PALISADES NUCLEAR PLANT

TITLE: CORE OPERATING LIMITS REPORT

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Preparer — Date

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Core Operating Limits Report

1.0 CORE OPERATING LIMITS REPORT

This Core Operating Limits Report for Palisades has been prepared in accordance with the requirements of Technical Specification 6.6.5. The Technical Specifications affected by this report are listed below:

Section	Title	CTS	{ITS}
2.1	ASI Limits for T_{inlet} Function	3.1.1	3.2.4
2.2	Regulating Group Insertion Limits	3.10.5	3.1.6
2.3	Linear Heat Rate (LHR) Limits	3.23.1	3.2.1
2.4	Radial Peaking Factor Limits	3.23.2	3.2.2

NOTE:

Any procedure or document previously referencing the Technical Specifications for any operating limit that has been moved to the COLR should be viewed as referencing the COLR until the applicable procedures or documents are revised.

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 ASI Limits for T_{inlet} Function CTS - 3.1.1 {ITS -3.2.4}

The ASI limit for the T_{inlet} function is shown in Figure 2.1.

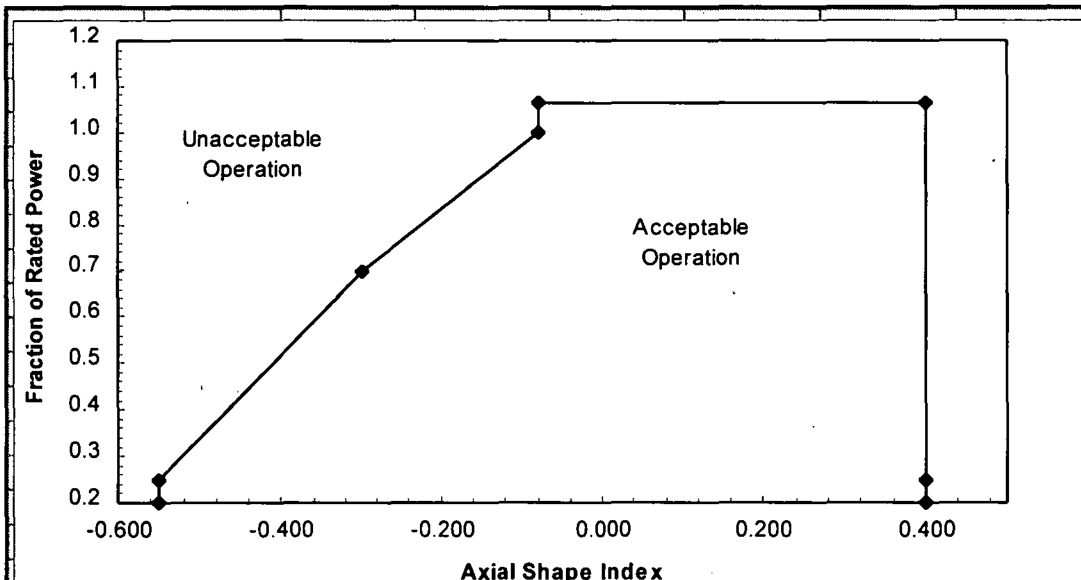

Figure 2.1 - ASI Limit for Tinlet Function

Break Points:

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-0.550,   0.250
-0.300,   0.700
-0.080,   1.000
-0.080,   1.065
+0.400,   1.065
+0.400,   0.250
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2.2 Regulating Group Insertion Limits CTS - 3.10.5 {ITS -3.1.6}

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.

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. The reactor shall not be made critical with a control rod position lower than the insertion limit for zero power shown on Figure 2.2.

