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TITLE: **WCNOC Cycle 11 Core Operating Limits Report**

WOLF CREEK
NUCLEAR OPERATING CORPORATION

1. ☒ APPROVED-MFG. MAY PROCEED
2. ☐ NOT APPROVED--RESUBMIT FINAL DOCUMENT/DRAWING MFG. MAY PROCEED ☐ YES ☐ NO
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SUPERVISOR PD Adam DATE 11/16/99

ENGINEERING REVIEW				RELEASED: DC30 12/18/99

COMMENTS

Safety Related

NOTE: This document is to be released in conjunction with ITS implementation on December 18, 1999.

COMPONENT NUMBER(S):		
VTD & REV NUMBER:	MODEL/TYPE NUMBER(S):	
REFERENCE DOCUMENTS:	SPEC. NUMBER(S):	
P.O. #:	NPRDS CODE(S):	CHANGE PACKAGE NUMBER:

LIST OF APPLICABLE FORMS ATTACHED TO THIS VTD PACKAGE:

☐ APF 05-013-02 Vendor Technical Document (VTD) Revision Sheet

☐ APF 05-013-04 Vendor Technical Document Comparison Report

☐ APF 05-013-03 Vendor Technical Document Information Restrictions/Limitations

☒ Enclosed Revision(s) or Revision Date(s) R/2 December, 1999

WOLF CREEK GENERATING STATION
CYCLE 11

CORE OPERATING LIMITS REPORT
Revision 2

December, 1999

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1.0 CORE OPERATING LIMITS REPORT

The CORE OPERATING LIMITS REPORT (COLR) for Wolf Creek Generating Station Cycle 11 has been prepared in accordance with the requirements of Technical Specification 5.6.5.

The core operating limits that are included in the COLR affect the following Technical Specifications:

3.1.3	Moderator Temperature Coefficient (MTC)
3.1.5	Shutdown Bank Insertion Limits
3.1.6	Control Bank Insertion Limits
3.2.3	AXIAL FLUX DIFFERENCE (AFD) (Relaxed Axial Offset Control (RAOC) Methodology)
3.2.1	Heat Flux Hot Channel Factor ($F_Q(Z)$) (F_Q Methodology)
3.2.2	Nuclear Enthalpy Rise Hot Channel Factor ($F^N_{\Delta H}$)
3.9.1	Boron Concentration
SHUTDOWN MARGIN for Specifications 3.1.1, 3.1.4, 3.1.5, 3.1.6, and 3.1.8	

2.0 OPERATING LIMITS

The cycle-specific parameter limits for the specifications listed in Section 1.0 are presented in the subsections below:

2.1 Moderator Temperature Coefficient (MTC)

(LCO 3.1.3)

The MTC shall be less positive than the limit provided in Figure 1.

The MTC shall be less negative than -50 pcm/°F.

(SR 3.1.3.2)

The 300 PPM MTC Surveillance limit is -41 pcm/°F (equilibrium, all rods withdrawn, RATED THERMAL POWER condition).

The 60 PPM MTC Surveillance limit is -46 pcm/°F (equilibrium, all rods withdrawn, RATED THERMAL POWER condition).

