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November 5, 2004
L-04-147

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

Subject: Beaver Valley Power Station, Unit No. 1
Docket No. 50-334, License No. DPR-66
Cycle 17 Reload and Core Operating Limits Report

Beaver Valley Power Station, Unit No. 1 completed the sixteenth cycle of operation on October 17, 2004, with a burnup of 19,562.59 MWD/MTU. This letter describes the Cycle 17 reload design, provides a copy of the Core Operating Limits Report (COLR) in accordance with Technical Specification 6.9.5.d, and documents our review in accordance with 10 CFR 50.59 including our determination that no Technical Specification or license amendment is required for the Cycle 17 reload design.

The Beaver Valley Power Station Unit No. 1 reactor core features a low leakage pattern. During 1R16 refueling, 9 Region 13A, 12 Region 13B, 8 Region 16A, 12 Region 16B and 16 Region 17A fuel assemblies were discharged and replaced with 1 reinserted Region 17A fuel assembly from the spent fuel pool, 32 fresh Region 19A fuel assemblies enriched to 3.6 nominal weight percent, and 24 fresh Region 19B fuel assemblies enriched to a 4.4 nominal weight percent. Cycle 17 is the third cycle with Robust Fuel Assemblies (RFA) in the core. Region 19A and 19B are the RFA-2 design.

FirstEnergy Nuclear Operating Company has performed a review of this reload core design to determine those parameters affecting the design basis limits and the safety analyses for postulated accidents described in the Updated Final Safety Analysis Report (UFSAR). The analytical methods used to determine the core operating limits meet the criteria specified in Technical Specification 6.9.5.a, b and c. The Cycle 17 reactor core reload evaluation concluded that the implementation of the 17 x 17 core will not adversely affect the safety of the plant. The reload evaluation also concluded that the core design did not require any Technical Specification changes, and did not require a license amendment pursuant to 10 CFR 50.59 due to no new safety analyses changes, no new fission product barrier design basis limits, or no new methods of evaluation as described in the UFSAR. The Beaver Valley Plant Operations Review Committee has concurred with the conclusions of the reload evaluation.

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The Core Operating Limits Report (COLR) is enclosed in accordance with Technical Specification 6.9.5.d. The COLR has been updated for this cycle by revising the F_Q , F_{xy} and maximum $F_Q^{T*} P_{REL}$ criteria.

No regulatory commitments are contained in this submittal. If there are any questions concerning this matter, please contact Mr. Larry R. Freeland, Manager, Regulatory Compliance at 724-682-4284.

Sincerely,



L. William Pearce

c: Mr. T. G. Colburn, NRR Senior Project Manager
Mr. P. C. Cataldo, NRC Sr. Resident Inspector
Mr. S. J. Collins, NRC Region I Administrator
Mr. L. E. Ryan (BRP/DEP)

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4.1 CORE OPERATING LIMITS REPORT

This Core Operating Limits Report provides the cycle specific parameter limits developed in accordance with the NRC approved methodologies specified in Technical Specification Administrative Control 6.9.5.

Specification 3.1.3.5 Shutdown Rod Insertion Limits

The shutdown rods shall be withdrawn to at least 225 steps.*

Specification 3.1.3.6 Control Rod Insertion Limits

Control Banks A and B shall be withdrawn to at least 225 steps.*

Control Banks C and D shall be limited in physical insertion as shown in Figure 4.1-1.*

Specification 3.2.1 Axial Flux Difference

NOTE: The target band is $\pm 7\%$ about the target flux from 0% to 100% RATED THERMAL POWER.

The indicated Axial Flux Difference:

- a. Above 90% RATED THERMAL POWER shall be maintained within the $\pm 7\%$ target band about the target flux difference.
- b. Between 50% and 90% RATED THERMAL POWER is within the limits shown on Figure 4.1-2.
- c. Below 50% RATED THERMAL POWER may deviate outside the target band.

Specification 3.2.2 $F_Q(Z)$ and F_{xy} Limits

$$F_Q(Z) \leq \frac{CF_Q}{P} * K(Z) \quad \text{for } P > 0.5$$

$$F_Q(Z) \leq \frac{CF_Q}{0.5} * K(Z) \quad \text{for } P \leq 0.5$$

Where: $CF_Q = 2.20$ $P = \frac{\text{THERMAL POWER}}{\text{RATED THERMAL POWER}}$

$K(Z)$ = the function obtained from Figure 4.1-3.