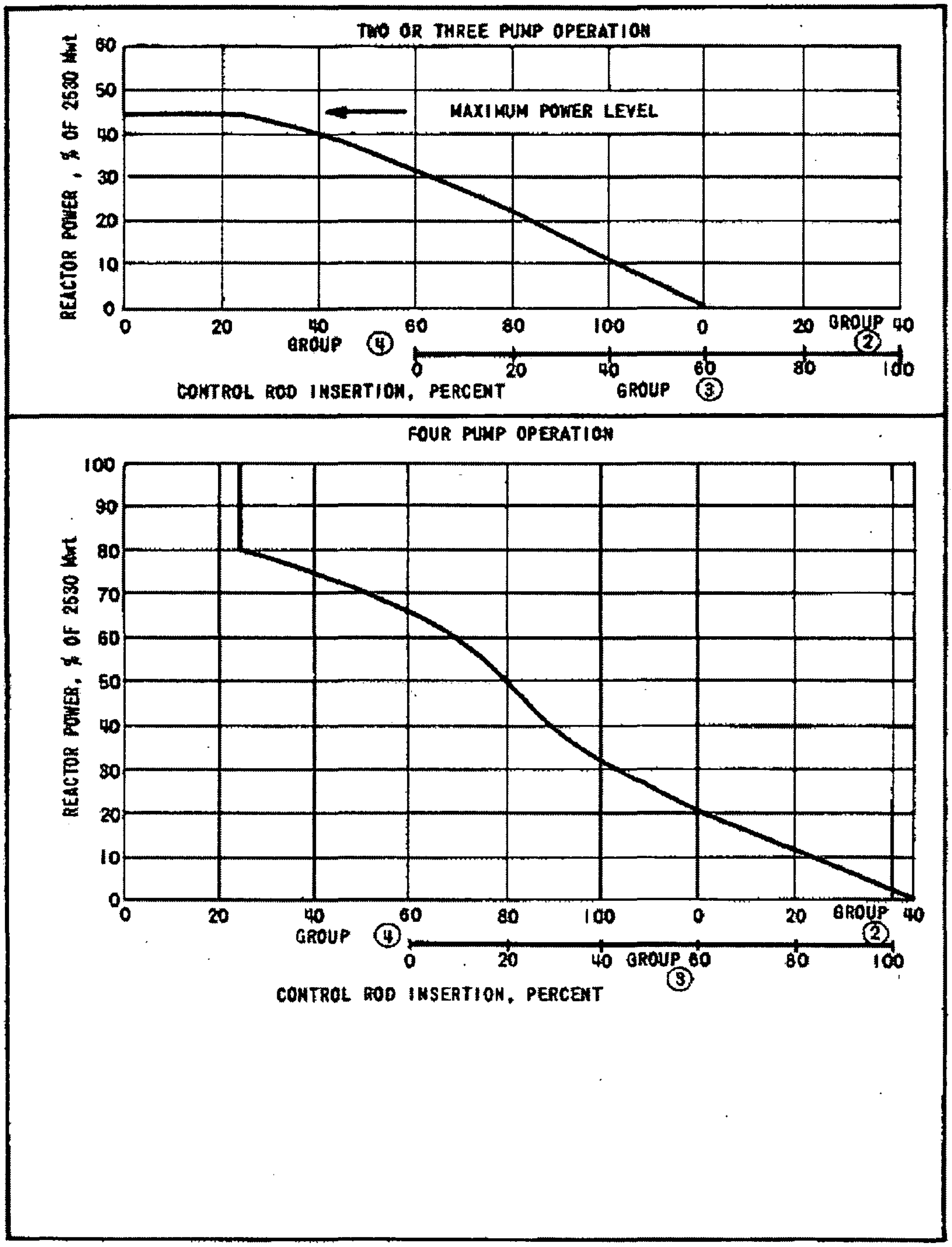

Figure 2.2 Power Dependent Control Rod Insertion Limits

2.3 Linear Heat Rate (LHR) Limits CTS - 3.23.1 {ITS -3.2.1}

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

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

Where:

LHR_{TS} = Maximum allowable LHR shown in Table 2.1.

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

Table 2.1 - Linear Heat Rate Limit

Peak Rod	15.28 (kW/ft)

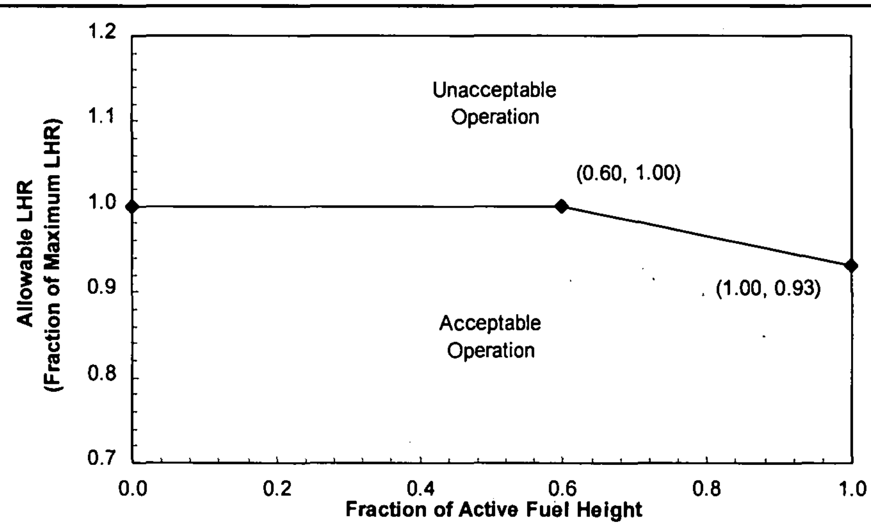

Figure 2.3 - Allowable LHR as a Function of Peak Power Location

2.4 Radial Peaking Factor Limits CTS - 3.23.2 {ITS -3.2.2}

The radial peaking factor shall not exceed the following:

for P $\geq$ 0.5

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

and for P < 0.5,

$$F_r = F_r^{TS} x1.15$$

Where:

F_r	=	Measured F_r^A or F_r^T,
F_r^{TS}	=	Maximum allowable F_r^A or F_r^T (Table 2.2),
P	=	Fraction of rated power.

