Entergy Nuclear Northeast
Indian Point Energy Center
450 Broadway, GSB
P.O. Box 249
Buchanan, NY 10511-0249

T.R. Jones
Manager, Licensing
Tel 914 734 6670

May 15, 2007

Re: Indian Point Unit 3
Docket No. 50-286
NL-07-060

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

Subject: Revised Core Operating Limits Report for Indian Point Unit 3

Dear Sir/Madam:

Please find the Core Operating Report (COLR) for Indian Point Unit 3 Cycle 15 in Enclosure 1. The COLR complies with the Indian Point 3 Technical Specifications (TS) 5.6.5.d including the cycle-specific operating limits required for the operation of Indian Point Unit 3. Also, two mid-cycle revisions to the Cycle 14 COLR are provided in Enclosure 2. This transmittal provides the information required by TS 5.6.5.d.

There are no new commitments being made in this submittal. If you have any questions or require additional information, please contact Mr. T.R. Jones, Manager, Licensing at (914) 734-6670.

Sincerely,

T.R. Jones
Manager, Licensing
Indian Point Energy Center

Enclosure 1: Indian Point 3 COLR – Cycle 15
Enclosure 2: Indian Point 3 COLR – Cycle 14 Mid-Cycle Revisions

cc: Mr. Samuel J. Collins, Regional Administrator, NRC Region I
Mr. John Boska, Senior Project Manager, NRC NRR DORL
NRC Resident Inspector's Office, Indian Point 3

A001

ENCLOSURE 1 TO NL-07-060

Indian Point 3 Cycle 15 COLR

ENTERGY NUCLEAR OPERATIONS, INC.
INDIAN POINT NUCLEAR GENERATING UNIT NO. 3
DOCKET NO. 50-286

Entergy
Nuclear Northeast

One Site, One Team, One Fleet
Indian Point Energy Center

Procedure Use Is:

☑ Continuous

☐ Reference

☐ Information

Control Copy: _____

Effective Date: 3/26/07

3-GRAPH-RPC-16 , Revision: 0

CORE OPERATING LIMITS FOR CYCLE 15

Approved By:

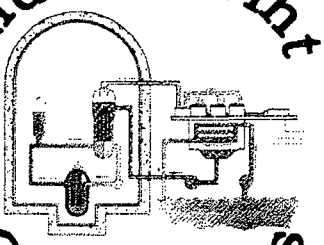
Mark J Mall 3/26/07

Procedure Sponsor, DM/Designee Date

Team 3B

Procedure Owner

Indian Point Operations



NEW PROCEDURE

TABLE OF CONTENTS

NOTE

- The *Core Operating Limits Report (COLR)*, including any mid-cycle revisions or supplements thereto, SHALL be provided upon issuance, for each reload cycle, to the NRC Document Control Desk with copies to the Regional Administrator and Resident Inspector.
- The data presented in this report applies to Cycle 15 ONLY and SHALL NOT be used for other cycles of operation. Any technical change to this document requires a Safety Screen OR Evaluation to be performed in accordance with 10 CFR 50.59.
- The Technical Specification (TS) references shown next to each Factor OR Limit in this COLR, are there to identify the corresponding sections in TS, which refer to the COLR.

1.0 TS 2.1.1 Safety Limits (SLs)

In Mode 1 and 2, the combination of thermal power level, pressurizer pressure, and highest loop average coolant temperature SHALL not exceed the limits shown in Figure 1, REACTOR CORE SAFETY LIMIT – FOUR LOOPS IN OPERATION. The safety limit is exceeded if the point defined by the combination of Reactor Coolant System average temperature and power level is at any time above the appropriate pressure line.

2.0 TS 3.1.1 Shutdown Margin (SDM)

The SDM SHALL be greater than or equal to 1.3 % $\Delta k/k$ (MODE 2, 3, 4 and 5 with $K_{eff} < 1.0$).

3.0 TS 3.1.3 Moderator Temperature Coefficient (MTC)

MODE 1, 2 with $K_{eff} \geq 1.0$: MTC upper limit SHALL be < 0.0 $\Delta k/k/°F$ at hot zero power

MODE 1, 2 and 3 : MTC lower limit SHALL be $\geq$ -38.0 pcm/°F @ 300 ppm

$\geq$ -44.5 pcm/°F @ 60 ppm

$\geq$ -47.0 pcm/°F @ 0 ppm

The Cycle 15 NuPOP may be referenced for the predicted MTC.

4.0 TS 3.1.5 Shutdown Bank Insertion Limits

The Shutdown Banks SHALL be fully withdrawn when the reactor is in MODE 1 and MODE 2 (Mode 2 with any Control bank not fully inserted). Shutdown Banks with a group step counter demand position $\geq$ 225 steps are considered fully withdrawn due to the bank demand position being above the top of the active fuel. (Not applicable during SR 3.1.4.2).

5.0 TS 3.1.6 Control Bank Insertion Limits

The Control Banks Insertion Limits for MODE 1 and MODE 2 with $K_{EFF} \geq 1.0$ are as indicated in Figure 2, ROD BANK INSERTION LIMITS vs RATED THERMAL POWER. Control Bank Insertion Limits apply to step counter demand position (Not applicable during SR 3.1.4.2).

Control Bank Overlap Pattern: MODE 1 and MODE 2 with $K_{EFF} \geq 1$. (TS 3.1.6.B)
Withdraw: A, B, C, D
Insert : D, C, B, A

Control Bank Overlap (TS 3.1.6.B): 104 steps

Control Bank Fully Withdrawn Position (TS 3.1.6.B): 230 steps

6.0 TS 3.2.1 Heat Flux Hot Channel Factor ($F_Q(Z)$)

NOTE

K(Z) is the fraction given in FIGURE 3, HOT CHANNEL FACTOR NORMALIZED OPERATING ENVELOPE, AND Z is the core height location of F_Q.

MODE 1: IF $P > .5$, $F_Q(Z) \leq (2.50 / P) \times K(Z)$

IF $P \leq .5$, $F_Q(Z) \leq (5.00) \times K(Z)$

7.0 TS 3.2.2 Nuclear Enthalpy Rise Hot Channel Factor ($F^N_{\Delta H}$)

NOTE

P is the fraction of Rated Thermal Power (RTP) at which the core is operating.

MODE 1:

$$F^N_{\Delta H} \leq 1.70 \{1 + 0.3 (1 - P) \}$$

8.0 TS 3.2.3 Axial Flux Difference (AFD) (Constant Axial Offset Control (CAOC)

MODE 1 with RTP > 15%, the Indicated limit is the Target Band; i.e., the Target $\pm$ 5%. The AFD SHALL be maintained within the acceptable operation limits of Figure 4, AXIAL FLUX DIFFERENCE ENVELOPE LIMITS, as required by TS 3.2.3.

9.0 TS 3.3.1 RPS Instrumentation

MODE 1 and MODE 2:

As per Attachment 1, OVERTEMPERATURE ΔT/ OVERPOWER ΔT:

Overtemperature ΔT: Allowable Value as referenced in Technical Specifications Table 3.3.1-1, Function 5, Note 1. REFER TO Attachment 1.

Overpower ΔT : Allowable Value as referenced in Technical Specifications Table 3.3.1-1, Function 6, Note 2. REFER TO Attachment 1.

10.0 TS 3.4.1 RCS Pressure, Temperature and Flow Departure from Nucleate Boiling (DNB) Limits

The following DNB related parameters are applicable in MODE 1:

a. Reactor Coolant System average $T_{AVG} \leq 572.0°F$ and highest loop $T_{AVG} \leq 576.7°F$
b. Pressurizer Pressure $\geq$ 2204 psig
c. Reactor Coolant System Total Flow Rate $\geq$ 364,700 gpm

11.0 TS 3.9.1 Refueling Boron Concentration

MODE 6:

When required by Technical Specification 3.9.1, the minimum boron concentration in the RCS, Refuel Canal, and Reactor Cavity SHALL be the more restrictive of either $\geq$ 2050 ppm OR that which is sufficient to provide a shutdown margin $\geq$ 5% Δk/k

FIGURE 1

REACTOR CORE SAFETY LIMIT – FOUR LOOPS IN OPERATION

(Page 1 of 1)