* As indicated by the group demand counter

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The F_{xy} limits [$F_{xy}(L)$] for RATED THERMAL POWER within specific core planes shall be:

$$F_{xy}(L) = F_{xy}(RTP)(1 + PF_{xy} * (1-P))$$

Where: For all core planes containing D-Bank:

$$F_{xy}(RTP) \leq 1.71$$

For unrodded core planes:

$$F_{xy}(RTP) \leq 1.68 \text{ from 1.8 ft. elevation to 2.3 ft. elevation}$$

$$F_{xy}(RTP) \leq 1.73 \text{ from 2.3 ft. elevation to 3.7 ft. elevation}$$

$$F_{xy}(RTP) \leq 1.79 \text{ from 3.7 ft. elevation to 5.8 ft. elevation}$$

$$F_{xy}(RTP) \leq 1.81 \text{ from 5.8 ft. elevation to 7.4 ft. elevation}$$

$$F_{xy}(RTP) \leq 1.74 \text{ from 7.4 ft. elevation to 8.9 ft. elevation}$$

$$F_{xy}(RTP) \leq 1.60 \text{ from 8.9 ft. elevation to 10.2 ft. elevation}$$

$$PF_{xy} = 0.2$$

$$P = \frac{\text{THERMAL POWER}}{\text{RATED THERMAL POWER}}$$

Figure 4.1-4 provides the maximum total peaking factor times relative power ($F_Q^T * P_{rel}$) as a function of axial core height during normal core operation.

