Entergy Nuclear Northeast
Indian Point Energy Center
450 Broadway, GSB
P.O. Box 249
Buchanan, N.Y. 10511-0249
Tel (914) 734-6710

Robert Walpole
Licensing Manger

NL-11-049

May 4, 2011

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

SUBJECT: Revised Core Operating Limits Report
Indian Point Nuclear Generating Unit No. 3
Docket No. 50-286
License No. DPR-64

Dear Sir or Madam:

Enclosures 1 and 2 to this letter provide Entergy Nuclear Operations Core Operating Limits Report (COLR) for Indian Point 3 Cycle 17. This report is submitted in accordance with Technical Specification 5.6.5.d. For completeness two revisions are enclosed. The change from revision 3 to 4 was a minor editorial change made to a procedural note. Both revisions are based on the same Westinghouse supplied COLR.

There are no new commitments contained in this letter. If you have any questions or require additional information, please contact me at 914-734-6710.

Sincerely,

RW/mb

cc: next page

A001
NRR

Enclosure: 1. 3-GRAPH-RPC-16, Rev. 3, Core Operating Limits Report
2. 3-GRAPH-RPC-16, Rev. 4, Core Operating Limits Report

cc: Mr. William Dean, Regional Administrator, NRC Region 1
Mr. John Boska, Senior Project Manager, NRC NRR DORL
IPEC NRC Resident Inspector's Office
Mr. Francis J. Murray, President and CEO, NYSERDA *(w/o* enclosure)
Mr. Paul Eddy, New York State Department of Public Service

ENCLOSURE 1 TO NL-11-049

3-GRAPH-RPC-16, Rev. 3, Core Operating Limits Report

ENTERGY NUCLEAR OPERATIONS, INC.
INDIAN POINT UNIT 3 NUCLEAR POWER PLANT
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: 4/6/2011

3-GRAPH-RPC-16 , Revision: 3

CORE OPERATING LIMITS REPORT

Indian Point Operations

Approved By:

John Balletta 4-6-11

Procedure Sponsor, DM/Designee Date

Team 3B

Procedure Owner

PARTIAL REVISION

REVISION SUMMARY

(Page 1 of 1)

1.0 REASON FOR REVISION

1.1 Incorporate Cycle 17 Specific Data.

2.0 SUMMARY OF CHANGES

2.1 Updated data throughout the graph to reflect cycle 17 per Indian Point Unit 3 Cycle 17 Core Operating Limits Report (COLR), Revision 0, as supplied by Westinghouse.

2.2 Changed TS 3.1.6 Control Bank Insertion Limits from each control bank shall be considered fully withdrawn at ≥ 230 steps to each control bank shall be considered fully withdrawn at ≥ 225 steps.

2.3 Changed the title of Attachment 1 from OVERTEMPERATURE ΔT to OVERTEMPERATURE ΔT ALLOWABLE VALUE

2.4 Clarified reference to Technical Specification Table 3.3.1-1 Note 1 Value and deleted introductory NOTE on Attachment 1.

2.5 Changed the T' definition from loop specific T to loop specific T_{avg} on Attachment 1.

2.6 Changed the title of Attachment 2 from OVERPOWER ΔT to OVERPOWER ΔT ALLOWABLE VALUE

2.7 Clarified the reference to Technical Specification Table 3.3.1-1 Note 2 Value and deleted introductory NOTE on Attachment 2.

2.8 Changed the T" definition from loop specific T to loop specific T_{avg} on Attachment 2.

2.9 Changed Labeling on Figure1 from ACCEPTABLE/ UNACCEPTABLE OPERATION to ACCEPTABLE/ UNACCEPTABLE CONSEQUENCES

2.10 Added Power Level and Tech Spec Envelope values to Figure 4

TABLE OF CONTENTS

SECTION **PAGE**

ATTACHMENTS

FIGURES

NOTE

- The Technical Specification references shown next to each Factor OR Limit in this COLR are there to identify the corresponding sections in the Technical Specifications that refer to the COLR.
- The COLR, including any midcycle revisions or supplements, shall be provided for each reload cycle to the NRC. **{T.S. 5.6.5d.}**
- The data presented in this report applies to Cycle 17 ONLY and may NOT be used for other cycles of operation. Also, it applies only to operation at a maximum power level of 3188.4 MWt. Any technical change to this document requires a Safety Evaluation to be performed in accordance with 10CFR50.59.