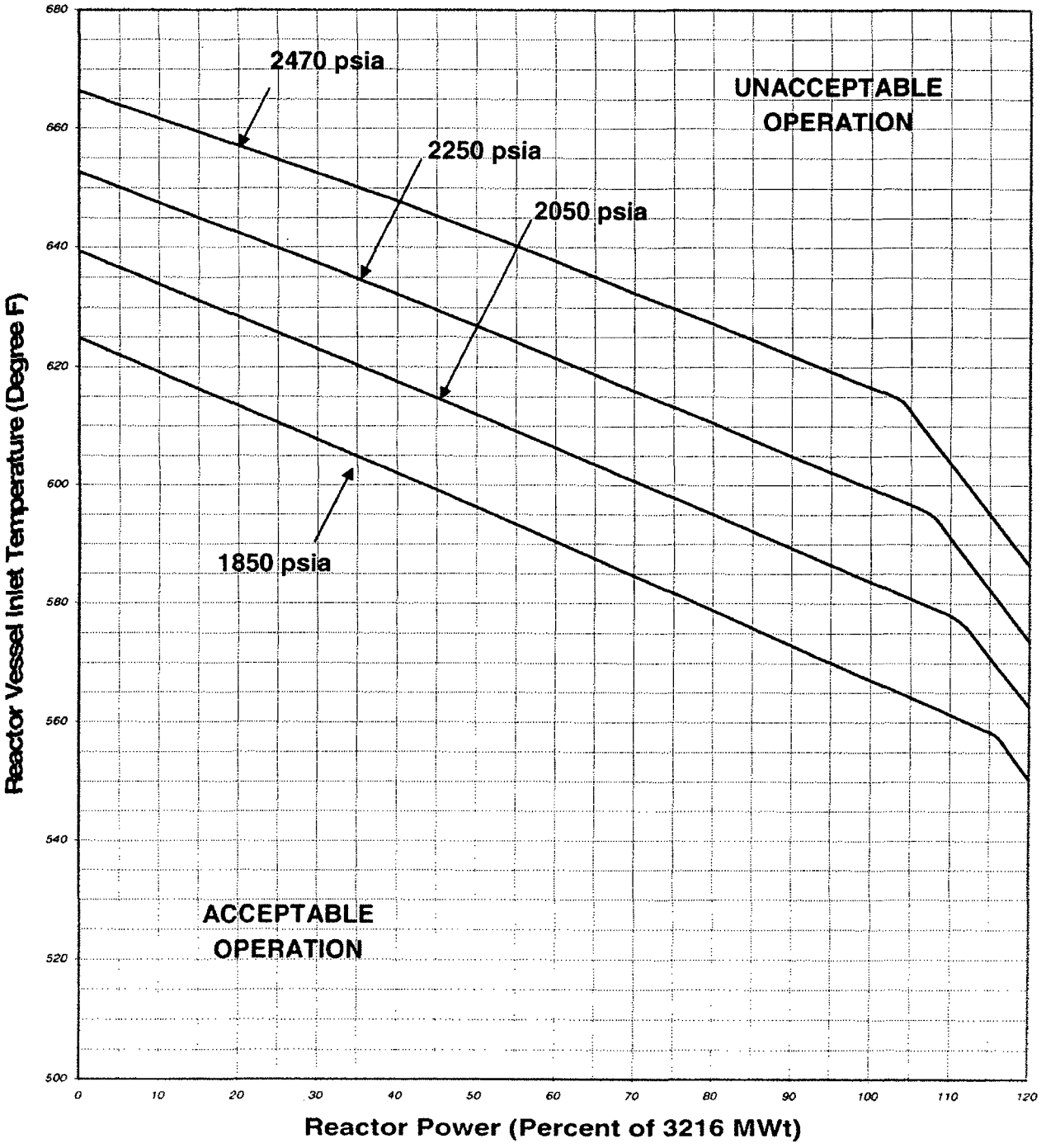


FIGURE 2

ROD BANK INSERTION LIMITS vs RATED THERMAL POWER
(Page 1 of 1)

(Four Loop Operation)
104 Step Overlap

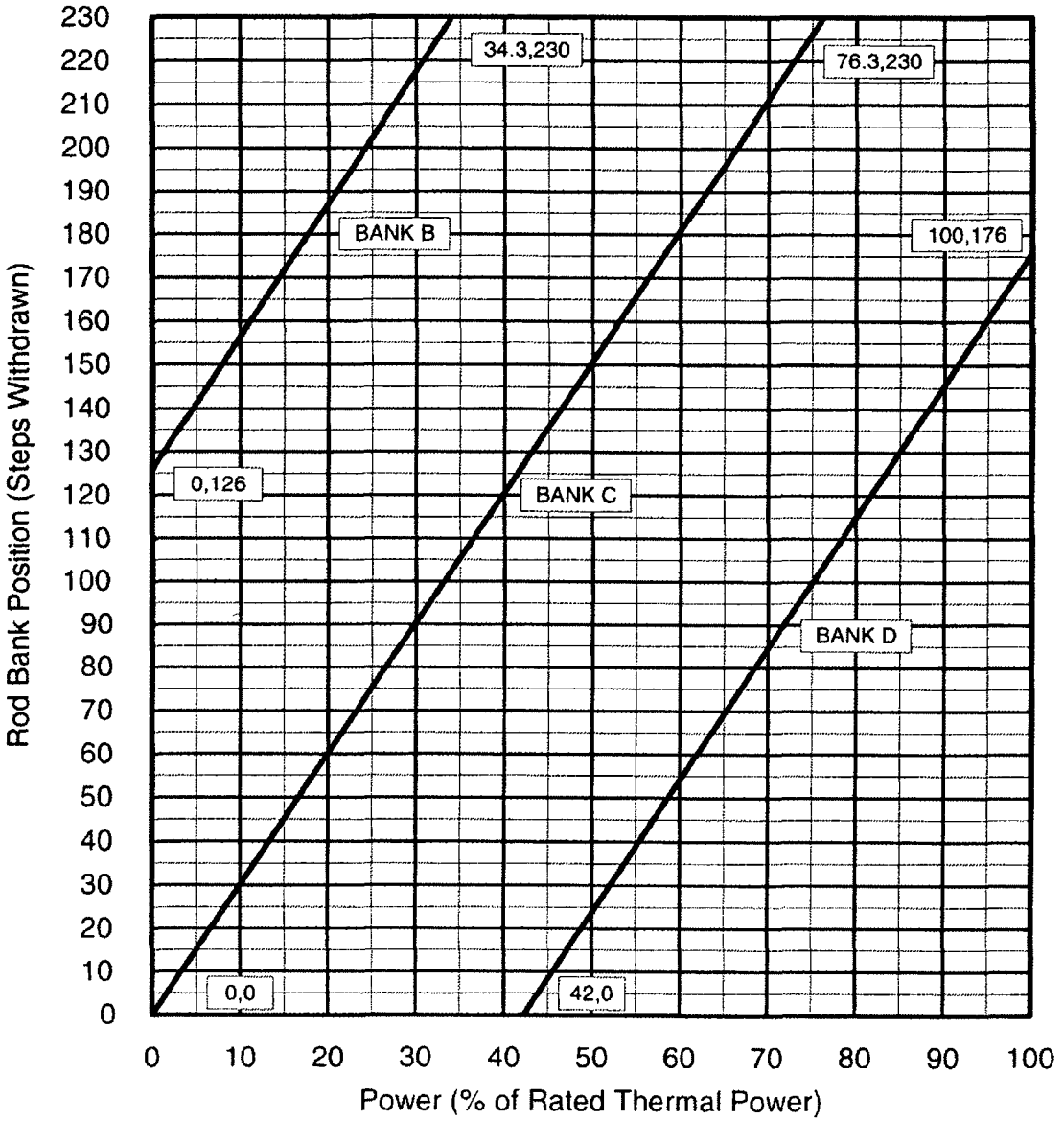


FIGURE 3
HOT CHANNEL FACTOR NORMALIZED OPERATING ENVELOPE
(Page 1 of 1)

(For S/G Tube Plugging up to 10%)

