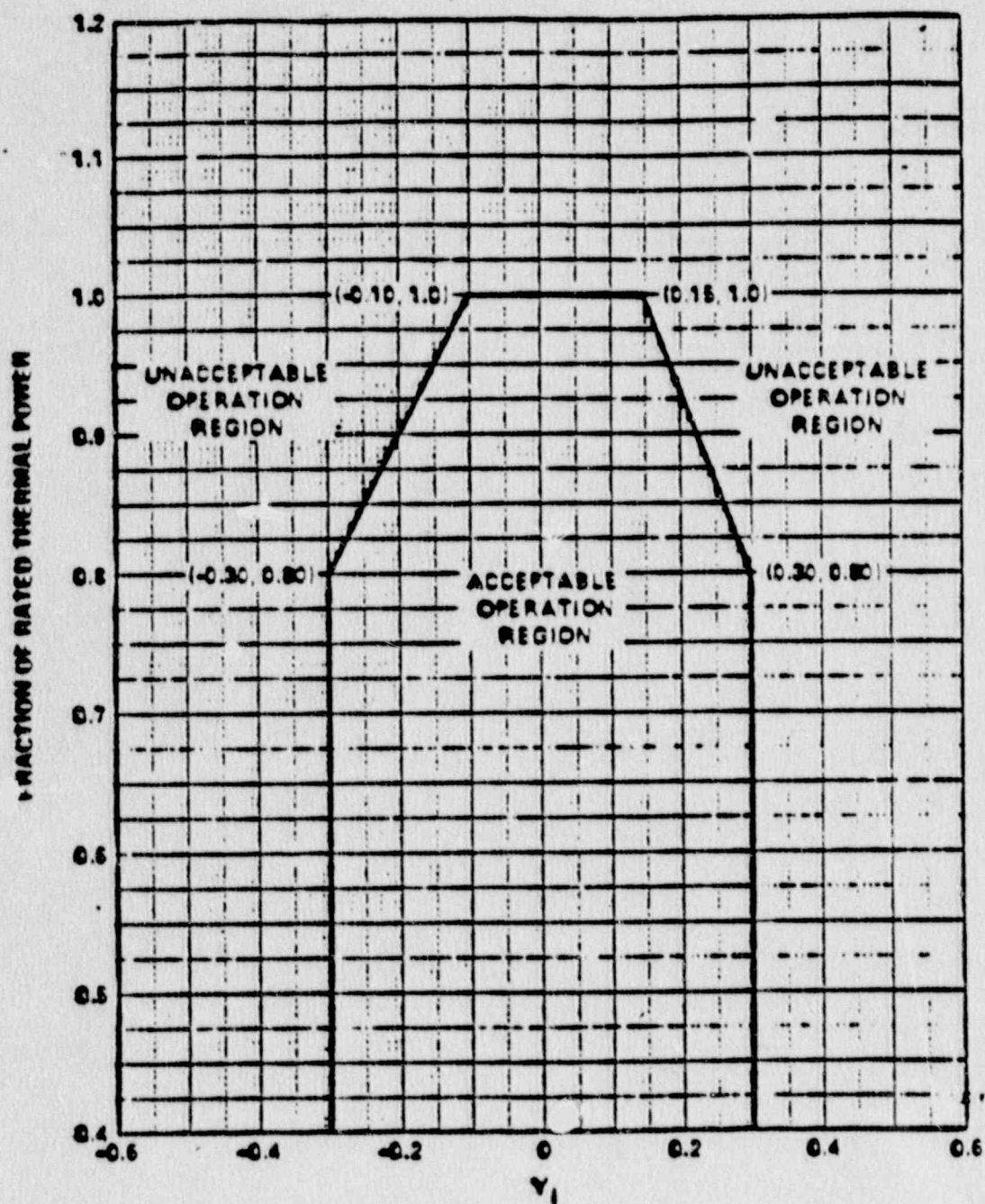


FIGURE 2.7-1 AXIAL SHAPE INDEX Operating Limits with Four Reactor Coolant Pumps Operating