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**DOCKET NO. 50-255, LICENSE DPR-20, PALISADES PLANT  
CORE OPERATING LIMITS REPORT – REVISION 9**

Revision 9 of the Palisades Core Operating Limits Report (COLR) is attached. This revision contains the limits for fuel cycle 16 and future cycles. This report is submitted in accordance with the requirements of Palisades Technical Specification 5.6.5.d.

**SUMMARY OF COMMITMENTS**

This letter contains no new commitments and no revisions to existing commitments.

Nathan L. Haskell  
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cc: Administrator, Region III, USNRC  
Project Manager, NRR, USNRC  
NRC Resident Inspector, Palisades

Enclosure

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**ENCLOSURE**

**CONSUMERS ENERGY COMPANY  
PALISADES PLANT  
DOCKET 50-255**

**PALISADES CORE OPERATING LIMITS REPORT  
Revision 9**

**10 Pages**

PALISADES NUCLEAR PLANT

TITLE: CORE OPERATING LIMITS REPORT

*R3/i* \_\_\_\_\_ *4/10/01*  
Preparer Date

*J. A. Mante* \_\_\_\_\_ *4/9/01*  
Technical Reviewer Date

*J. A. Mante* \_\_\_\_\_ *4/9/01* *SDR-2001-0065*  
PRC Reviewed Date Reference #

 \_\_\_\_\_ *4/19/01*  
Nuclear Engineering Manager Approval Date

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Core Operating Limits Report

1.0 INTRODUCTION

This Core Operating Limits Report for Palisades has been prepared in accordance with the requirements of Technical Specification 5.6.5. The Technical Specifications LCOs affected by this report are listed below:

<u>Section</u>	<u>Title</u>	<u>LCO</u>
2.1	SHUTDOWN MARGIN (SDM)	3.1.1 3.1.6 3.9.1
2.2	Regulating Rod Group Position Limits	3.1.6
2.3	Linear Heat Rate (LHR)	3.2.1
2.4	Radial Peaking Factors	3.2.2
2.5	AXIAL SHAPE INDEX (ASI)	3.2.4

## 2.0 OPERATING LIMITS

The cycle specific parameter limits for the specifications listed in Section 1 are presented in the following subsections. These limits have been developed using the NRC-approved methodologies specified in Section 3.0.

### 2.1 SHUTDOWN MARGIN (SDM)

2.1.1 MODES 1 and 2 (LCO 3.1.6 Regulating Rod Group Position Limits) - The minimum SDM requirement is 2% with the most reactive rod fully withdrawn. The rod insertion limit (PDIL) is discussed in Section 2.2 and shown in Figure 2.2-1.

2.1.2 MODES 3, 4 and 5, Loops Filled (LCO 3.1.1 SHUTDOWN MARGIN) - The SDM requirements are given in the following table for normal cooldowns and heatups, ie, non-emergency conditions.

Average PCS Temperature	Reactor Core Flow	SDM Requirements
≥ 525°F	4 PCPs	≥ 2%
≥ 525°F	< 4 PCPs	≥ 2%
< 525°F	≥ 2810 gpm	≥ 2% <sup>1</sup>
< 525°F	< 2810 gpm	≥ 3.5% <sup>1</sup>

**NOTE:**

1. SDM assuming  $T_{ave}$  of 60°F.

2.1.3 MODE 5, Loops Not Filled (LCO 3.1.1 SHUTDOWN MARGIN) - The SDM requirement is ≥ 3.5% assuming  $T_{ave}$  of 60°F for normal cooldowns and heatups, ie, non-emergency conditions.

2.1.4 MODE 6 (LCO 3.9.1 Boron Concentration) - The SDM requirement is specified in the definition of REFUELING BORON CONCENTRATION.

## 2.2 Regulating Rod Group Position Limits

- a. To implement the limits on SHUTDOWN MARGIN, individual rod worth and hot channel factors, the limits on control rod regulating group insertion shall be established as shown on Figure 2.2-1.
- b. The sequence of withdrawal of the regulating groups shall be 1, 2, 3, 4.
- c. An overlap of control banks in excess of 40% shall not be permitted.
- d. If the reactor is subcritical, the rod position at which criticality could be achieved if the control rods were withdrawn in normal sequence shall not be lower than Group 2 at 72 inches (ie, ~ 45% control rod insertion)