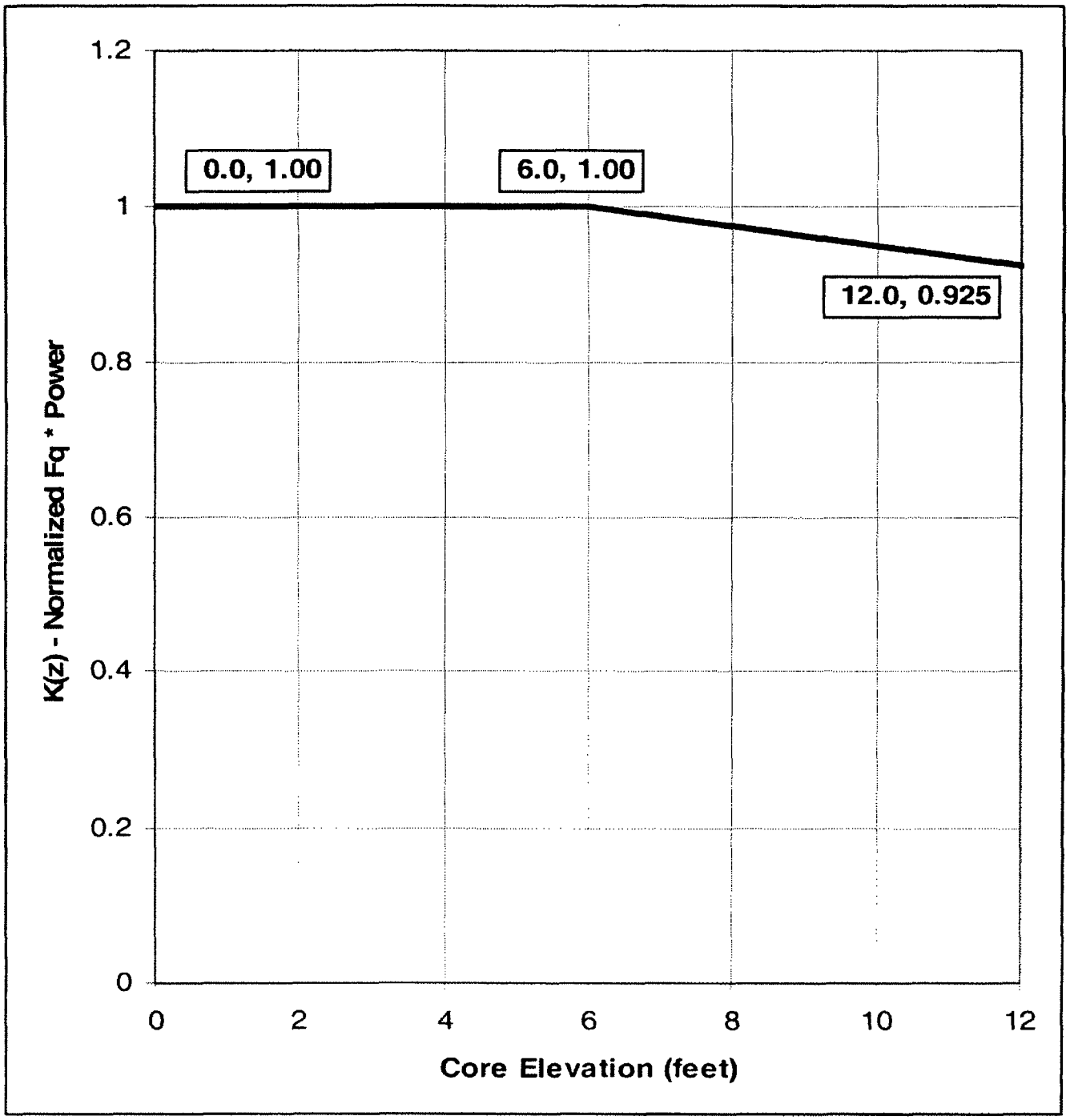
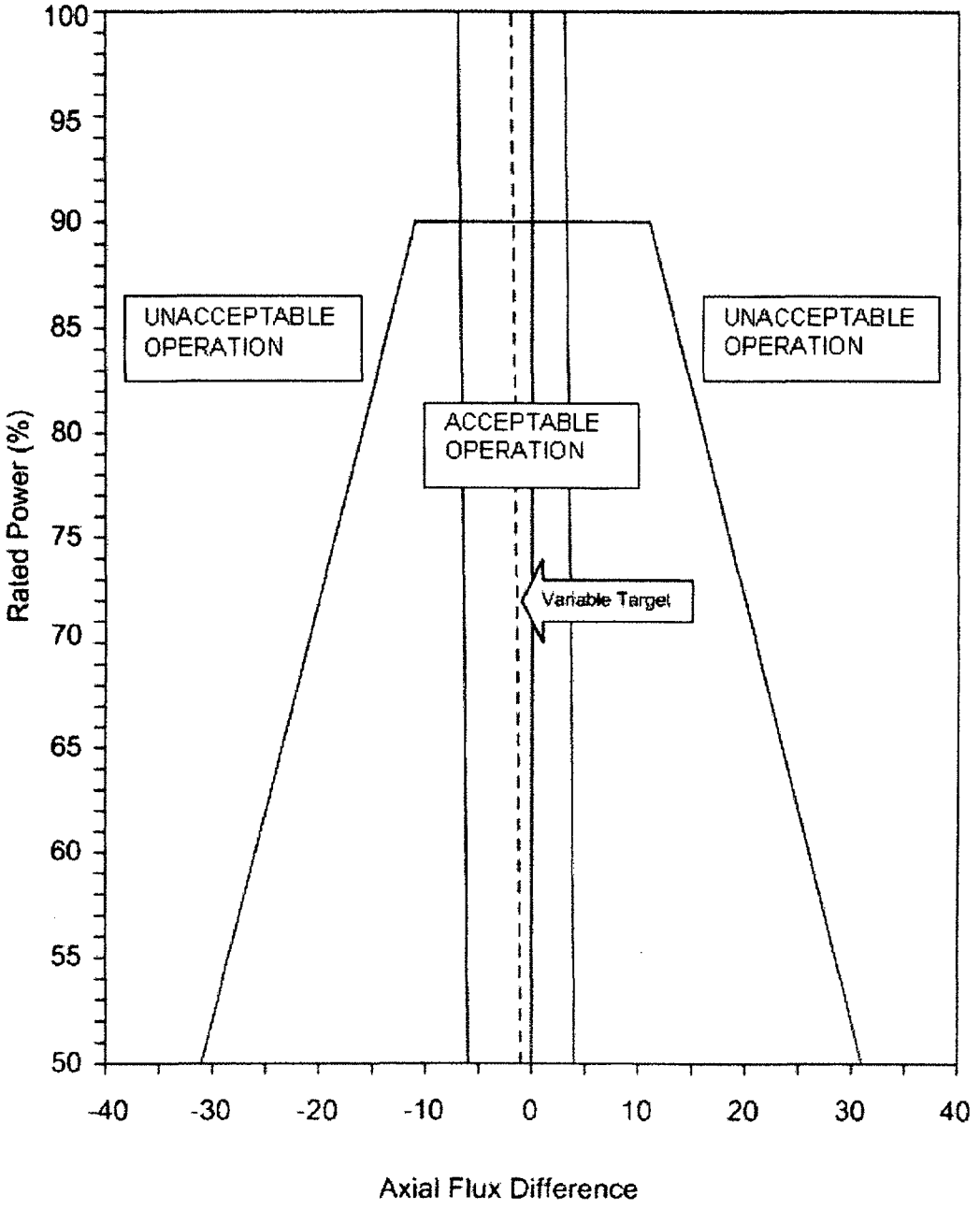


FIGURE 4
AXIAL FLUX DIFFERENCE ENVELOPE LIMITS
(Page 1 of 1)



ATTACHMENT 1
OVERTEMPERATURE ΔT/ OVERPOWER ΔT
(Page 1 of 2)

The Overtemperature ΔT Function Allowable Value SHALL not exceed the following:

NOTE

For limitations on the maximum trip Set point, see Technical Specification 3.3.1.

$$\Delta T \leq \Delta T_o \{ K_1 - K_2 [(1 + \tau_1 s)/(1 + \tau_2 s)] (T_{AVG} - T') + K_3 (P - P') - f_1(\Delta I) \}$$

Where: ΔT is measured RCS ΔT, °F (measured by hot leg and cold leg RTDs).

ΔT_o is the loop specific indicated ΔT at RTP, °F.

s is the Laplace transform operator, sec^{-1}.

T_{AVG} is the measured RCS average temperature, °F.

T′ is the loop specific indicated T_{AVG} at RTP, °F ≤ 572.0 °F.

P is the measured pressurizer pressure, psig

P′ is the nominal RCS operating pressure, ≥ 2235 psig

$K_1 \leq 1.26$ $K_2 \geq 0.022/°F$ $K_3 \geq 0.00070/psig$

$\tau_1 \geq 25.0$ sec $\tau_2 \leq 3.0$ sec

$f_1(\Delta I) =$ -4.00{15.75 + (qt - qb)} when qt - qb ≤ - 15.75% RTP

0% of RTP when -15.75% RTP < qt - qb ≤ 6.9% RTP

+3.33{(qt - qb) – 6.9} when qt - qb > 6.9% RTP

Where qt and qb are percent RTP in the upper and lower halves of the core, respectively, and qt + qb is the total THERMAL POWER in percent RTP.

ATTACHMENT 1
OVERTEMPERATURE ΔT/ OVERPOWER ΔT
(Page 2 of 2)

The Overpower ΔT Function Allowable Value SHALL not exceed the following:

NOTE

For limitations on the maximum trip Set point, see Technical Specification 3.3.1.

$$\Delta T \leq \Delta T_o \{ K_4 - K_5 [(\tau_3 s)/(1 + \tau_3 s)](T_{AVG}) - K_6(T_{AVG} - T'') - f_2(\Delta I) \}$$

Where: ΔT is measured RCS ΔT, °F (measured by hot leg and cold leg RTDs).
ΔT_o is the loop specific indicated ΔT at RTP, °F.
s is the Laplace transform operator, sec^{-1}.
T_{AVG} is the measured RCS average temperature, °F.
T'' is the loop specific indicated T_{AVG} at RTP, °F ≤ 572.0 °F.

$K_4 \leq 1.10$ $K_5 \geq 0.0175/°F$ for increasing T_{AVG} $K_6 \geq 0.0015/°F$ when $T_{AVG} > T''$
$0/°F$ for decreasing T_{AVG} $0/°F$ when $T_{AVG} \leq T''$

$\tau_3 = 10$ sec
$f_2(\Delta I) = 0$

ENCLOSURE 2 TO NL-07-060

Indian Point 3 Cycle 14 COLR
Mid-Cycle Revisions

ENTERGY NUCLEAR OPERATIONS, INC.
INDIAN POINT NUCLEAR GENERATING UNIT NO. 3
DOCKET NO. 50-286

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Nuclear Northeast

Procedure Use Is:
- ☑ Continuous
- ☐ Reference
- ☐ Information

Control Copy: _____

Effective Date: 1/31/2006

3-POP-2.3, Revision: 16

CORE OPERATING LIMITS FOR CYCLE 14

Approved By:

P E Lauder 1/25/06

Procedure Sponsor, DM/Designee — Date

Team 3B

Procedure Owner

Indian Point Operations

EDITORIAL REVISION

REVISION SUMMARY

(Page 1 of 1)

1.0 REASON FOR REVISION

1.1 Corrected τ_3 expression $\tau_3 \geq 10$ sec. (CR-IP3-2005-05151, **Editorial 4.6.13**).

2.0 SUMMARY OF CHANGES

2.1 Changed the value τ_3 for Overpower ΔT on Attachment 5 from $\tau_3 \geq 10$ sec to $\tau_3 = 10$ sec. to ensure Unit 3 Technical Specifications, The Unit 3 Core Operating Limits Report and 3-POP-2.3 are consistent until Unit 3 Technical Specifications are corrected. (CR-IP3-2005-05151, **Editorial 4.6.13**).

TABLE OF CONTENTS

1.0 PURPOSE

1.1 This procedure establishes the cycle specific safety limits for the reactor fuel.

1.2 This procedure applies to Cycle 14 fuel.

2.0 PRECAUTIONS AND LIMITATIONS

2.1 The data presented in this report applies to Cycle 14 Only and SHALL NOT be used for other operating cycles.

2.2 This data is applicable from completion of cycle 14 core reload until initiation of the cycle 15 core reload.

NOTE

The *Core Operating Limits Report (COLR)*, including any mid-cycle revisions or supplements thereto, shall be provided upon issuance, for each reload cycle, to the NRC Document Control Desk with copies to the Regional Administrator and Resident Inspector.