Specification 3.2.3 $F_{\Delta H}^N$

$$F_{\Delta H}^N \leq CF_{\Delta H} * (1 + PF_{\Delta H} (1-P))$$

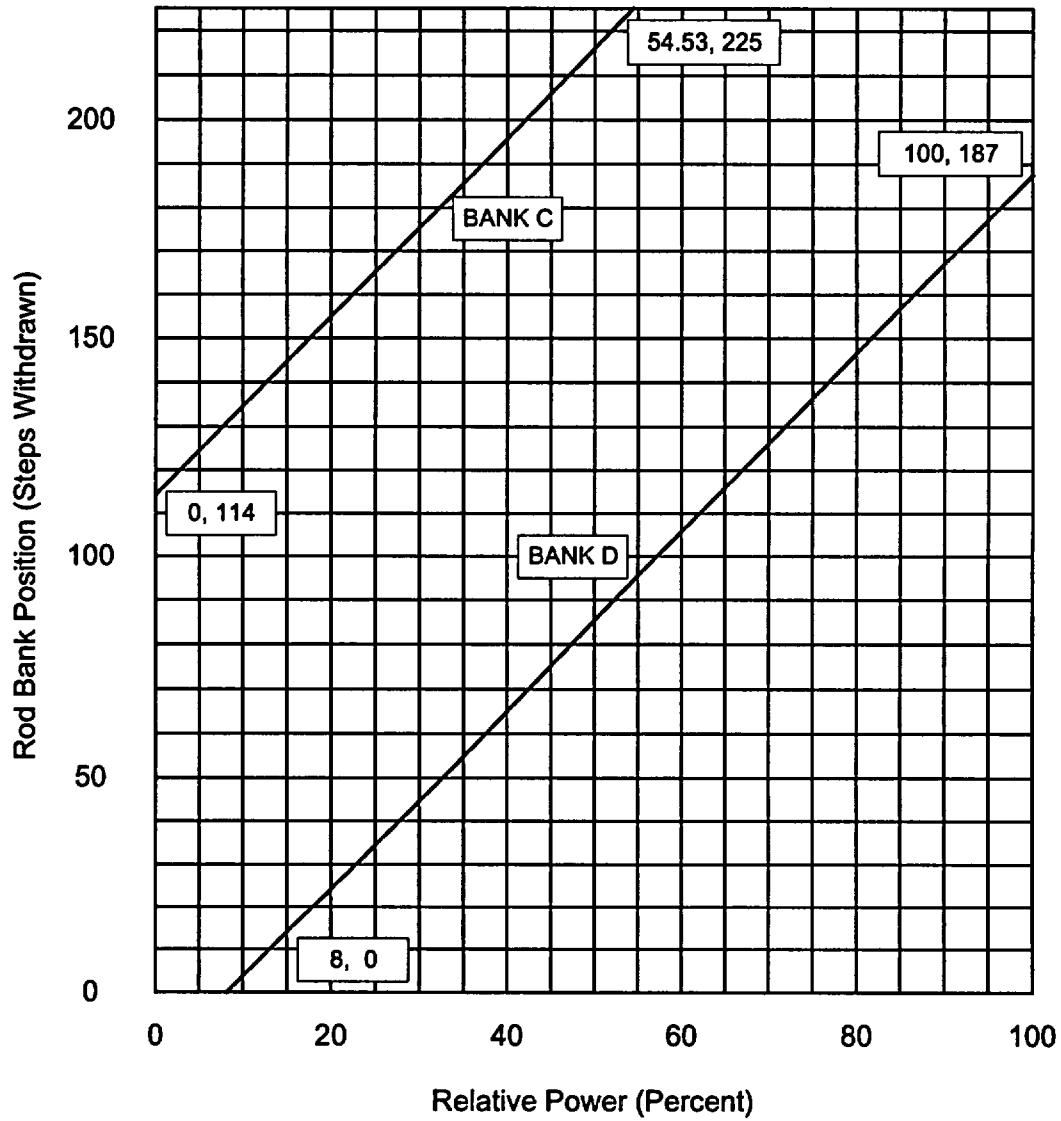
Where: $CF_{\Delta H} = 1.62$

$$PF_{\Delta H} = 0.3$$