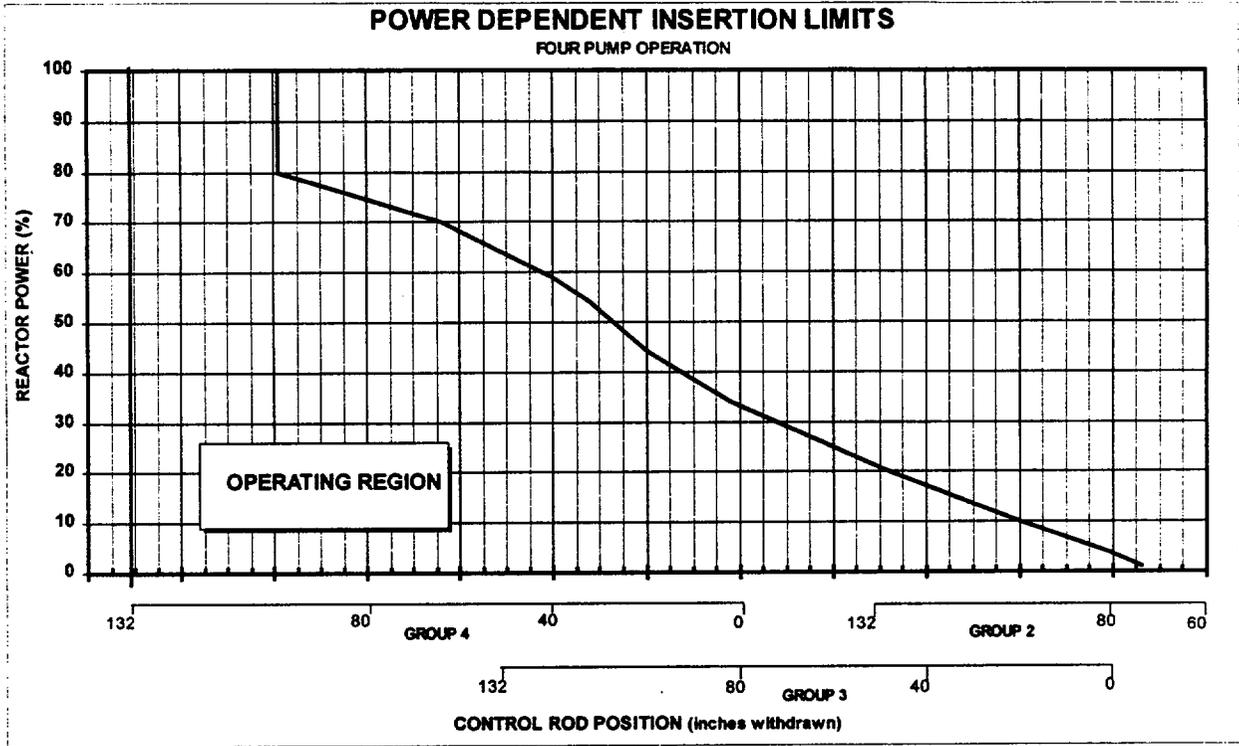


Figure 2.2-1 Regulating Rod Group Position Limits

2.3 Linear Heat Rate (LHR)

The LHR in the peak powered fuel rod shall not exceed the following:

$$LHR \leq LHR_{TS} \times F_A(z)$$

Where:

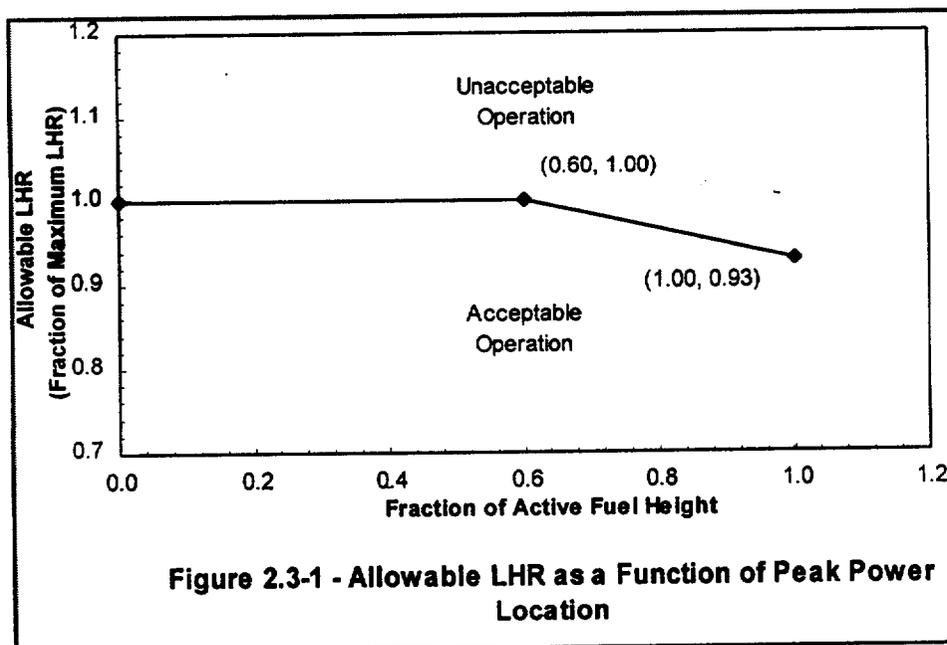
$LHR_{TS}$  = Maximum allowable LHR shown in Table 2.3-1.

$F_A(z)$  = Allowable LHR as a function of peak power location shown in Figure 2.3-1.

Table 2.3-1 - Linear Heat Rate Limit

Peak Rod	15.28 (kW/ft)
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To ensure that the design margin of safety is maintained, the determination of both the incore alarm setpoints and the APL takes into account the local LHGR measurement uncertainty factors given in Table 2.4-2, an engineering uncertainty factor and a thermal power measurement uncertainty factor (values given in B 3.2.1).