2.3 IF a part of this procedure is changed which affects information contained in the COLR **{Definition 5.1}**, THEN SUBMIT a copy of this approved procedure to the Site Licensing Manager for transmittal to the NRC per TS: 5.6.5 **{Reference 6.1.1}**

2.4 COLR data is provided by Reactor Engineering per procedure RA-25, Control of Core Operating Limits Report.

3.0 PREREQUISITES

None

4.0 PROCEDURE

4.1 The following are Core Operating Limits for the Cycle 14 reactor fuel:

Table 4.1
CORE OPERATING LIMITS FOR CYCLE REACTOR FUEL

PARAMETER	VALUE	CORRESPONDING T.S.	APPLICABILITY
Hot Channel Factor at Rated Thermal Power, $F_Q(Z)$ (Measured via flux mapping)	2.5	3.2.1 (B.3.2.1 for mathematical formula, error tolerances, and measurement by flux mapping)	Mode 1
Height Dependent $F_Q(Z)$ Multiplier K (Z), referred to as "fraction"	Refer to Attachment 2	3.2.1	Mode 1
Hot Channel Factor at Rated Thermal Power, $F_{\Delta H}^N$ for Vantage + for 15x15 Upgrade	 1.70 1.70	3.2.2	Mode 1
Power Factor Multiplier for $F_{\Delta H} = PF_{\Delta H}$ $PF_{\Delta H}$ for $0.00 \leq P \leq 1.0$	 0.3	3.2.2	Mode 1
Equation for $F_{\Delta H}^N$ (Measured via flux mapping)	$F_{\Delta H}^N \leq F_{\Delta H}^{RTP}(1+ PF_{\Delta H}(1-P))$	3.2.2, B3.2.2, B2.1.1 for variable definitions and error tolerances	Mode 1
Axial Flux Difference Band Width	±5% Refer to Attachment 3	3.2.3 3.2.3	Mode 1 with Thermal Power > 15%

Table 4.1

CORE OPERATING LIMITS FOR CYCLE REACTOR FUEL

PARAMETER	VALUE	CORRESPONDING T.S.	APPLICABILITY
Axial Flux Difference Envelope Limits at 90% power	-11%, +11% Refer to Attachment 3	3.2.3	Mode 1 with Thermal Power > 15%
Axial Flux Difference Envelope Increase for each 2% of rated thermal power < 90% RTP but ≥ 50% RTP	±1% Refer to Attachment 3	3.2.3	Mode 1 with Thermal Power > 15%
Shutdown Bank Insertion Limits	≥ 225 Steps withdrawn (Indicated)	3.1.5	Mode 1 Mode 2 with any Control bank not fully inserted. N/A during SR 3.1.4.2
Control Bank Insertion Limits	Refer to Attachment 1	3.1.6	Mode 1 Mode 2 with K_{eff} ≥ 1.0 N/A during SR 3.1.4.2
Control Bank Overlap Pattern	Withdraw: A, B, C, D Insert: D, C B, A	3.1.6, B3.1.6	Mode 1 Mode 2 with K_{eff} ≥ 1.0
Control Bank Overlap	104 Steps	3.1.6, B3.1.6	Mode 1 Mode 2 with K_{eff} ≥ 1.0
Control Bank Fully Withdrawn Position	230 Steps	3.1.6, B3.1.6	Mode 1 Mode 2 with K_{eff} ≥ 1.0
Shutdown Margin	≥ 1.3% ΔK/ K	3.1.1, 3.1.8	Mode 2 during physics tests Mode 2 with K_{eff} < 1.0 Modes 3, 4, 5

Table 4.1

CORE OPERATING LIMITS FOR CYCLE REACTOR FUEL

PARAMETER	VALUE	CORRESPONDING T.S.	APPLICABILITY
Reactor Coolant System and Refueling Cavity Boron Concentration	More restrictive of : ≥ 2050 ppm OR concentration that provides a SDM ≥ 5% ΔK/ K	3.9.1	Mode 6
Moderator Temperature Coefficient Limits Lower:	@ 300 ppm ≥ - 38.0 pcm/°F @ 60 ppm ≥ - 44.5 pcm/°F @ LCO ≥ - 47.0 pcm/°F	3.1.3	Modes 1, 2, 3 for lower limit
Upper:	≤ 0.0 ΔK/ K °F		Mode 1 and Mode 2 with Keff ≥ 1.0 for upper limit
Reactor Core Safety Limits	Refer to Attachment 4	2.1.1	Modes 1 and 2
Overtemperature ΔT Limit and Overpower ΔT Limit	Refer to Attachment 5	3.3.1	Modes 1 and 2
RCS Pressure	Indicated Pressurizer Pressure ≥ 2204 psig	3.4.1	Mode 1
Temperature	Indicated RCS average loop temperature ≤ 576.7°F for full power Tavg = 572.0°F		
Flow Departure from Nucleate Boiling (DNB) Limits	Minimum measured RCS total flow rate ≥ 364,700 gpm.		

5.0 DEFINITIONS

5.1 **Core Operating Limits Report (COLR)** - the parts of this procedure which satisfy the requirements of T.S. 1.1, 5.6.5.

6.0 REFERENCES

6.1 Commitment Documents

6.1.1 Technical Specification 5.6.5.

6.2 Development Documents

6.2.1 NRC Generic Letter 88-16

6.2.2 Indian Point Unit 3 Cycle 14 Reload Safety Evaluation, March 2005

6.2.3 Core Operating Limits Report for Cycle 14, Rev. 0.

6.2.4 Technical Specification 2.1.1, 3.1.1, 3.1.3, 3.1.5, 3.1.6, 3.1.8, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.4.1, 3.9.1, B.2.1.1, B3.4.1.