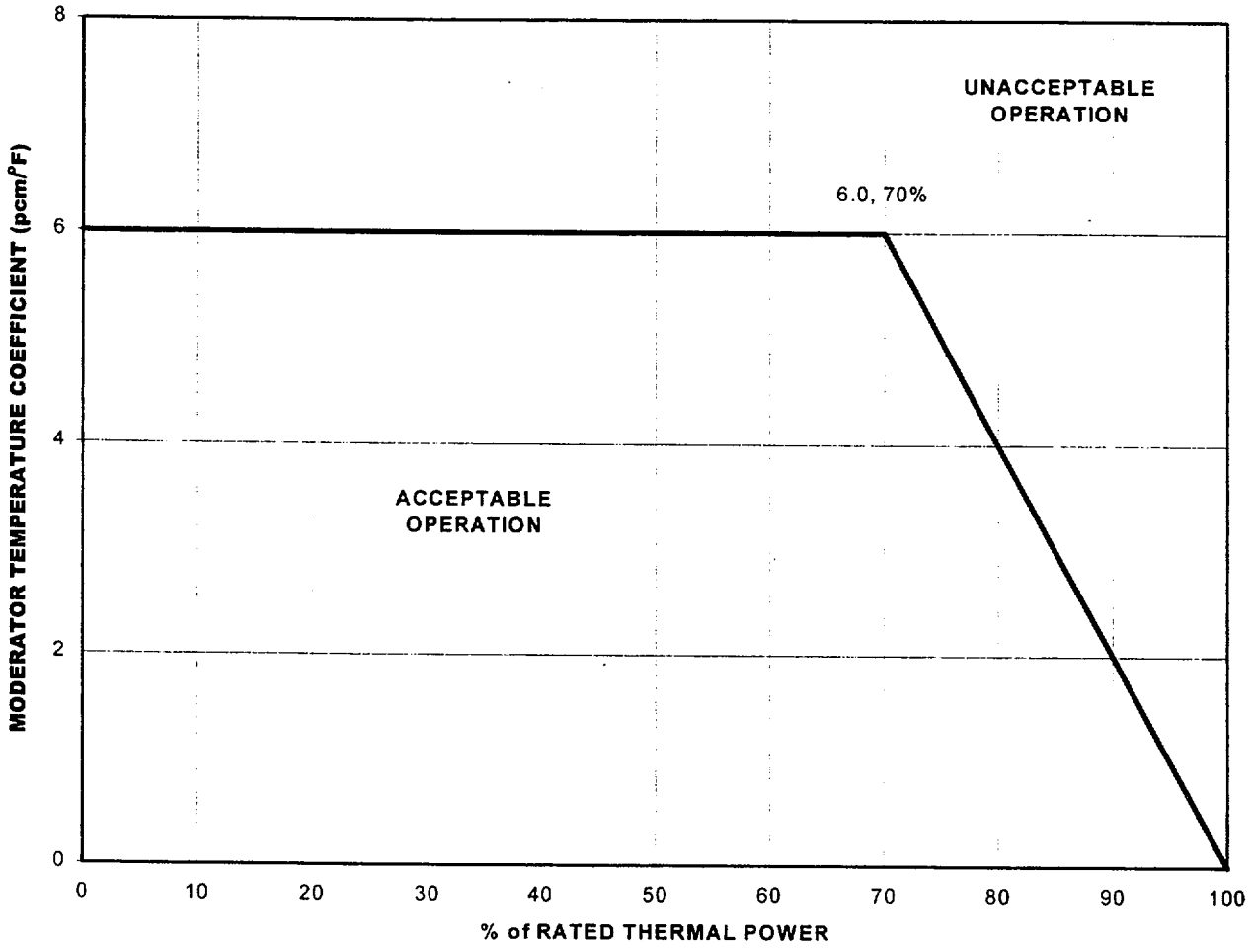

Figure 1
Moderator Temperature Coefficient Vs. RATED THERMAL POWER

2.2 Shutdown Bank Insertion Limits

(LCO 3.1.5)

The shutdown banks shall be fully withdrawn (i.e., positioned within the interval of $\geq$ 222 and $\leq$ 231 steps withdrawn).

2.3 Control Bank Insertion Limits

(LCO 3.1.6)

The Control Bank insertion, sequence, and overlap limits are specified in Figure 2.