## 2.4 Radial Peaking Factors

The radial peaking factor shall not exceed the following:

for  $P \geq 0.5$

$$F_r = F_r^{TS} \times [1.0 + 0.3 \times (1 - P)]$$

and for  $P < 0.5$ ,

$$F_r = F_r^{TS} \times 1.15$$

Where:

$F_r$  = Measured  $F_r^A$  or  $F_r^T$ ,

$F_r^{TS}$  = Maximum allowable  $F_r^A$  or  $F_r^T$  (Table 2.4-1),

$P$  = Fraction of rated power.

Table 2.4-1 - Peaking Factor Limits,  $F_r^{TS}$

Peaking Factor	Reload N	All Other Fuel Types <sup>a</sup>
Peak Rod $F_r^T$	1.92	2.02

Assembly  $F_r^A$  Peaking Factor is 1.915 for all Fuel Types.<sup>a</sup>

To ensure that the design margin of safety is maintained, the determination of radial peaking factors takes into account the appropriate measurement uncertainty factors given in Table 2.4-2.

<sup>a</sup> "Fuel Types" refer to fuel present in the current cycle core as described in the latest revision of the cycle specific safety analysis report.

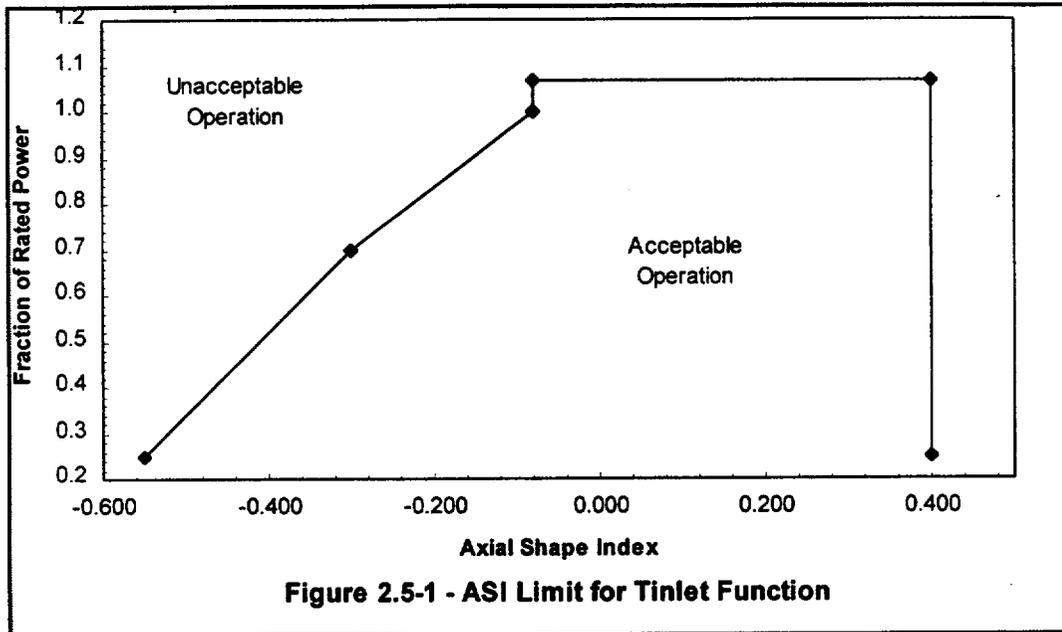
**TABLE 2.4-2 POWER DISTRIBUTION MEASUREMENT UNCERTAINTY FACTORS**

LHR/Peaking Factor Parameter	Measurement Uncertainty <sup>(a)</sup>	Measurement Uncertainty <sup>(b)</sup>	Measurement Uncertainty <sup>(c)</sup>
LHR	0.0623	0.0664	0.0795
$F_r^A$	0.0401	0.0490	0.0695
$F_r^T$	0.0455	0.0526	0.0722

- (a) Measurement uncertainty for reload cores using all fresh incore detectors.
- (b) Measurement uncertainty for reload cores using a mixture of fresh and once-burned incore detectors.
- (c) Measurement uncertainty when quadrant power tilt, as determined using incore measurements and an incore analysis computer program, exceeds 2.8% but is less than or equal to 5%.

## 2.5 AXIAL SHAPE INDEX (ASI)

The ASI limit for the  $T_{inlet}$  function is shown in Figure 2.5-1.



Break Points:

-0.550,	0.250
-0.300,	0.700
-0.080,	1.000
-0.080,	1.065
+0.400,	1.065
+0.400,	0.250

## 3.0 ANALYTICAL METHODS

The analytical methods used to determine the core operating limits are those previously reviewed and approved by the NRC, specifically those described in the Technical Specification Section 5.6.5 list of methodology documents. Specific application of these methodologies to Palisades is described in the cycle's most current safety analysis reports.

The analytical methods used to determine the radial peaking factor measurement uncertainty factors are described in FSAR, Section 3.3.2.5.