6.2.5 Technical Specification 5.6.5.

6.2.6 NRC Safety Evaluation Report for T.S. Amendment 103.

6.3 Interface Documents

RA-25, Control of Core Operating Limits Report

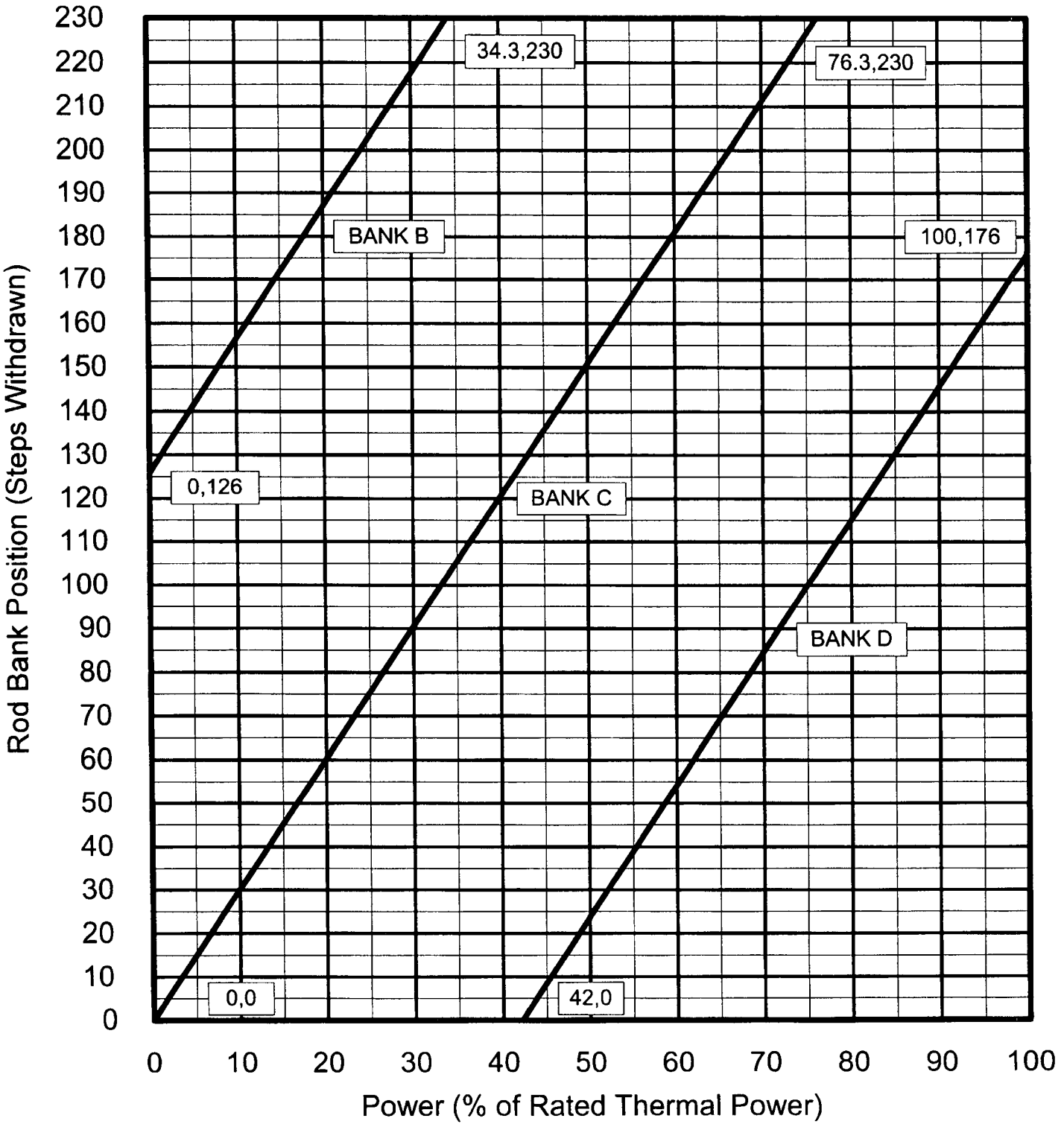
7.0 RECORDS AND DOCUMENTATION

None

ATTACHMENT 1

CONTROL ROD INSERTION LIMITS vs RATED THERMAL POWER

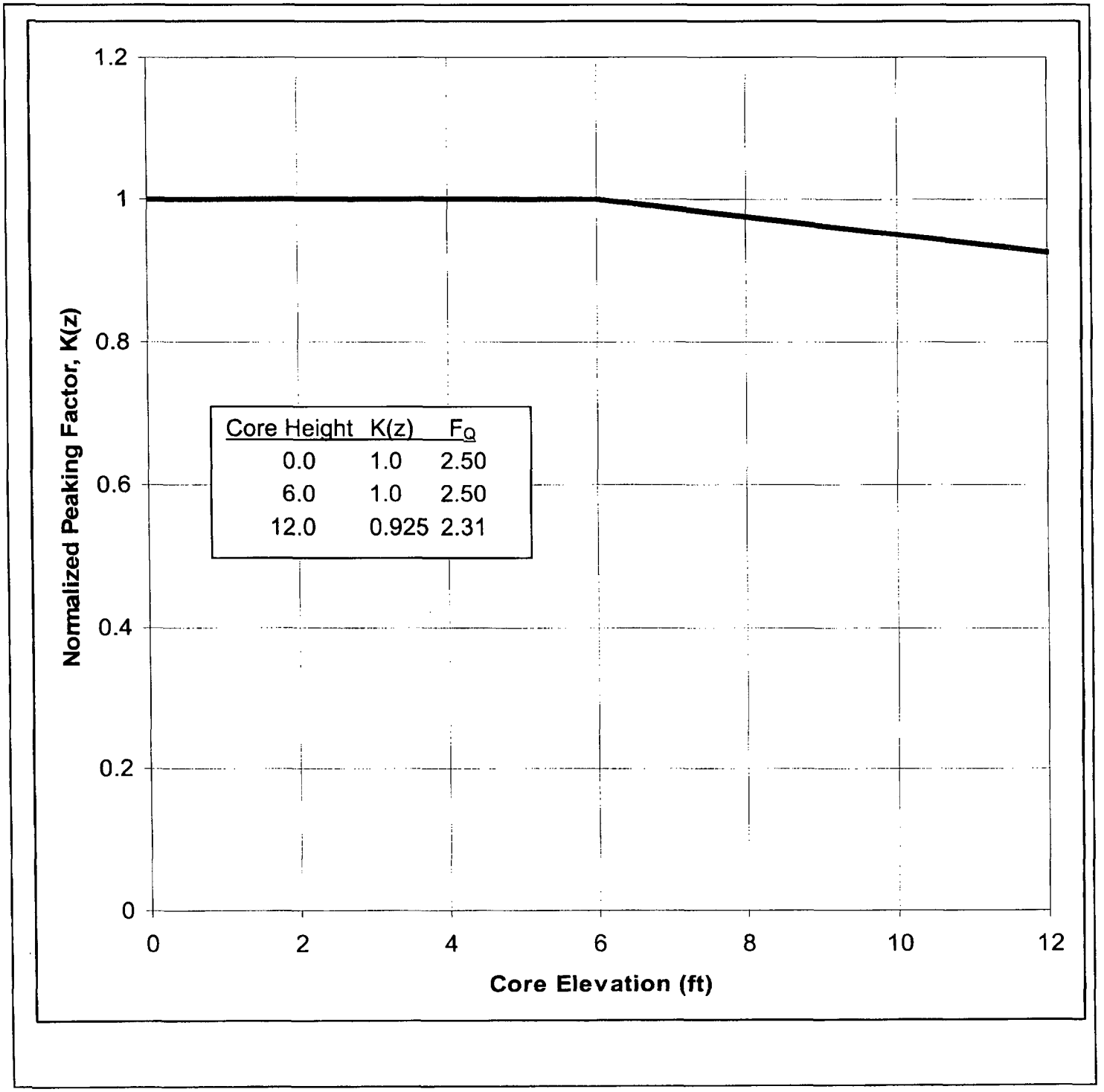
(Page 1 of 1)



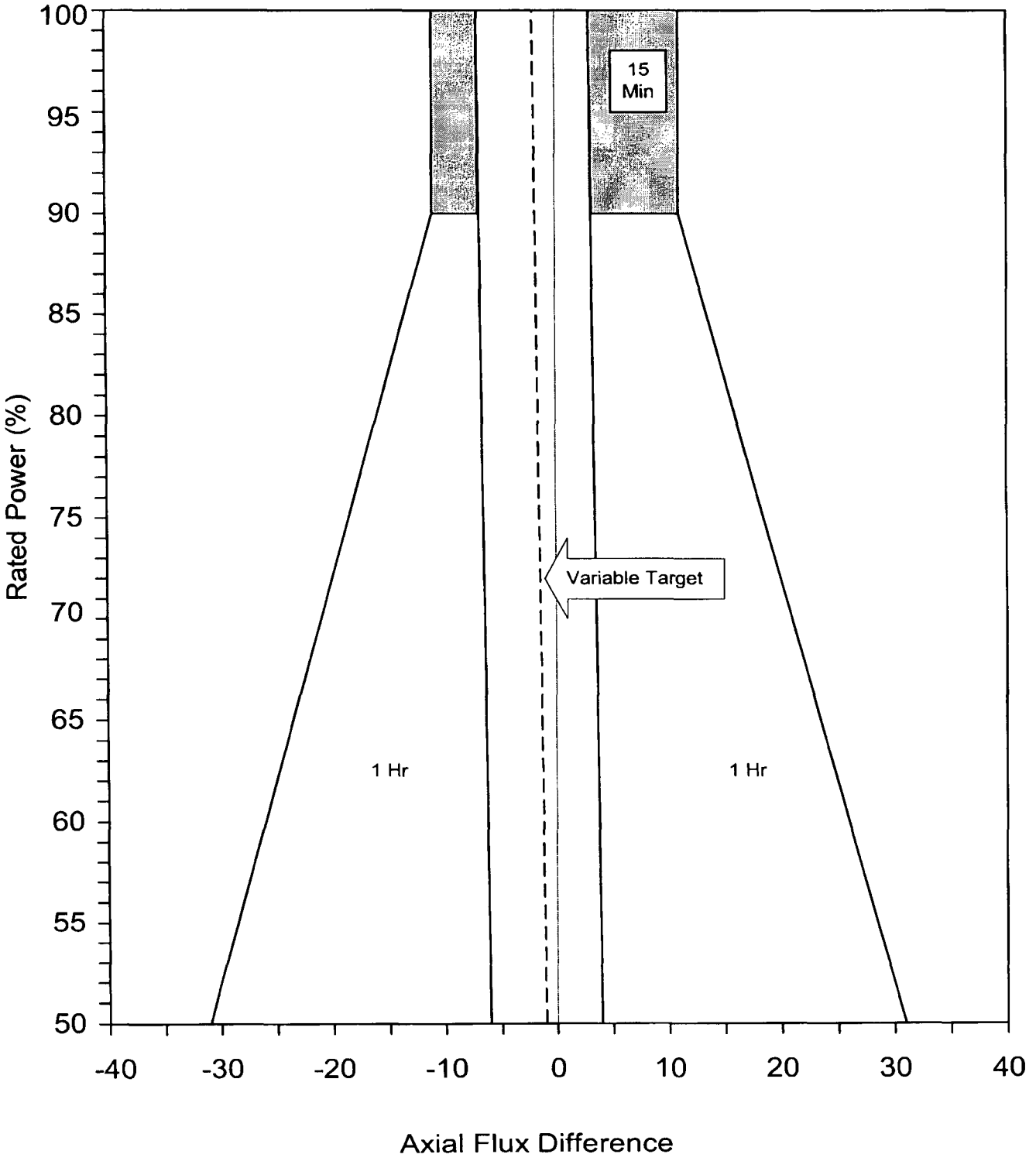
ATTACHMENT 2

K(z) NORMALIZED $F_{Q(z)}$ AS A FUNCTION OF CORE HEIGHT

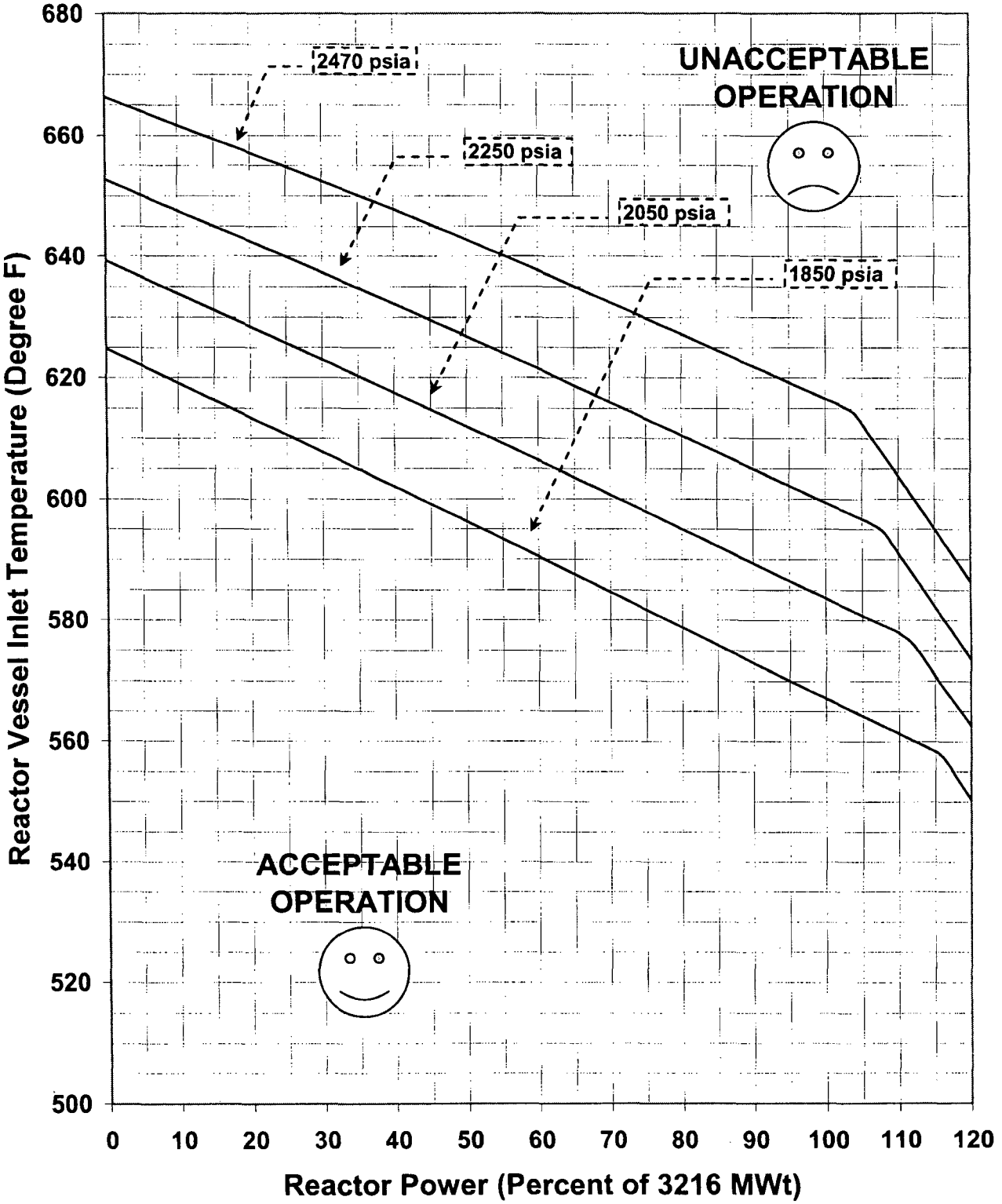
(Page 1 of 1)