TS 2.1.1 Reactor Core SLs

In MODE 1 and 2, the combination of thermal power level, pressurizer pressure, and Reactor Vessel inlet temperature SHALL not exceed the limits shown in Figure 1. The safety limit is exceeded if the point defined by the combination of Reactor Vessel inlet temperature and power level is at any time above the appropriate pressure line.

TS 3.1.1 Shutdown Margin (SDM)

The shutdown margin SHALL be greater than or equal to 1.3% Δk/k.

TS 3.1.3 Moderator Temperature Coefficient (MTC)

The MTC upper limit SHALL be < 0.0 Δk/k/°F at hot zero power.

The MTC lower limit SHALL be less negative than or equal to:

-38.0 pcm/ºF	@	300 ppm
-44.5 pcm/ºF	@	60 ppm
-47.0 pcm/ºF	@	0 ppm

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. Shutdown Banks with a group step counter demand position ≥ 225 steps are considered fully withdrawn because the bank demand position is above the top of the active fuel.

TS 3.1.6 Control Bank Insertion Limits

The Control Bank Insertion Limits for MODE 1 and MODE 2 with $k_{eff} \geq 1.0$ are as indicated in Figure 2. Control Bank Insertion Limits apply to the step counter demand position.

Each control bank shall be considered fully withdrawn at ≥ 225 steps.

TS 3.2.1 Heat Flux Hot Channel Factor (FQ(Z))

NOTE

- P is the fraction of Rated Thermal Power (RTP) at which the core is operating.
- K(Z) is the fraction given in Figure 3 and Z is the core height location of F_Q.

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

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

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.

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

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

The Indicated limit is the Target Band; i.e., the Target ± 5%

The AFD shall be maintained within the ACCEPTABLE OPERATION portion of Figure 4, as required by TS 3.2.3.

TS 3.3.1 RPS Instrumentation

1. Overtemperature ΔT — Allowable Value as referenced in Technical Specifications Table 3.3.1-1, Function 5, Note 1
   Refer to Attachment 1

2. Overpower ΔT — Allowable Value as referenced in Technical Specifications Table 3.3.1-1, Function 6, Note 2
   Refer to Attachment 2

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 loop $T_{avg} \leq 576.7°F$ for full-power $T_{avg} = 572.0°F$
b. Pressurizer Pressure ≥ 2204 psig
c. Reactor Coolant System Total Flow Rate ≥ 364,700 gpm

TS 3.9.1 Refueling Boron Concentration

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 ≥ 2050 ppm or that which is sufficient to provide a shutdown margin ≥ 5% Δk/k.

Attachment 1

OVERTEMPERATURE ΔT ALLOWABLE VALUE

The Overtemperature ΔT Function Allowable Value SHALL NOT exceed the Technical Specification Table 3.3.1-1, Note 1 value.

The following provides the computed value:

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

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 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 2

OVERPOWER ΔT ALLOWABLE VALUE

The Overpower ΔT Function Allowable Value SHALL NOT exceed the Technical Specification Table 3.3.1-1, Note 2 value.

The following provides the computed value:

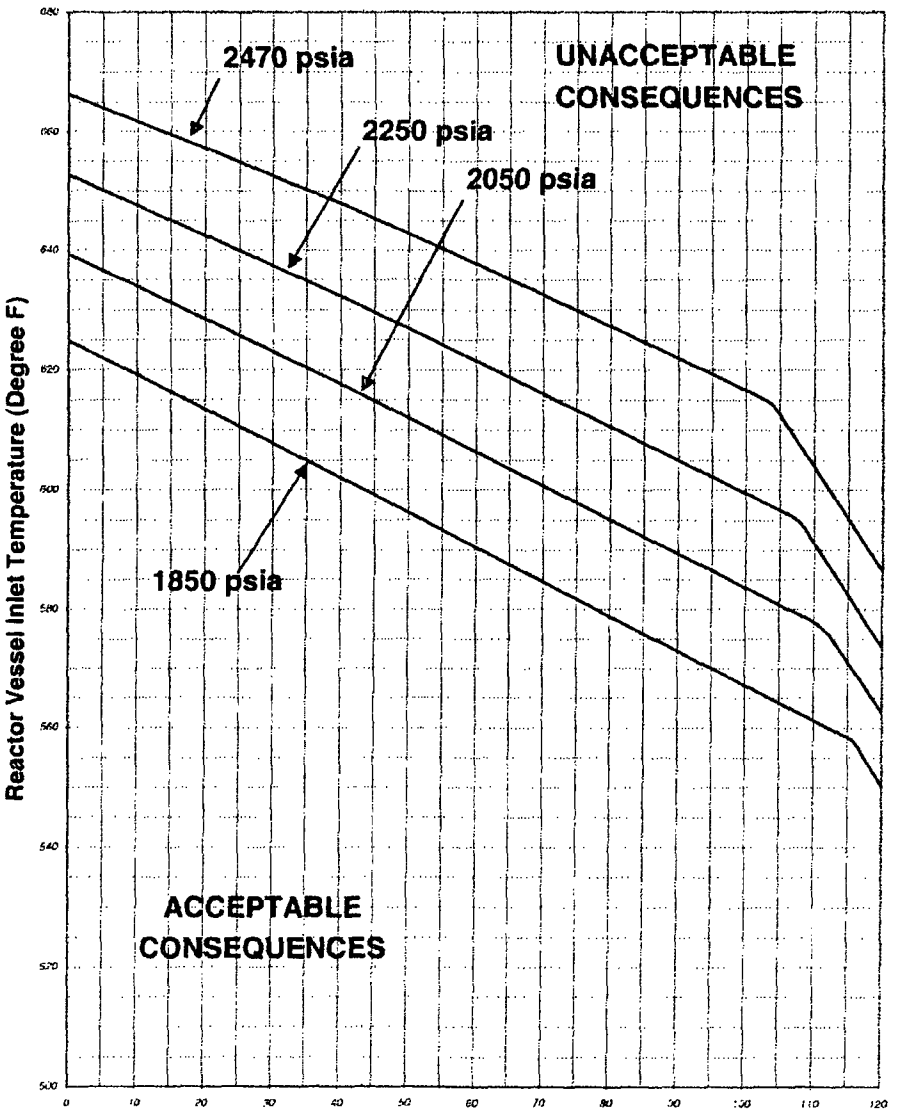
$$\Delta T \leq \Delta T_o [K_4 - K_5 [(\tau_3 s)/(1 + \tau_3 s)](T) - K_6(T - T') - f_2(\Delta I)]$$

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 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, 0/°F for decreasing T $K_6 \geq 0.0015$/°F when T > T', 0/°F when T ≤ T'

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

Figure 1
Reactor Core Safety Limit – Four Loops in Operation



[Conservative relative to 3188.4 MWt; use as-is for operation at 3188.4 MWt]