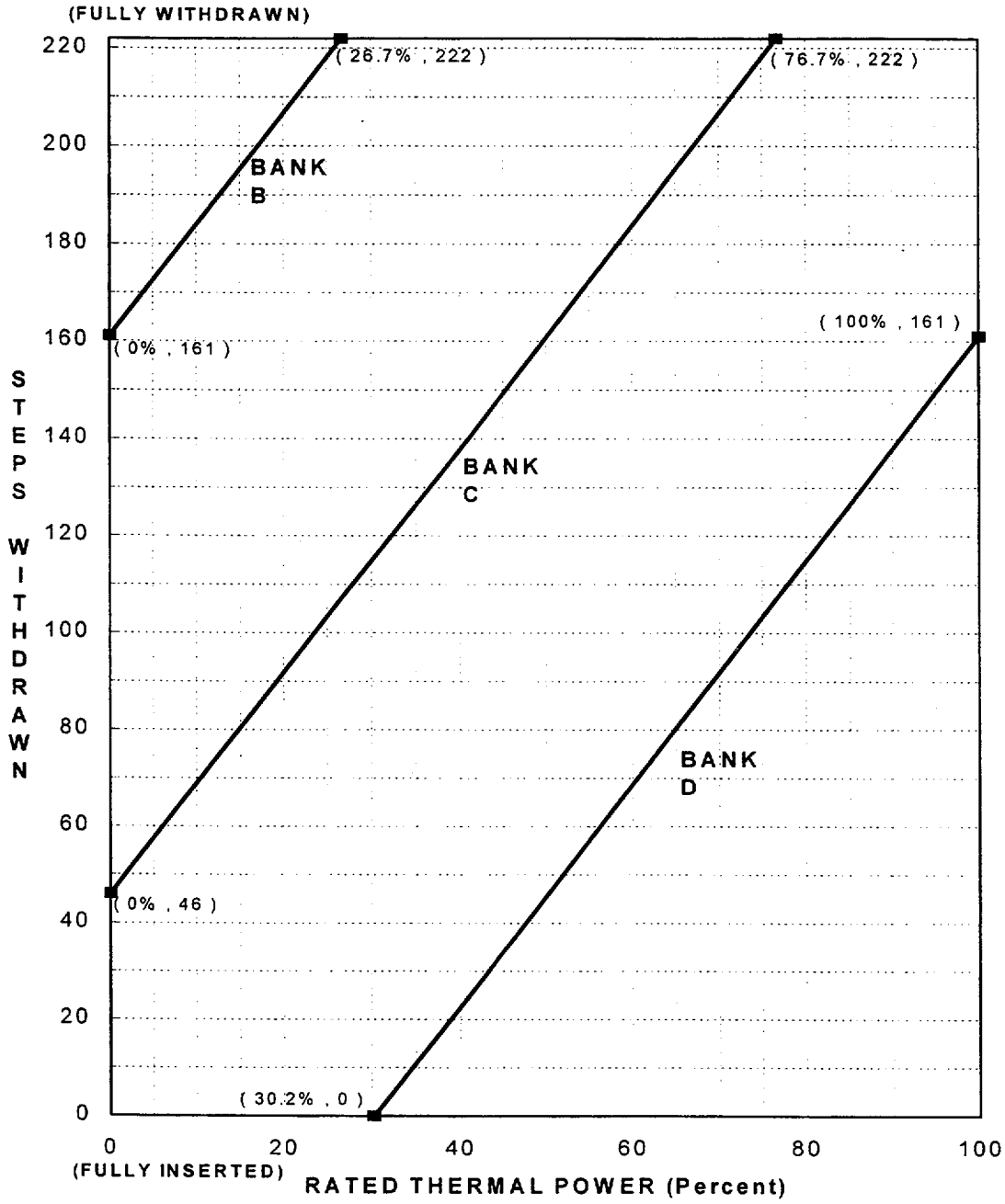

Figure 2

Conrol Bank Insertion, Sequence, and Overlap Limits Versus Thermal Power-Four Loop Operation

Fully withdrawn shall be the condition where control banks are at a position within the interval of ≥ 222 and ≤ 231 steps withdrawn.