ATTACHMENT 3
AXIAL FLUX DIFFERENCE ENVELOPE LIMITS
(Page 1 of 1)



ATTACHMENT 4
REACTOR CORE SAFETY LIMIT – FOUR LOOPS IN OPERATION
(Page 1 of 1)



ATTACHMENT 5
OVERTEMPERATURE ΔT/ OVERPOWER ΔT
(Page 1 of 2)

The Overtemperature ΔT Function Allowable Value SHALL not exceed the following:

NOTE

For limitations on the maximum trip Setpoint, see Technical Specification 3.3.1.

$$\Delta T \leq \Delta T_o [K_1 - K_2 [(1 + \tau_1 s)/(1 + \tau_2 s)] (T_{avg} - T') + K_3 (P - P') - f_1(\Delta I)]$$

Where: ΔT is measured RCS ΔT, °F (measured by hot leg and cold leg RTDs).
ΔT_o is the loop specific indicated ΔT at RTP, °F.
s is the Laplace transform operator, sec^{-1}.
T_{avg} is the measured RCS average temperature, °F.
T′ is the loop specific indicated T_{avg} at RTP, °F ≤ 572.0 °F.
P is the measured pressurizer pressure, psig
P′ is the nominal RCS operating pressure, ≥ 2235 psig

$K_1 \leq 1.26$ $K_2 \geq 0.022/°F$ $K_3 \geq 0.00070/psi$

$\tau_1 \geq 25.0$ sec $\tau_2 \leq 3.0$ sec

$f_1(\Delta I) =$ -4.00{15.75 + (qt - qb)} when qt - qb < - 15.75% RTP
0% of RTP when -15.75% RTP ≤ qt - qb ≤ 6.9% RTP
+3.33{(qt - qb) – 6.9} when qt - qb > 6.9% RTP

Where qt and qb are percent RTP in the upper and lower halves of the core, respectively, and qt + qb is the total THERMAL POWER in percent RTP.

ATTACHMENT 5
OVERTEMPERATURE ΔT/ OVERPOWER ΔT
(Page 2 of 2)

The Overpower ΔT Function Allowable Value SHALL not exceed the following:

$$\Delta T \leq \Delta T_o (K_4 - K_5 [(\tau_3 s)/(1 + \tau_3 s)](T_{avg}) - K_6(T_{avg} - T'')) - f_2(\Delta I)$$

Where: ΔT is measured RCS ΔT, °F (measured by hot leg and cold leg RTDs).
ΔT_o is the loop specific indicated ΔT at RTP, °F.
s is the Laplace transform operator, sec^{-1}.
T_{avg} is the measured RCS average temperature, °F.
T'' is the loop specific indicated T_{avg} at RTP, °F ≤ 572.0 °F.

$K_4 \leq 1.10$ $K_5 \geq 0.0175/°F$ for increasing T_{avg} $K_6 \geq 0.0015/°F$ when $T_{avg} > T''$
$0/°F$ for decreasing T_{avg} $0/°F$ when $T_{avg} \leq T''$

τ_3 = 10 sec
$f_2(\Delta I) = 0$

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Nuclear Northeast

Procedure Use Is:
- ☑ Continuous
- ☐ Reference
- ☐ Information

Control Copy: _____

Effective Date: 8/12/05

3-POP-2.3, Revision: 15

CORE OPERATING LIMITS FOR CYCLE 14

3

Indian Point Operations

Approved By:

Mark J. Miller 8/1/05

Procedure Sponsor, DM/Designee Date

Team 3B

Procedure Owner

EDITORIAL REVISION

REVISION SUMMARY

(Page 1 of 1)

1.0 REASON FOR REVISION

1.1 Corrected τ_3 expression $\tau_3 \geq 10$ sec. (CR-IP2-2005-02150, **Editorial 4.6.13**).

2.0 SUMMARY OF CHANGES

2.1 Corrected τ_3 expression in Attachment 5 from $\tau_3 \leq 10$ sec to $\tau_3 \geq 10$ sec to agree with Technical Specifications. This was a typographical error in both the COLR and Technical Specifications for IP3. (CR-IP2-2005-02150, **Editorial 4.6.13**).

TABLE OF CONTENTS

1.0 PURPOSE

1.1 This procedure establishes the cycle specific safety limits for the reactor fuel.

1.2 This procedure applies to Cycle 14 fuel.

2.0 PRECAUTIONS AND LIMITATIONS

2.1 The data presented in this report applies to Cycle 14 Only and SHALL NOT be used for other operating cycles.

2.2 This data is applicable from completion of cycle 14 core reload until initiation of the cycle 15 core reload.

NOTE

The *Core Operating Limits Report (COLR)*, including any mid-cycle revisions or supplements thereto, shall be provided upon issuance, for each reload cycle, to the NRC Document Control Desk with copies to the Regional Administrator and Resident Inspector.

2.3 IF a part of this procedure is changed which affects information contained in the COLR **{Definition 5.1}**, THEN SUBMIT a copy of this approved procedure to the Site Licensing Manager for transmittal to the NRC per TS: 5.6.5 **{Reference 6.1.1}**

2.4 COLR data is provided by Reactor Engineering per procedure RA-25, Control of Core Operating Limits Report.

3.0 PREREQUISITES

None

4.0 PROCEDURE

4.1 The following are Core Operating Limits for the Cycle 14 reactor fuel:

Table 4.1
CORE OPERATING LIMITS FOR CYCLE REACTOR FUEL

PARAMETER	VALUE	CORRESPONDING T.S.	APPLICABILITY
Hot Channel Factor at Rated Thermal Power, $F_Q(Z)$ (Measured via flux mapping)	2.5	3.2.1 (B.3.2.1 for mathematical formula, error tolerances, and measurement by flux mapping)	Mode 1
Height Dependent $F_Q(Z)$ Multiplier K (Z), referred to as "fraction"	Refer to Attachment 2	3.2.1	Mode 1
Hot Channel Factor at Rated Thermal Power, $F_{\Delta H}^N$ for Vantage + for 15x15 Upgrade	 1.70 1.70	3.2.2	Mode 1
Power Factor Multiplier for $F_{\Delta H} = PF_{\Delta H}$ $PF_{\Delta H}$ for $0.00 \leq P \leq 1.0$	 0.3	3.2.2	Mode 1
Equation for $F_{\Delta H}^N$ (Measured via flux mapping)	$F_{\Delta H}^N \leq F_{\Delta H}^{RTP}(1+ PF_{\Delta H}(1-P))$	3.2.2, B3.2.2, B2.1.1 for variable definitions and error tolerances	Mode 1
Axial Flux Difference Band Width	±5% Refer to Attachment 3	3.2.3 3.2.3	Mode 1 with Thermal Power > 15%

Table 4.1

CORE OPERATING LIMITS FOR CYCLE REACTOR FUEL

PARAMETER	VALUE	CORRESPONDING T.S.	APPLICABILITY
Axial Flux Difference Envelope Limits at 90% power	-11%, +11% Refer to Attachment 3	3.2.3	Mode 1 with Thermal Power > 15%
Axial Flux Difference Envelope Increase for each 2% of rated thermal power < 90% RTP but ≥ 50% RTP	±1% Refer to Attachment 3	3.2.3	Mode 1 with Thermal Power > 15%
Shutdown Bank Insertion Limits	≥ 225 Steps withdrawn (Indicated)	3.1.5	Mode 1 Mode 2 with any Control bank not fully inserted. N/A during SR 3.1.4.2
Control Bank Insertion Limits	Refer to Attachment 1	3.1.6	Mode 1 Mode 2 with K_{eff} ≥ 1.0 N/A during SR 3.1.4.2
Control Bank Overlap Pattern	Withdraw: A, B, C, D Insert: D, C B, A	3.1.6, B3.1.6	Mode 1 Mode 2 with K_{eff} ≥ 1.0
Control Bank Overlap	104 Steps	3.1.6, B3.1.6	Mode 1 Mode 2 with K_{eff} ≥ 1.0
Control Bank Fully Withdrawn Position	230 Steps	3.1.6, B3.1.6	Mode 1 Mode 2 with K_{eff} ≥ 1.0
Shutdown Margin	≥ 1.3% ΔK/ K	3.1.1, 3.1.8	Mode 2 during physics tests Mode 2 with K_{eff} < 1.0 Modes 3, 4, 5

Table 4.1

CORE OPERATING LIMITS FOR CYCLE REACTOR FUEL

PARAMETER	VALUE	CORRESPONDING T.S.	APPLICABILITY
Reactor Coolant System and Refueling Cavity Boron Concentration	More restrictive of : ≥ 2050 ppm OR concentration that provides a SDM ≥ 5% ΔK/ K	3.9.1	Mode 6
Moderator Temperature Coefficient Limits Lower:	@ 300 ppm ≥ - 38.0 pcm/°F @ 60 ppm ≥ - 44.5 pcm/°F @ LCO ≥ - 47.0 pcm/°F	3.1.3	Modes 1, 2, 3 for lower limit
Upper:	≤ 0.0 ΔK/ K °F		Mode 1 and Mode 2 with Keff ≥ 1.0 for upper limit
Reactor Core Safety Limits	Refer to Attachment 4	2.1.1	Modes 1 and 2
Overtemperature ΔT Limit and Overpower ΔT Limit	Refer to Attachment 5	3.3.1	Modes 1 and 2
RCS Pressure	Indicated Pressurizer Pressure ≥ 2204 psig	3.4.1	Mode 1
Temperature	Indicated RCS average loop temperature ≤ 576.7°F for full power Tavg = 572.0°F		
Flow Departure from Nucleate Boiling (DNB) Limits	Minimum measured RCS total flow rate ≥ 364,700 gpm.		