$$P = \frac{\text{THERMAL POWER}}{\text{RATED THERMAL POWER}}$$

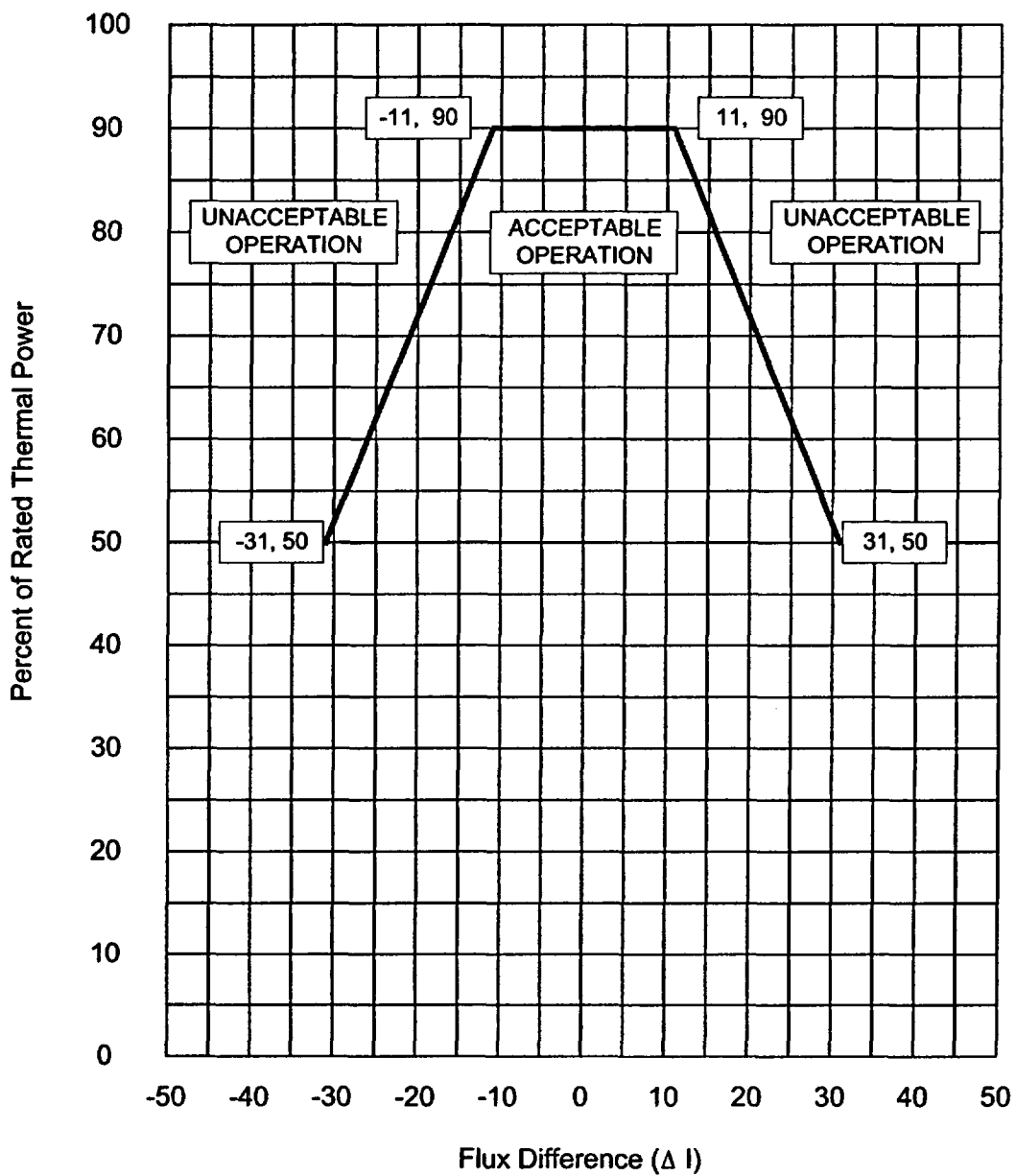
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**FIGURE 4.1-1
CONTROL ROD INSERTION LIMITS**