Figure 2
Rod Bank Insertion Limits
(Four Loop Operation)
104 Step Overlap

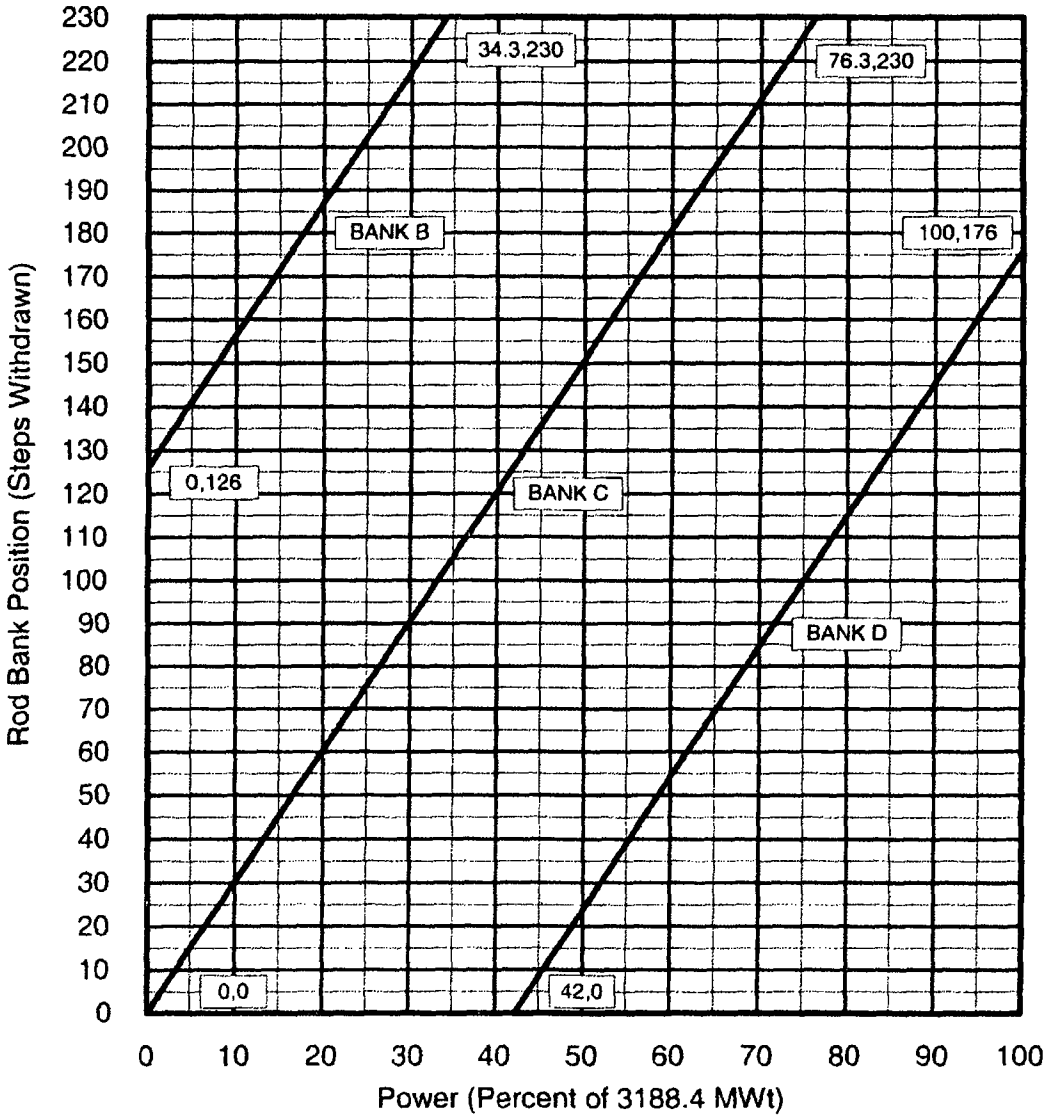


Figure 3
Hot Channel Factor Normalized Operating Envelope