5.0 DEFINITIONS

5.1 **Core Operating Limits Report (COLR)** - the parts of this procedure which satisfy the requirements of T.S. 1.1, 5.6.5.

6.0 REFERENCES

6.1 Commitment Documents

6.1.1 Technical Specification 5.6.5.

6.2 Development Documents

6.2.1 NRC Generic Letter 88-16

6.2.2 Indian Point Unit 3 Cycle 14 Reload Safety Evaluation, March 2005

6.2.3 Core Operating Limits Report for Cycle 14, Rev. 0.

6.2.4 Technical Specification 2.1.1, 3.1.1, 3.1.3, 3.1.5, 3.1.6, 3.1.8, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.4.1, 3.9.1, B.2.1.1, B3.4.1.

6.2.5 Technical Specification 5.6.5.

6.2.6 NRC Safety Evaluation Report for T.S. Amendment 103.

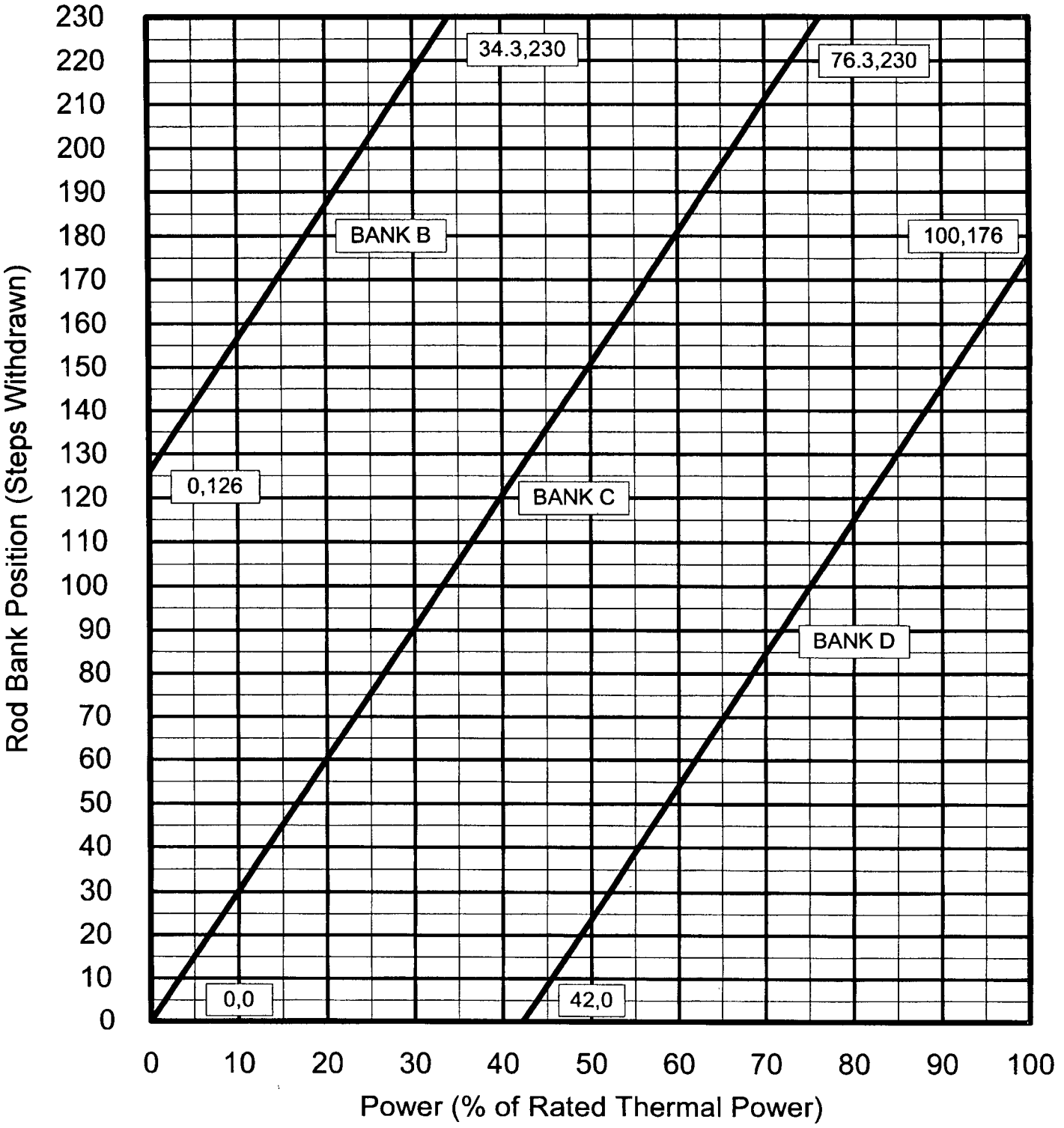
6.3 Interface Documents

RA-25, Control of Core Operating Limits Report

7.0 RECORDS AND DOCUMENTATION

None

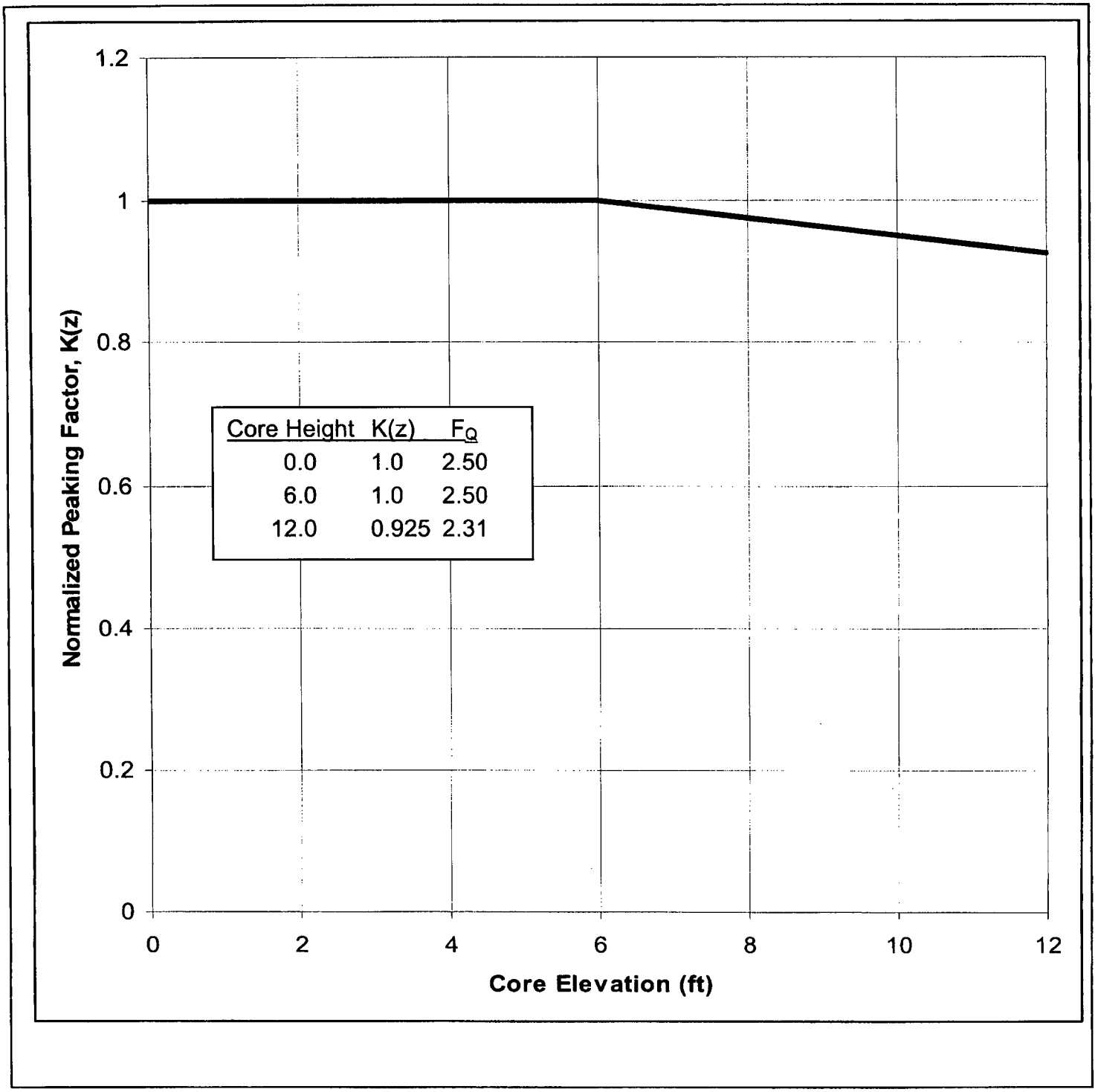
ATTACHMENT 1
CONTROL ROD INSERTION LIMITS vs RATED THERMAL POWER
(Page 1 of 1)