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**FIGURE 4.1-2
AXIAL FLUX DIFFERENCE LIMITS AS A FUNCTION OF
RATED THERMAL POWER**

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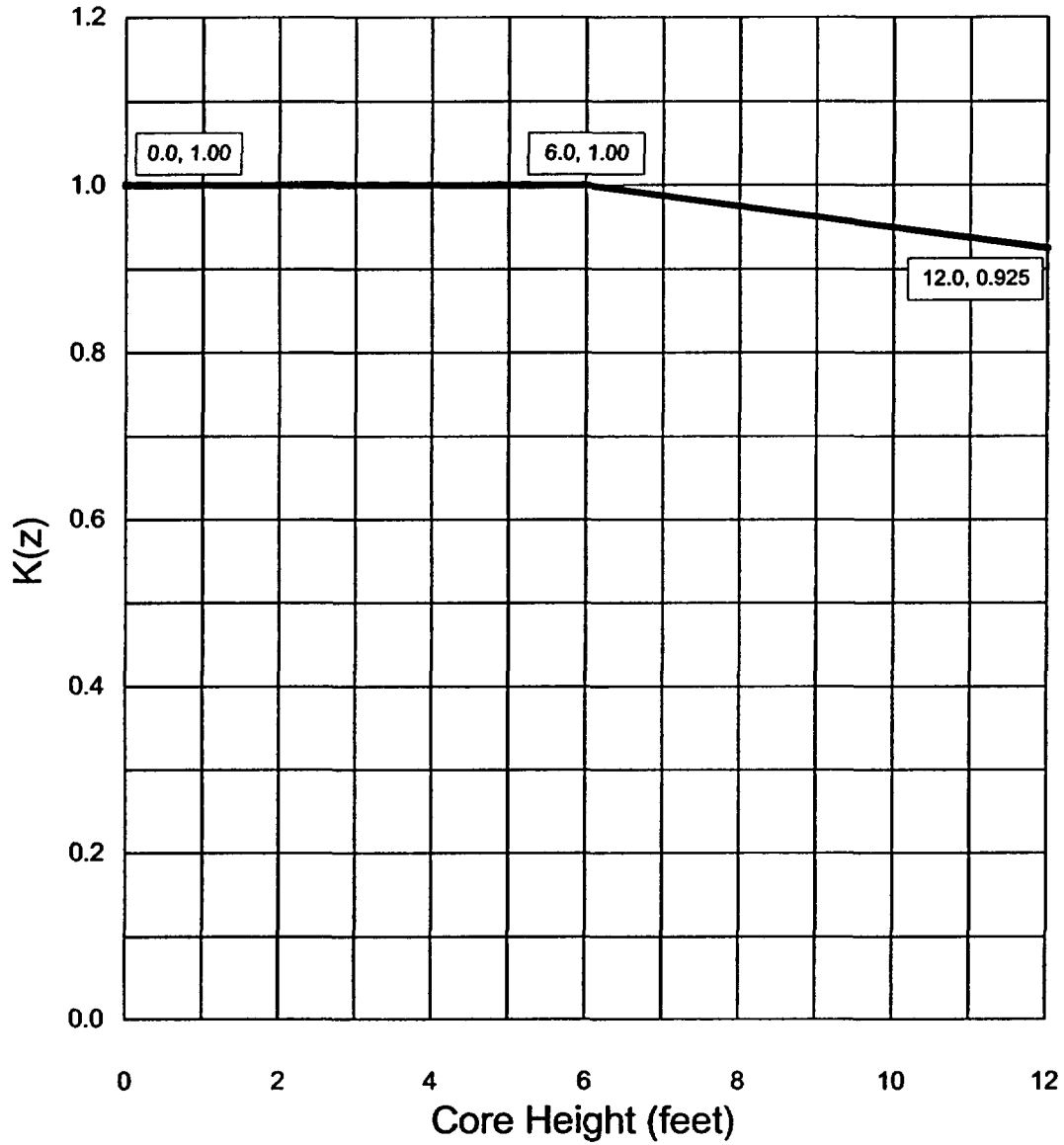
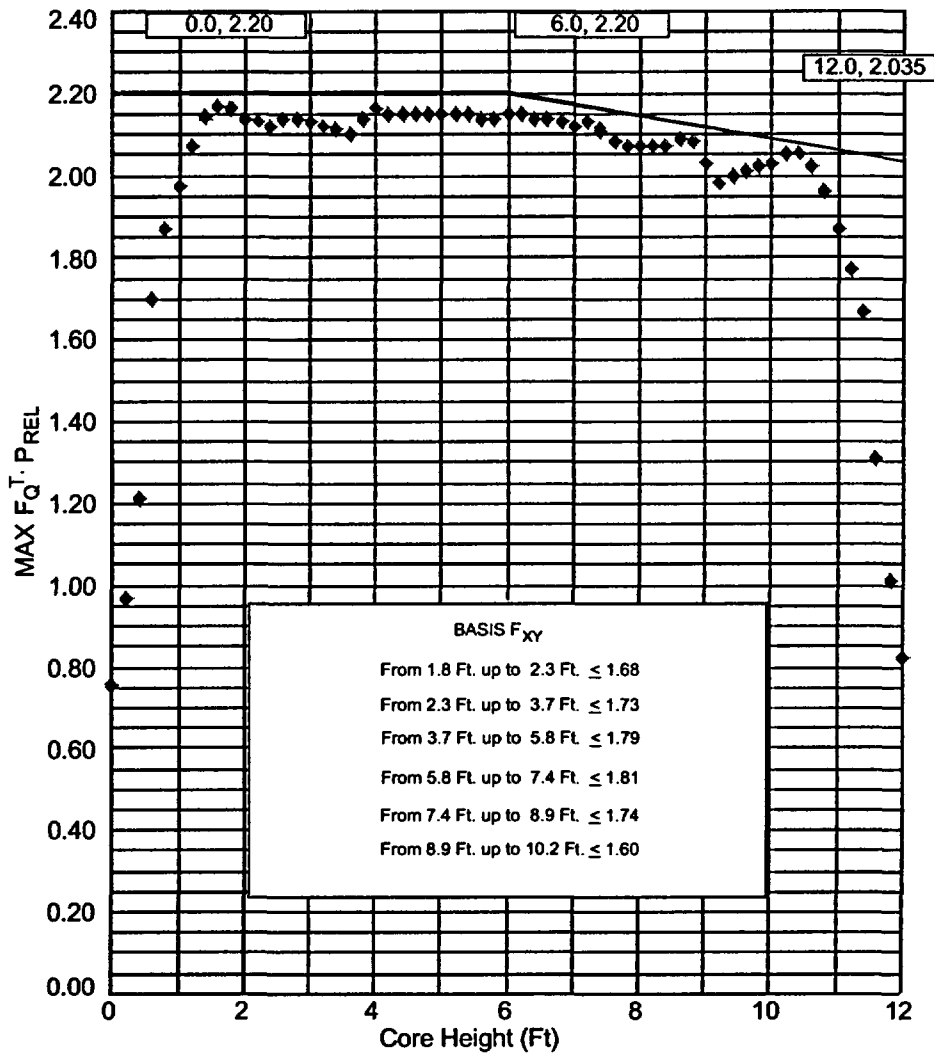