2.4 AXIAL FLUX DIFFERENCE (AFD) (Relaxed Axial Offset Control (RAOC) Methodology)

(LCO 3.2.3)

The indicated AXIAL FLUX DIFFERENCE (AFD) allowed operational space is defined by Figure 3.

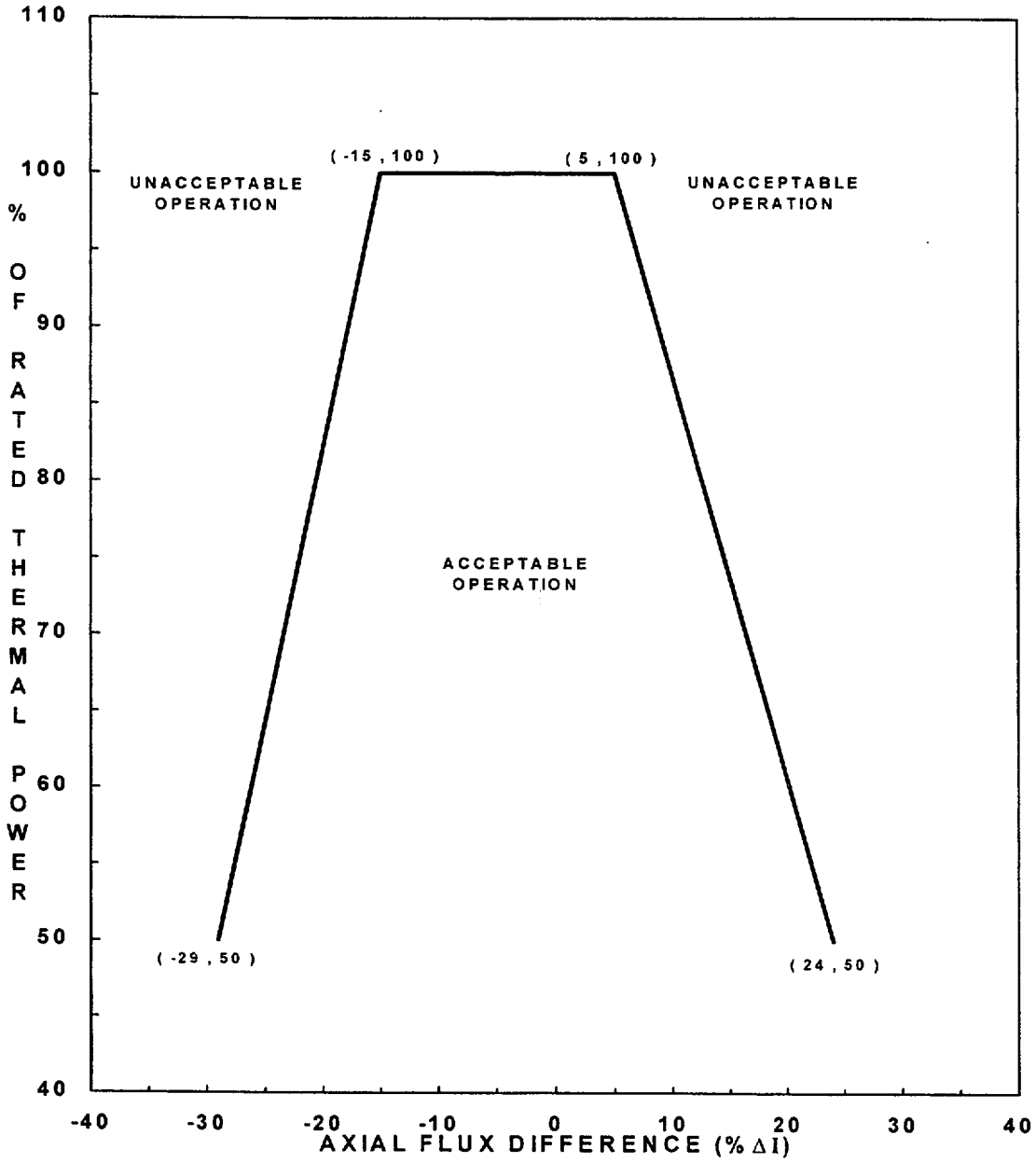

Figure 3

AXIAL FLUX DIFFERENCE Limits as a Function of RATED THERMAL POWER

2.5 Heat Flux Hot Channel Factor ($F_Q(Z)$)(F_Q Methodology)

(LCO 3.2.1)