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

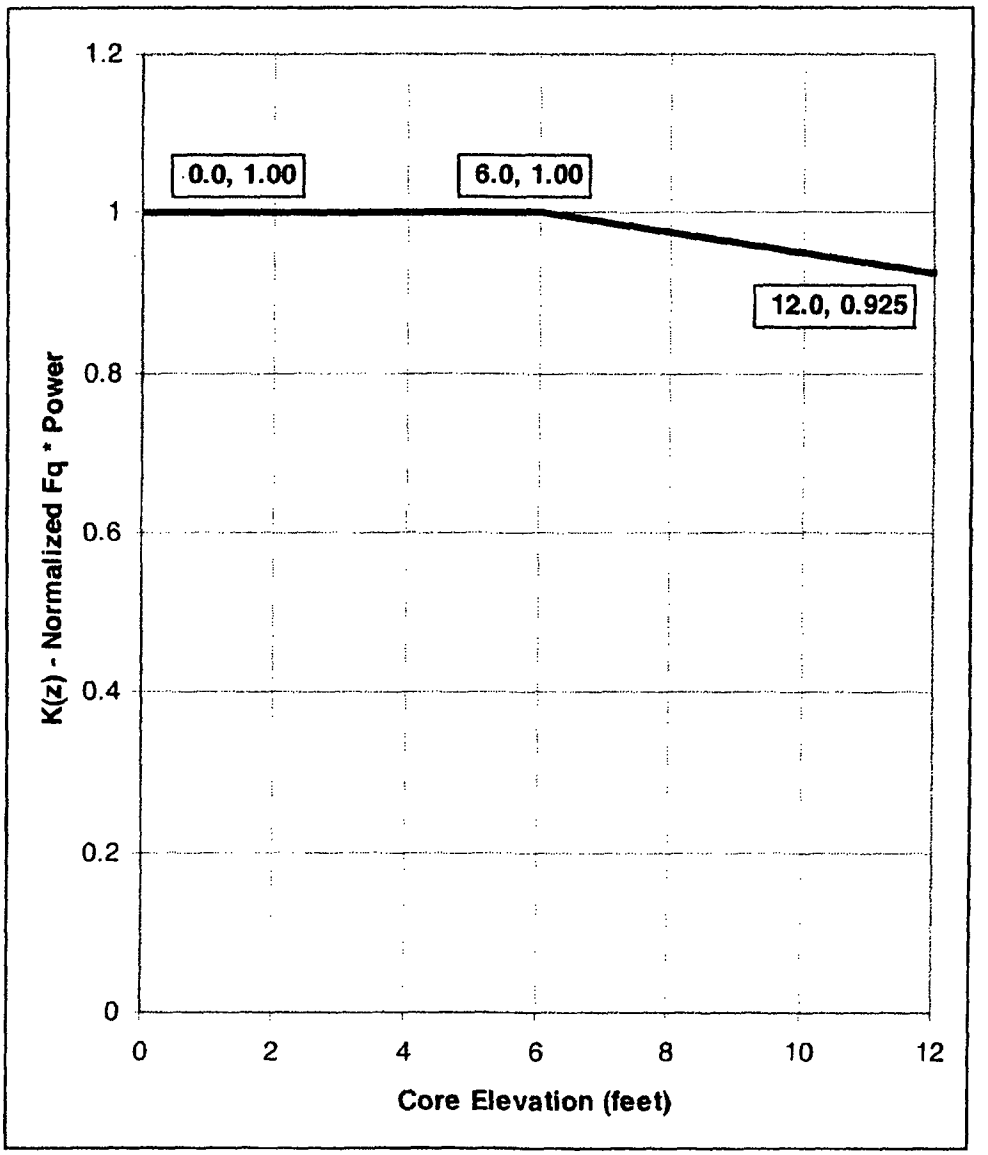
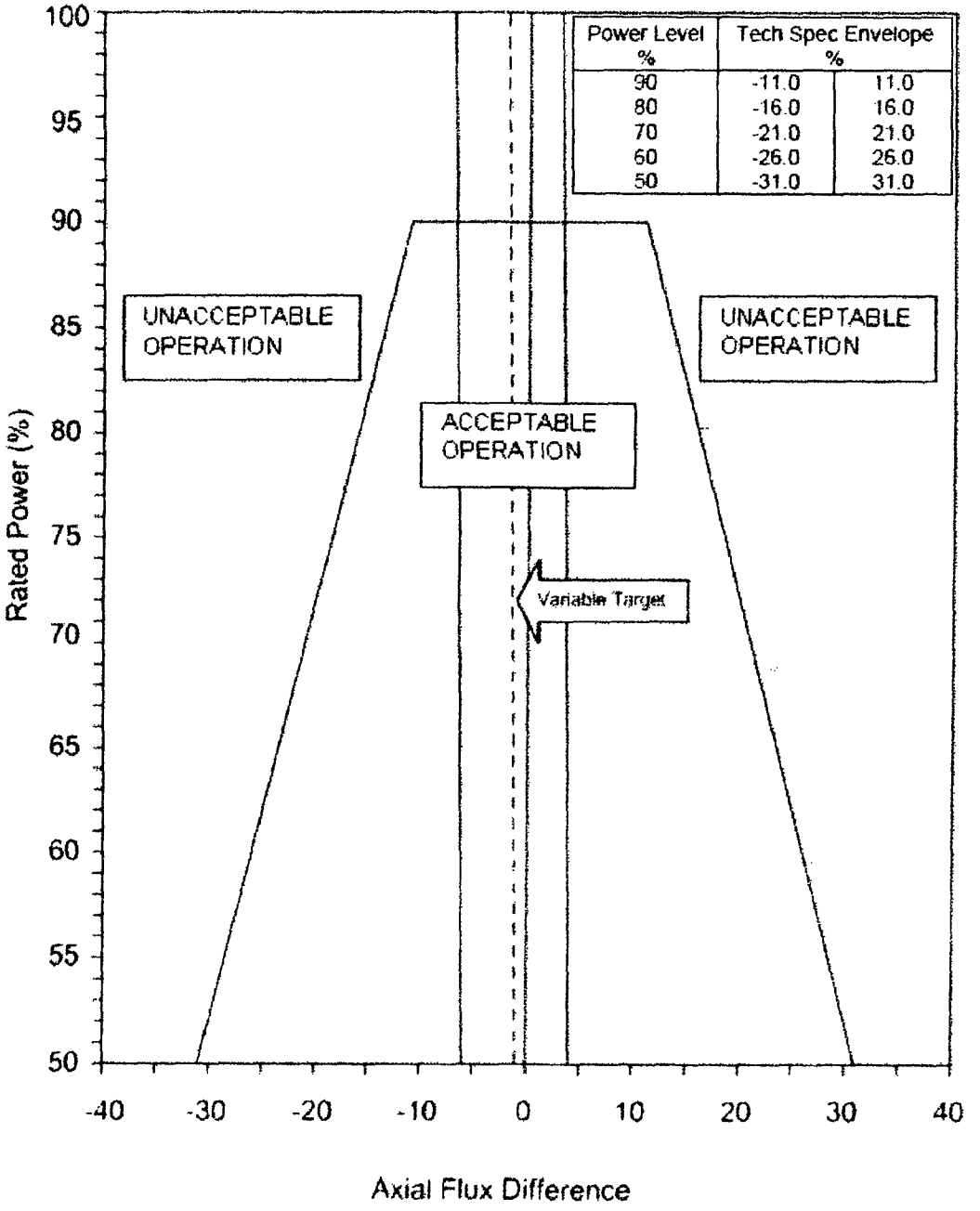