FIGURE 4.1-3
F₀T NORMALIZED OPERATING ENVELOPE, K(Z)

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**FIGURE 4.1-4
MAXIMUM (F_Q^T*PREL) VS AXIAL CORE HEIGHT
DURING NORMAL OPERATION**

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Specification 3.3.1.1 Reactor Trip System Instrumentation Setpoints, Table 3.3-1 Table Notations A and B

Overtemperature ΔT Setpoint Parameter Values:

<u>Parameter</u>	<u>Value</u>
Overtemperature ΔT reactor trip setpoint	$K1 \leq 1.259$
Overtemperature ΔT reactor trip setpoint Tavg coefficient	$K2 \geq 0.01655/^{\circ}F$
Overtemperature ΔT reactor trip setpoint pressure coefficient	$K3 \geq 0.000801/psia$
Tavg at RATED THERMAL POWER	$T' \leq 576.2^{\circ}F$
Nominal Pressurizer Pressure	$P' \geq 2250 psia$
Measured reactor vessel average temperature lead/lag time constants	$\tau_1 \geq 30 \text{ secs}$ $\tau_2 \leq 4 \text{ secs}$

$f(\Delta I)$ is a function of the indicated difference between top and bottom detectors of the power-range nuclear ion chambers; with gains to be selected based on measured instrument response during plant startup tests such that:

- (i) for $q_t - q_b$ between -36 percent and +15 percent, $f(\Delta I) = 0$ (where q_t and q_b are percent RATED THERMAL POWER in the top and bottom halves of the core respectively, and $q_t + q_b$ is total THERMAL POWER in percent of RATED THERMAL POWER).
- (ii) for each percent that the magnitude of $(q_t - q_b)$ exceeds -36 percent, the ΔT trip setpoint shall be automatically reduced by 2.08 percent of its value at RATED THERMAL POWER.
- (iii) for each percent that the magnitude of $(q_t - q_b)$ exceeds +15 percent, the ΔT trip setpoint shall be automatically reduced by 1.59 percent of its value at RATED THERMAL POWER.

Overpower ΔT Setpoint Parameter Values:

<u>Parameter</u>	<u>Value</u>
Overpower ΔT reactor trip setpoint	$K4 \leq 1.0916$
Overpower ΔT reactor trip setpoint Tavg rate/lag coefficient	$K5 \geq 0.02/^{\circ}F$ for increasing average temperature

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Overpower ΔT Setpoint Parameter Values (continued):

<u>Parameter</u>	<u>Value</u>
Overpower ΔT reactor trip setpoint T_{avg} heatup coefficient	$K6 \geq 0.00128/^{\circ}\text{F}$ for $T > T''$ $K6 = 0/^{\circ}\text{F}$ for $T \leq T''$
T_{avg} at RATED THERMAL POWER	$T'' \leq 576.2^{\circ}\text{F}$
Measured reactor vessel average temperature rate/lag time constant	$\tau_3 \geq 0$ secs

Specification 3.2.5 DNB Parameters

<u>Parameter</u>	<u>Indicated Value</u>
Reactor Coolant System T_{avg}	$T_{avg} \leq 580.0^{\circ}\text{F}^{(1)}$
Pressurizer Pressure	Pressure ≥ 2215 psia ⁽²⁾
Reactor Coolant System Total Flow Rate	Flow $\geq 267,400$ gpm ⁽³⁾

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- (1) The Reactor Coolant System (RCS) T_{avg} value includes allowances for rod control operation and verification via control board indication.
 - (2) The pressurizer pressure value includes allowances for pressurizer pressure control operation and verification via control board indication.
 - (3) The RCS total flow rate includes allowances for normalization of the cold leg elbow taps with a beginning of cycle precision RCS flow calorimetric measurement and verification on a periodic basis via control board indication.