$$F_Q(Z) \le \frac{CFQ}{P} * K(Z), \quad for\ P > 0.5$$

$$F_Q(Z) \le \frac{CFQ}{0.5} * K(Z), \quad for\ P \le 0.5$$

where, $P = \frac{THERMAL\ POWER}{RATED\ THERMAL\ POWER}$,

$CFQ = F_Q^{RTP}$

F_Q^{RTP} = $F_Q(Z)$ limit at RATED THERMAL POWER (RTP)

= 2.50, and

$K(Z)$ = as defined in Figure 4.

$F_Q^C(Z) = F_Q^M(Z)(1.03)(1.05) = F_Q^M(Z)(1.0815)$

where, $F_Q^M(Z)$ = Measured value of $F_Q(Z)$ from incore flux map

$$F_Q^W(Z) = F_Q^C(Z)W(Z)$$

where, $W(Z)$ = a cycle dependent function that accounts for power distribution transients encountered during normal operation (see Appendix A).

(SR 3.2.1.2)

See Appendix A for:

F_Q Penalty Factor

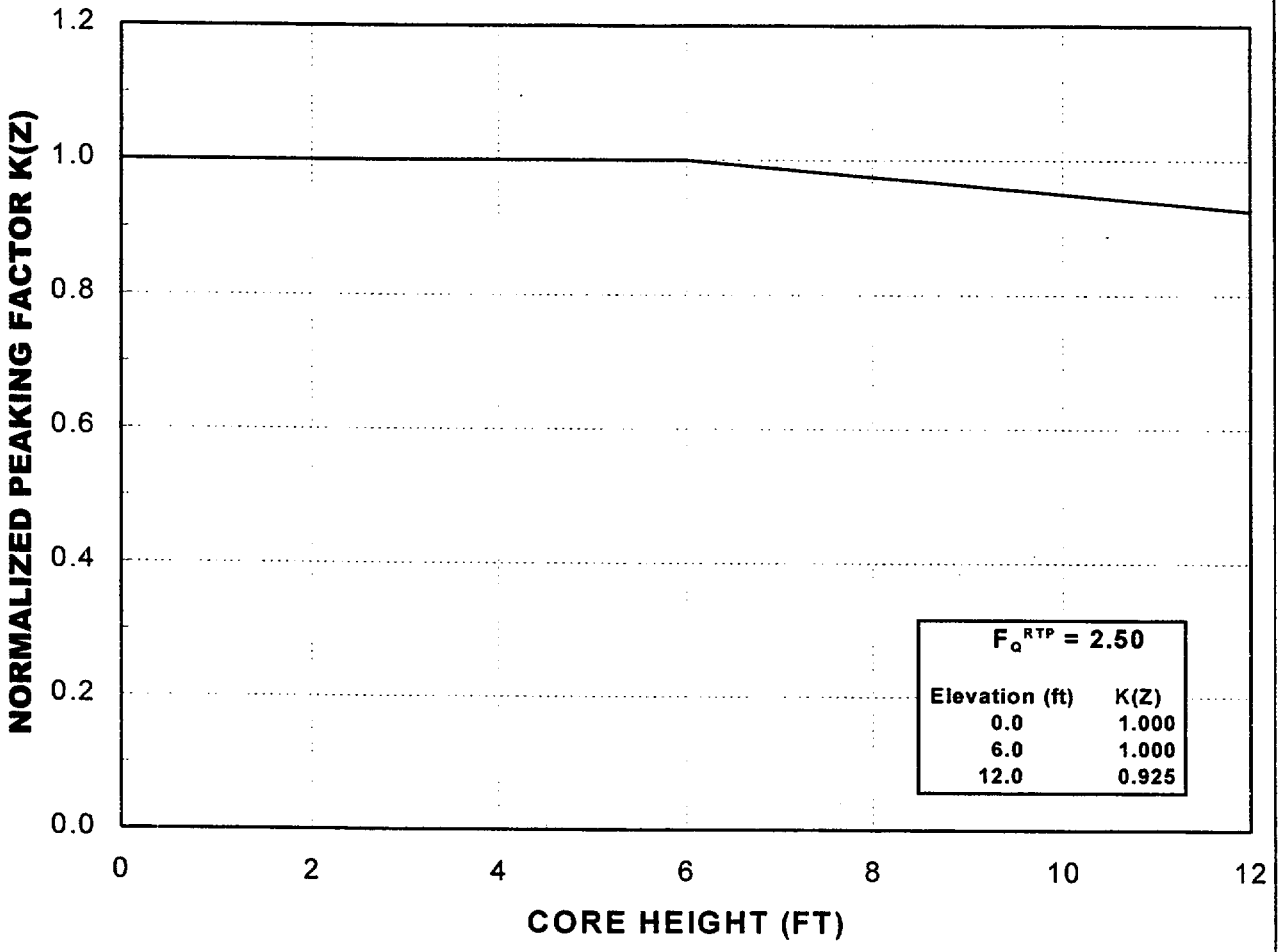

Figure 4

K(Z) - Normalized Peaking Factor Vs. Core Height

2.6 Nuclear Enthalpy Rise Hot Channel Factor ($F^N_{\Delta H}$)

(LCO 3.2.2)

$F^N_{\Delta H}$ shall be limited by the following relationship:

$$F^N_{\Delta H} \le F^{RTP}_{\Delta H}\left[1.0 + PF_{\Delta H}(1.0 - P)\right]$$

Where,

$F^{RTP}_{\Delta H}$ = $F^N_{\Delta H}$ limit at RATED THERMAL POWER (RTP)

= 1.586

$PF_{\Delta H}$ = power factor multiplier for $F^N_{\Delta H}$

= 0.3

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