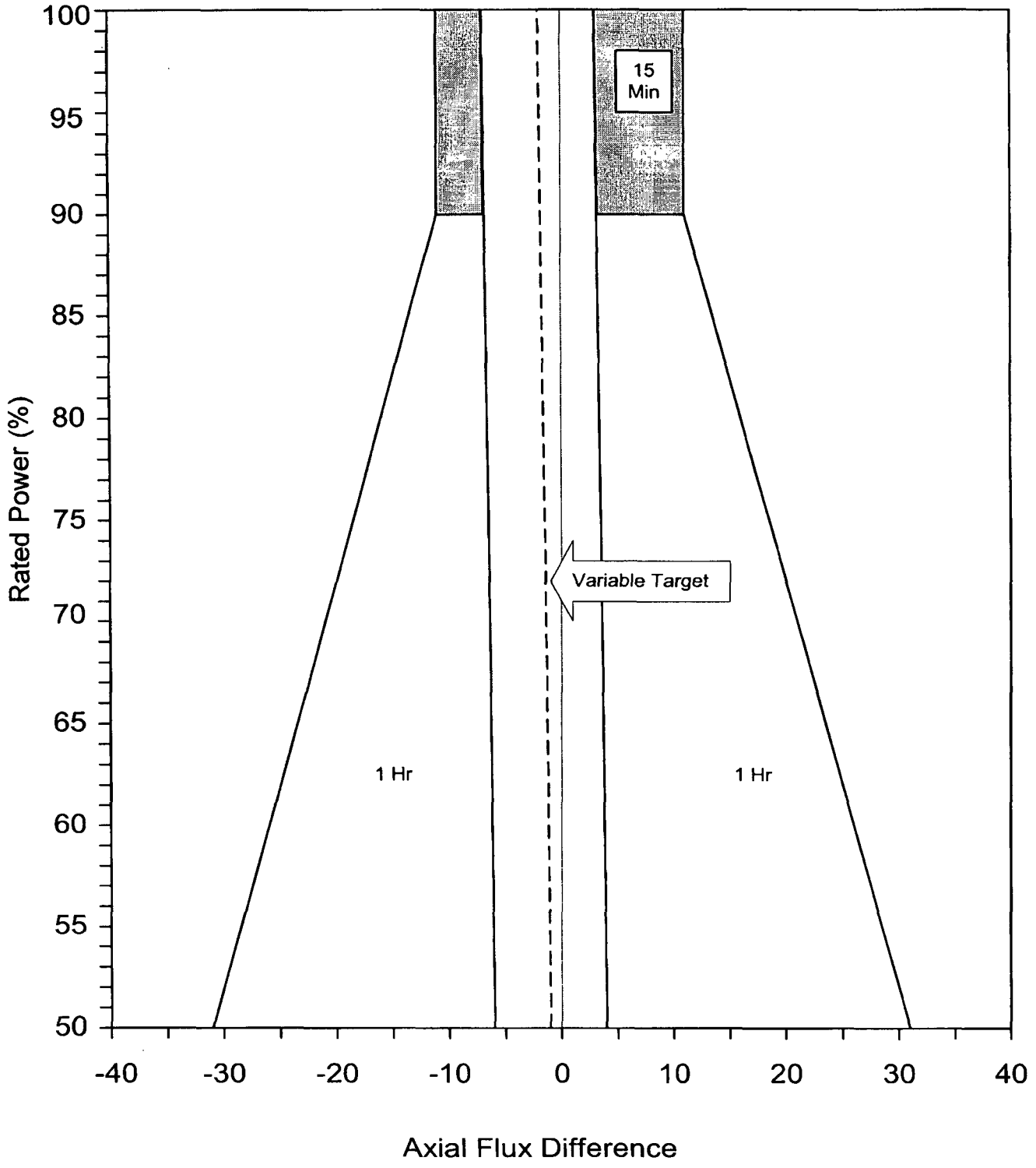
ATTACHMENT 2

K(z) NORMALIZED $F_Q(z)$ AS A FUNCTION OF CORE HEIGHT

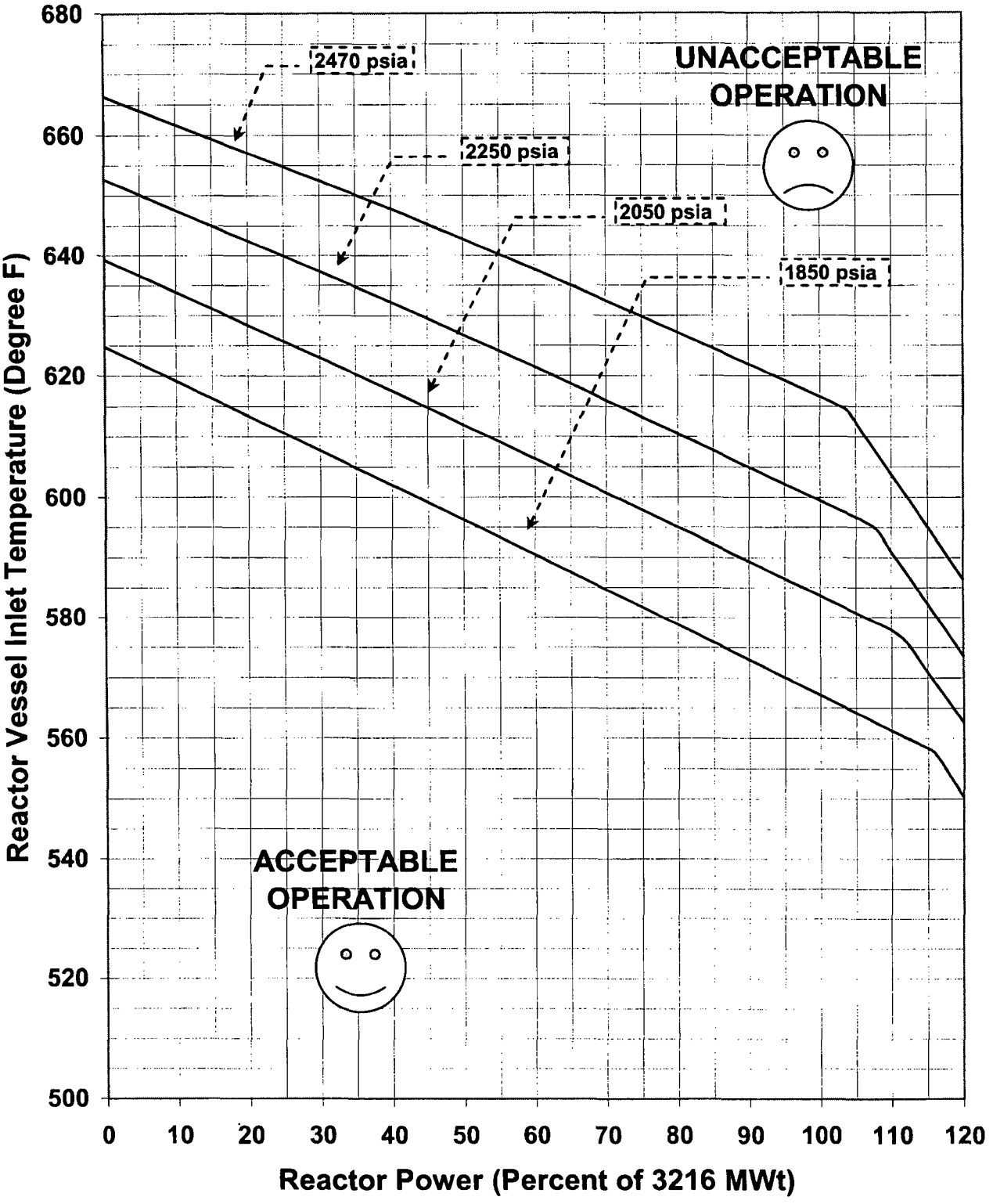
(Page 1 of 1)



ATTACHMENT 3
AXIAL FLUX DIFFERENCE ENVELOPE LIMITS
(Page 1 of 1)



ATTACHMENT 4
REACTOR CORE SAFETY LIMIT – FOUR LOOPS IN OPERATION
(Page 1 of 1)



ATTACHMENT 5
OVERTEMPERATURE ΔT/ OVERPOWER ΔT
(Page 1 of 2)

The Overtemperature ΔT Function Allowable Value SHALL not exceed the following:

NOTE

For limitations on the maximum trip Setpoint, see Technical Specification 3.3.1.

$$\Delta T \leq \Delta T_o [K_1 - K_2 [(1 + \tau_1 s)/(1 + \tau_2 s)] (T_{avg} - T') + K_3 (P - P') - f_1(\Delta I)]$$

Where: ΔT is measured RCS ΔT, °F (measured by hot leg and cold leg RTDs).
ΔT_o is the loop specific indicated ΔT at RTP, °F.
s is the Laplace transform operator, sec^{-1}.
T_{avg} is the measured RCS average temperature, °F.
T′ is the loop specific indicated T_{avg} at RTP, °F ≤ 572.0 °F.
P is the measured pressurizer pressure, psig
P′ is the nominal RCS operating pressure, ≥ 2235 psig

$K_1 \leq 1.26$ $K_2 \geq 0.022/°F$ $K_3 \geq 0.00070/psi$
$\tau_1 \geq 25.0$ sec $\tau_2 \leq 3.0$ sec

$f_1(\Delta I) =$ $-4.00\{15.75 + (qt - qb)\}$ when $qt - qb < -15.75\%$ RTP
0% of RTP when $-15.75\% \text{ RTP} \leq qt - qb \leq 6.9\%$ RTP
$+3.33\{(qt - qb) - 6.9\}$ when $qt - qb > 6.9\%$ RTP

Where qt and qb are percent RTP in the upper and lower halves of the core, respectively, and qt + qb is the total THERMAL POWER in percent RTP.

ATTACHMENT 5
OVERTEMPERATURE ΔT/ OVERPOWER ΔT
(Page 2 of 2)

The Overpower ΔT Function Allowable Value SHALL not exceed the following:

$$\Delta T \leq \Delta T_o (K_4 - K_5 [(\tau_3 s)/(1 + \tau_3 s)](T_{avg}) - K_6(T_{avg} - T'')) - f_2(\Delta I)$$

Where: ΔT is measured RCS ΔT, °F (measured by hot leg and cold leg RTDs).

ΔT_o is the loop specific indicated ΔT at RTP, °F.

s is the Laplace transform operator, sec^{-1}.

T_{avg} is the measured RCS average temperature, °F.

T'' is the loop specific indicated T_{avg} at RTP, °F ≤ 572.0 °F.

$K_4 \leq 1.10$ $K_5 \geq 0.0175$/°F for increasing T_{avg}, 0/°F for decreasing T_{avg} $K_6 \geq 0.0015$/°F when $T_{avg} > T''$, 0/°F when $T_{avg} \leq T''$

$\tau_3 \geq 10$ sec

$f_2(\Delta I) = 0$