Figure 4
Axial Flux Difference Envelope Limits



ENCLOSURE 2 TO NL-11-049

3-GRAPH-RPC-16, Rev. 4, Core Operating Limits Report

ENTERGY NUCLEAR OPERATIONS, INC.
INDIAN POINT UNIT 3 NUCLEAR POWER PLANT
DOCKET No. 50-286

Entergy
Nuclear Northeast

Procedure Use Is:

☑ Continuous

☐ Reference

☐ Information

Control Copy: _____

Effective Date: 4/29/11

3-GRAPH-RPC-16 , Revision: 4

CORE OPERATING LIMITS REPORT

Approved By:

P E Grandin , 4/29/11

Procedure Sponsor, DM/Designee Date

Team 3B

Procedure Owner

EDITORIAL REVISION

REVISION SUMMARY

(Page 1 of 1)

1.0 REASON FOR REVISION

1.1 Incorporate additional Cycle 17 changes.

2.0 SUMMARY OF CHANGES

2.1 Deleted 1st and 2nd NOTE bullets on Page 4 to agree with Indian Point Unit 3 Cycle 17 Core Operating Limits Report (COLR), Revision 0, as supplied by Westinghouse.

2.2 Changed 3rd NOTE bullet on Page 4 to agree with Indian Point Unit 3 Cycle 17 Core Operating Limits Report (COLR), Revision 0, as supplied by Westinghouse.

TABLE OF CONTENTS

SECTION **PAGE**

ATTACHMENTS

FIGURES

NOTE

The data presented in this report applies to Cycle 17 ONLY and may NOT be used for other cycles of operation. Also, it applies only to operation at a maximum power level of 3188.4 MWt. Any technical change to this document may require a Safety Evaluation to be performed in accordance with 10CFR50.59.

TS 2.1.1 Reactor Core SLs

In MODE 1 and 2, the combination of thermal power level, pressurizer pressure, and Reactor Vessel inlet temperature SHALL not exceed the limits shown in Figure 1. The safety limit is exceeded if the point defined by the combination of Reactor Vessel inlet temperature and power level is at any time above the appropriate pressure line.

TS 3.1.1 Shutdown Margin (SDM)

The shutdown margin SHALL be greater than or equal to 1.3% $\Delta k/k$.

TS 3.1.3 Moderator Temperature Coefficient (MTC)

The MTC upper limit SHALL be < 0.0 $\Delta k/k/°F$ at hot zero power.

The MTC lower limit SHALL be less negative than or equal to:

-38.0 pcm/°F	@	300 ppm
-44.5 pcm/°F	@	60 ppm
-47.0 pcm/°F	@	0 ppm

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. Shutdown Banks with a group step counter demand position ≥ 225 steps are considered fully withdrawn because the bank demand position is above the top of the active fuel.

TS 3.1.6 Control Bank Insertion Limits

The Control Bank Insertion Limits for MODE 1 and MODE 2 with $k_{eff} \geq 1.0$ are as indicated in Figure 2. Control Bank Insertion Limits apply to the step counter demand position.

Each control bank shall be considered fully withdrawn at ≥ 225 steps.

TS 3.2.1 Heat Flux Hot Channel Factor (FQ(Z))

NOTE

- P is the fraction of Rated Thermal Power (RTP) at which the core is operating.
- K(Z) is the fraction given in Figure 3 and Z is the core height location of F_Q.

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

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

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.

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

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

The Indicated limit is the Target Band; i.e., the Target ± 5%

The AFD shall be maintained within the ACCEPTABLE OPERATION portion of Figure 4, as required by TS 3.2.3.

TS 3.3.1 RPS Instrumentation

1. Overtemperature ΔT — Allowable Value as referenced in Technical Specifications Table 3.3.1-1, Function 5, Note 1
   Refer to Attachment 1

2. Overpower ΔT — Allowable Value as referenced in Technical Specifications Table 3.3.1-1, Function 6, Note 2
   Refer to Attachment 2

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 loop $T_{avg} \leq 576.7°F$ for full-power $T_{avg} = 572.0°F$
b. Pressurizer Pressure ≥ 2204 psig
c. Reactor Coolant System Total Flow Rate ≥ 364,700 gpm

TS 3.9.1 Refueling Boron Concentration

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 ≥ 2050 ppm or that which is sufficient to provide a shutdown margin ≥ 5% Δk/k.