$F^N_{\Delta H}$ = Measured values of $F^N_{\Delta H}$ obtained by using the movable incore detectors to obtain a power distribution map. The measured values of $F^N_{\Delta H}$ shall be used since an uncertainty of 4% for incore measurement of $F^N_{\Delta H}$ has been included in the above limit.

2.7 Boron Concentration

(LCO 3.9.1)

The refueling boron concentration shall be greater than or equal to 2300 PPM.

2.8 SHUTDOWN MARGIN

(LCO 3.1.1, 3.1.4, 3.1.5, 3.1.6, & 3.1.8)

The SHUTDOWN MARGIN shall be greater than or equal to 1300 pcm (1.3% $\Delta k/k$).

APPENDIX A

A. Input relating to LCO 3.2.1:

$$W(Z) = \frac{F_Q(Z)^{\text{max transient}}}{F_Q(Z)^{\text{steady state}}}$$

These values are issued in a controlled report which will be provided on request.

Input relating to SR 3.2.1.2

Cycle Burnup	$F_Q^W(Z)$ Penalty Factor
0	2.00
3900	2.00
4000	3.00
5500	3.00
5600	2.00
21000	2.00

Note: All cycle burnups outside of the above table shall use a 2% penalty factor for compliance with SR 3.2.1.2. Linear interpolation should be used for intermediate cycle burnups.

Technical Specification Bases 3.4.1, Applicable Safety Analysis

Cycle 11 Safety Analysis DNB Limit	1.76
WRB-2 Design Limit DNBR	1.23