Table 2.2 - Peaking Factor Limits, F_r^{TS}

Peaking Factor	Reload N	Reload O to R	Reload S
Assembly F_r^A	1.66	1.76	1.915
Peak Rod F_r^T	1.92	2.04	2.04

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 following documents:

3.1 EMF-96-029(P)(A) Volumes 1 and 2, "Reactor Analysis System for PWRs," Siemens Power Corporation, January 1997.

3.2 ANF-84-73 Revision 5 Appendix B (P)(A), "Advanced Nuclear Fuels Methodology for Pressurized Water Reactors: Analysis of Chapter 15 Events," Advanced Nuclear Fuels, July 1990. (Base report not approved)

3.3 XN-NF-82-21(P)(A) Revision 1, "Application of Exxon Nuclear Company PWR Thermal Margin Methodology to Mixed Core Configurations," Exxon Nuclear Company, September 1983.

3.4 EMF-84-093 (P)(A), Revision 1, "Steam Line Break Methodology for PWRs,"Siemens Power Corporation, February 1999.

3.5 XN-75-32(P)(A) Supplements 1 through 4, "Computational Procedure for Evaluating Fuel Rod Bowing," Exxon Nuclear Company, October 1983. (Base document not approved.)

3.6 EXEM PWR Large Break LOCA Evaluation Model as defined by:

XN-NF-82-20(P)(A) Revision 1 Supplement 2, "Exxon Nuclear Company Evaluation Model EXEM/PWR ECCS Model Updates," Exxon Nuclear Company, February 1985.

XN-NF-82-20(P)(A) Revision 1 and Supplements 1, 3 and 4, "Exxon Nuclear Company Evaluation Model EXEM/PWR ECCS Model Updates," Advanced Nuclear Fuels Corporation January 1990.

XN-NF-82-07(P)(A) Revision 1, "Exxon Nuclear Company ECCS Cladding Swelling and Rupture Model," Exxon Nuclear Company, November 1982.

XN-NF-81-58(P)(A) Revision 2 and Supplements 1 and 2, "RODEX2 Fuel Rod Thermal-Mechanical Response Evaluation Model," Exxon Nuclear Company, March 1984.

ANF-81-58(P)(A) Revision 2 Supplements 3 and 4 "RODEX2 Fuel Rod Thermal Mechanical Response Evaluation Model," Advanced Nuclear Fuels Corporation, June 1990.

XN-NF-85-16(P)(A) Volume 1 and Supplements 1, 2 and 3; Volume 2, Revision 1 and Supplement 1, "PWR 17x17 Fuel Cooling Test Program," Advanced Nuclear Fuels Corporation, February 1990.

XN-NF-85-105(P)(A) and Supplement 1, "Scaling of FCTF Based Reflood Heat Transfer Correlation for Other Bundle Designs," Advanced Nuclear Fuels Corporation, January 1990.

3.7 XN-NF-78-44(NP)(A), "A Generic Analysis of the Control Rod Ejection Transient for Pressurized Water Reactors," Exxon Nuclear Company, October 1983.

3.8 ANF-87-150 Volume 2, "Palisades Modified Reactor Protection System Report: Analysis of Chapter 15 Events," Advanced Nuclear Fuels Corporation, June 1988.

3.9 ANF-89-151(P)(A), "ANF-RELAP Methodology for Pressurized Water Reactors: Analysis of Non-LOCA Chapter 15 Events," Advanced Nuclear Fuels Corporation, May 1992.

3.10 EMF-92-153(P)(A) and Supplement 1, "HTP: Departure from Nucleate Boiling Correlation for High Thermal Performance Fuel," Siemens Power Corporation, March 1994.

3.11 XN-NF-621 (P)(A) Revision 1, "Exxon Nuclear DNB Correlation for PWR Fuel Designs," Exxon Nuclear Company, September 1983.

3.12 XN-NF-82-06(P)(A) Revision 1 and Supplements 2, 4 and 5, "Qualification of Exxon Nuclear Fuel for Extended Burnup," Exxon Nuclear Company, October 1986.

3.13 ANF-88-133(P)(A) and Supplement 1, "Qualification of Advanced Nuclear Fuels' PWR Design Methodology for Rod Burnups of 62 GWd/MTU," Advanced Nuclear Fuels Corporation, December 1991.

3.14 XN-NF-85-92(P)(A), "Exxon Nuclear Uranium Dioxide/Gadolinia Irradiation Examination and Thermal Conductivity Results," Exxon Nuclear Company, November 1986.

3.15 EMF-92-116(P)(A), "Generic Mechanical Design Criteria for PWR Fuel Designs," Siemens Power Corporation, February 1999.

3.16 EMF-2087(P)(A), "SEM/PWR-98: ECCS Evaluation Model for PWR LBLOCA Applications," Siemens Power Corporation, June 1999.

Specific application of these methodologies to Palisades is described in the cycle's most current safety analysis reports.