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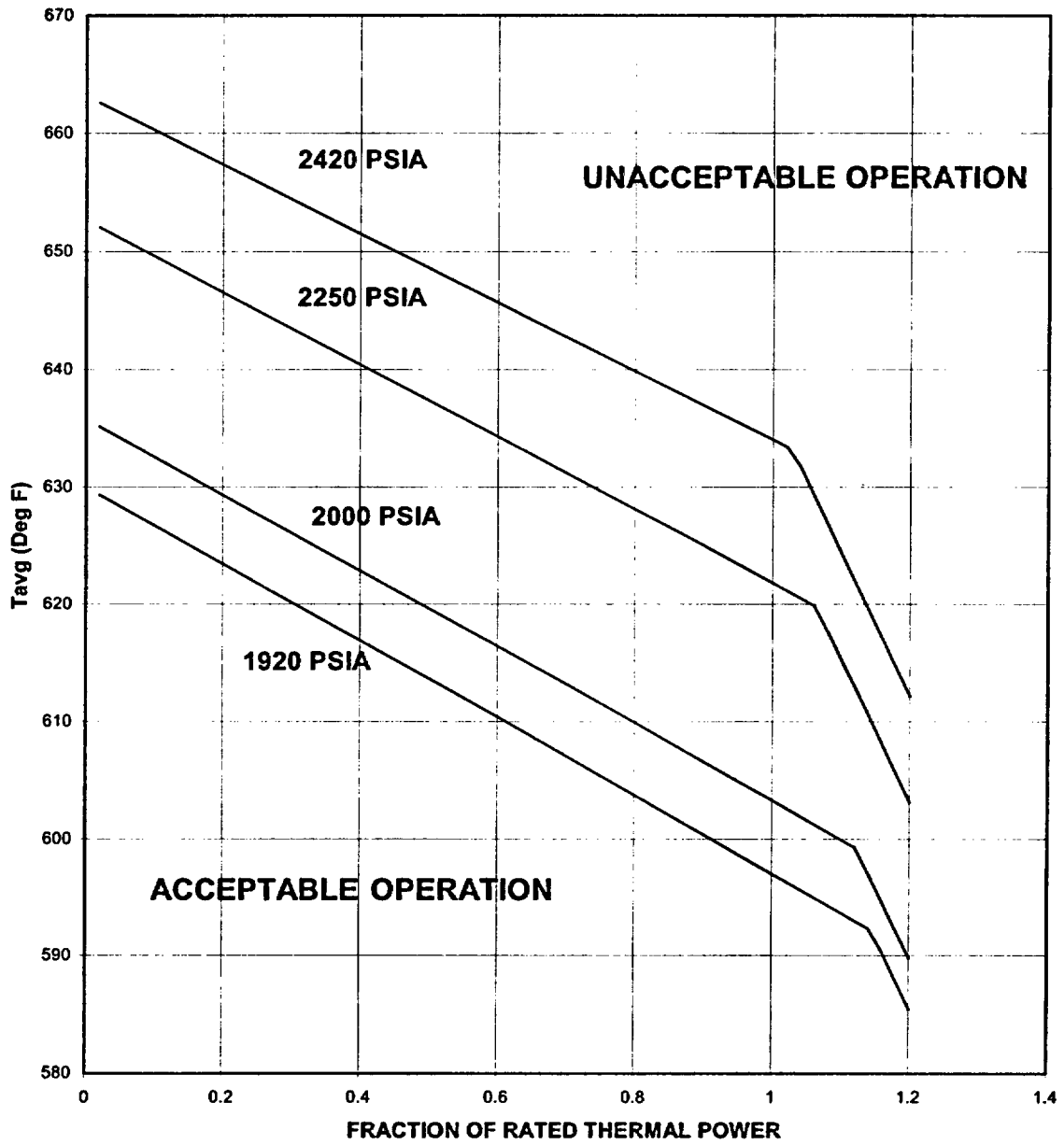


Figure 4.1-5
REACTOR CORE SAFETY LIMIT
THREE LOOP OPERATION
(Technical Specification Safety Limit 2.1.1)