Attachment 1

OVERTEMPERATURE ΔT ALLOWABLE VALUE

The Overtemperature ΔT Function Allowable Value SHALL NOT exceed the Technical Specification Table 3.3.1-1, Note 1 value.

The following provides the computed value:

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

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 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 2

OVERPOWER ΔT ALLOWABLE VALUE

The Overpower ΔT Function Allowable Value SHALL NOT exceed the Technical Specification Table 3.3.1-1, Note 2 value.

The following provides the computed value:

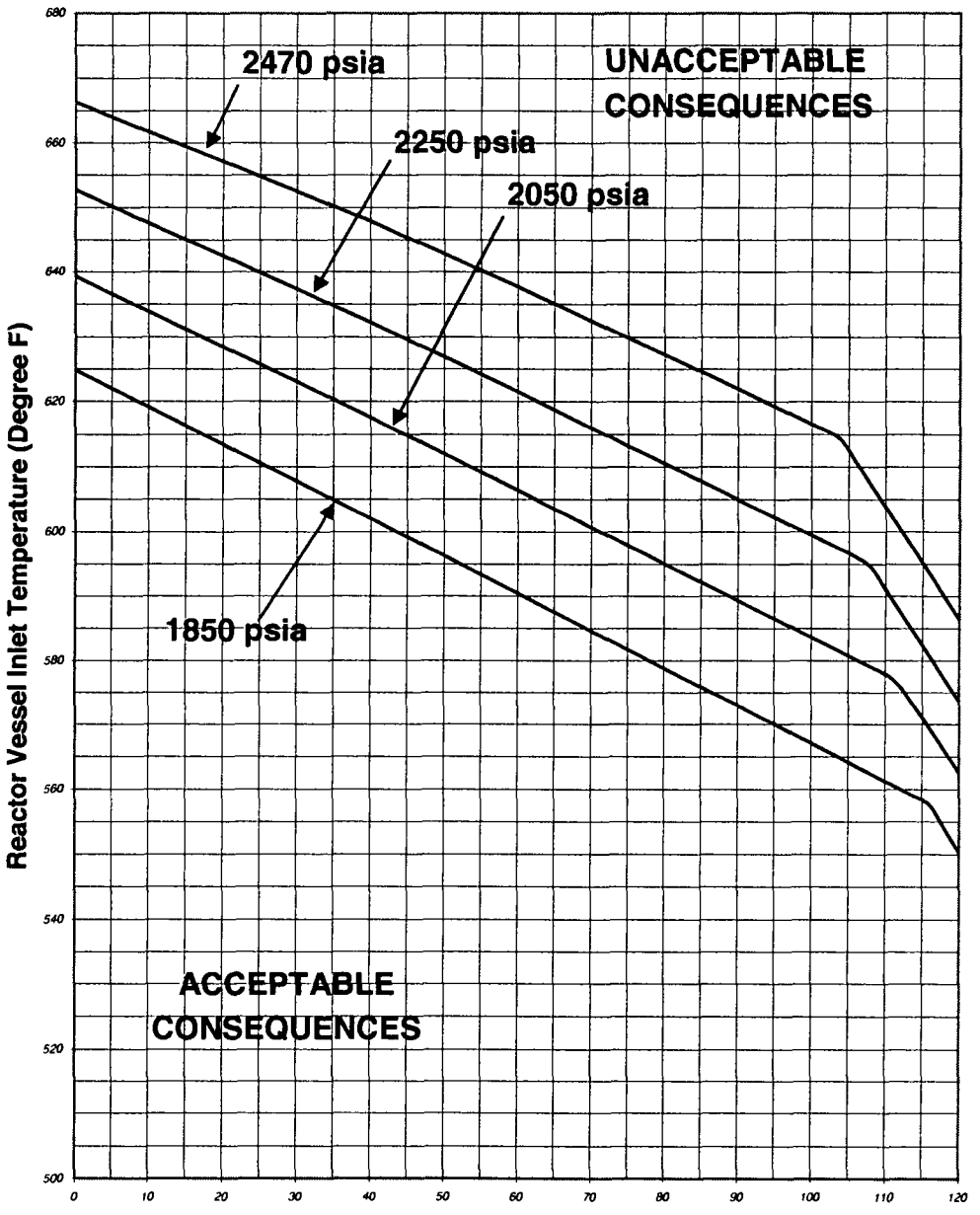
$$\Delta T \leq \Delta T_o [K_4 - K_5 [(\tau_3 s)/(1 + \tau_3 s)](T) - K_6(T - T'') - f_2(\Delta I)]$$

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 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, 0/°F for decreasing T $K_6 \geq 0.0015$/°F when $T > T''$, 0/°F when $T \leq T''$

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

Figure 1
Reactor Core Safety Limit – Four Loops in Operation



[Conservative relative to 3188.4 MWt; use as-is for operation at 3188.4 MWt]

Figure 2
Rod Bank Insertion Limits
(Four Loop Operation)
104 Step Overlap

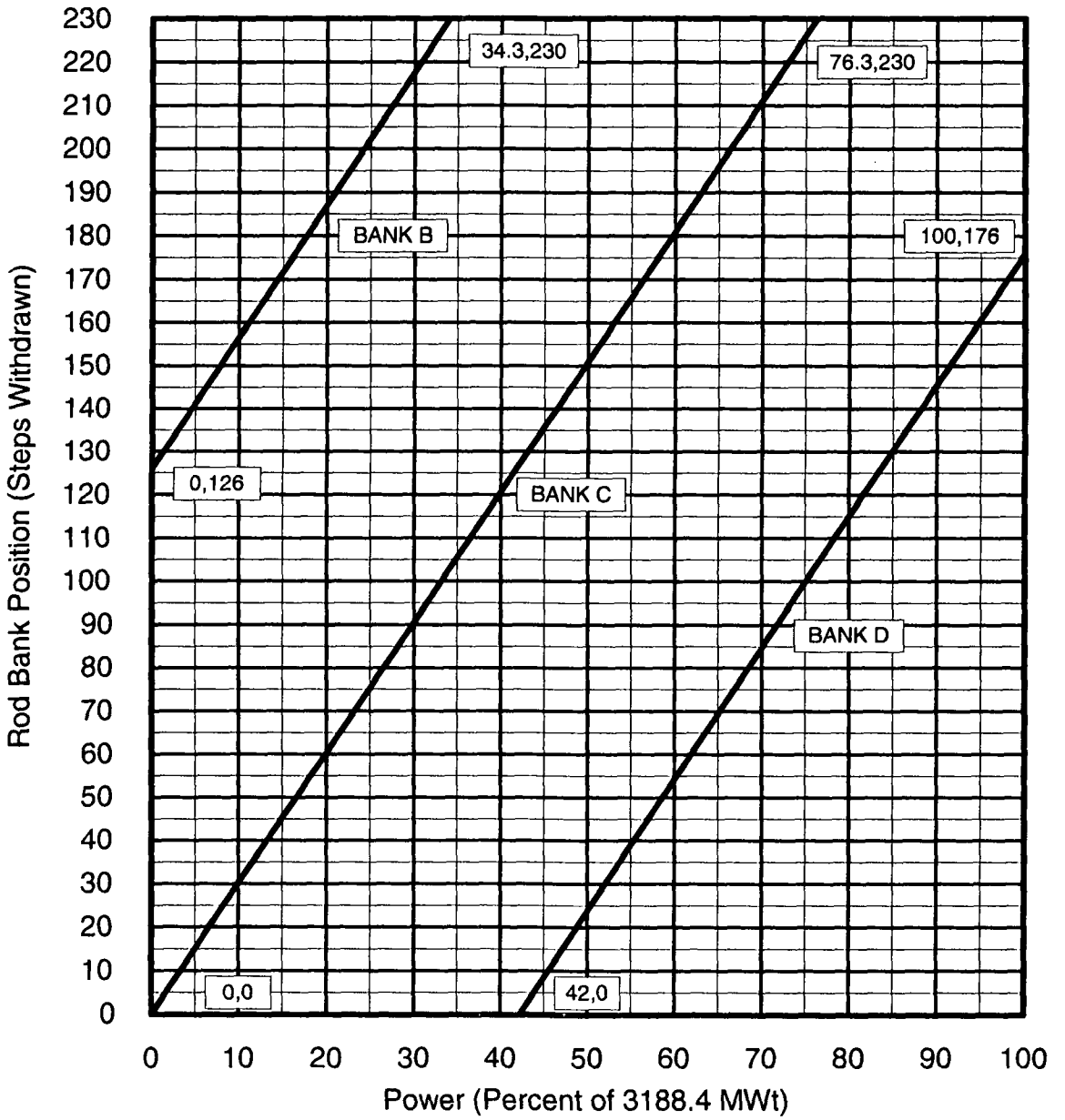


Figure 3
Hot Channel Factor Normalized Operating Envelope

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

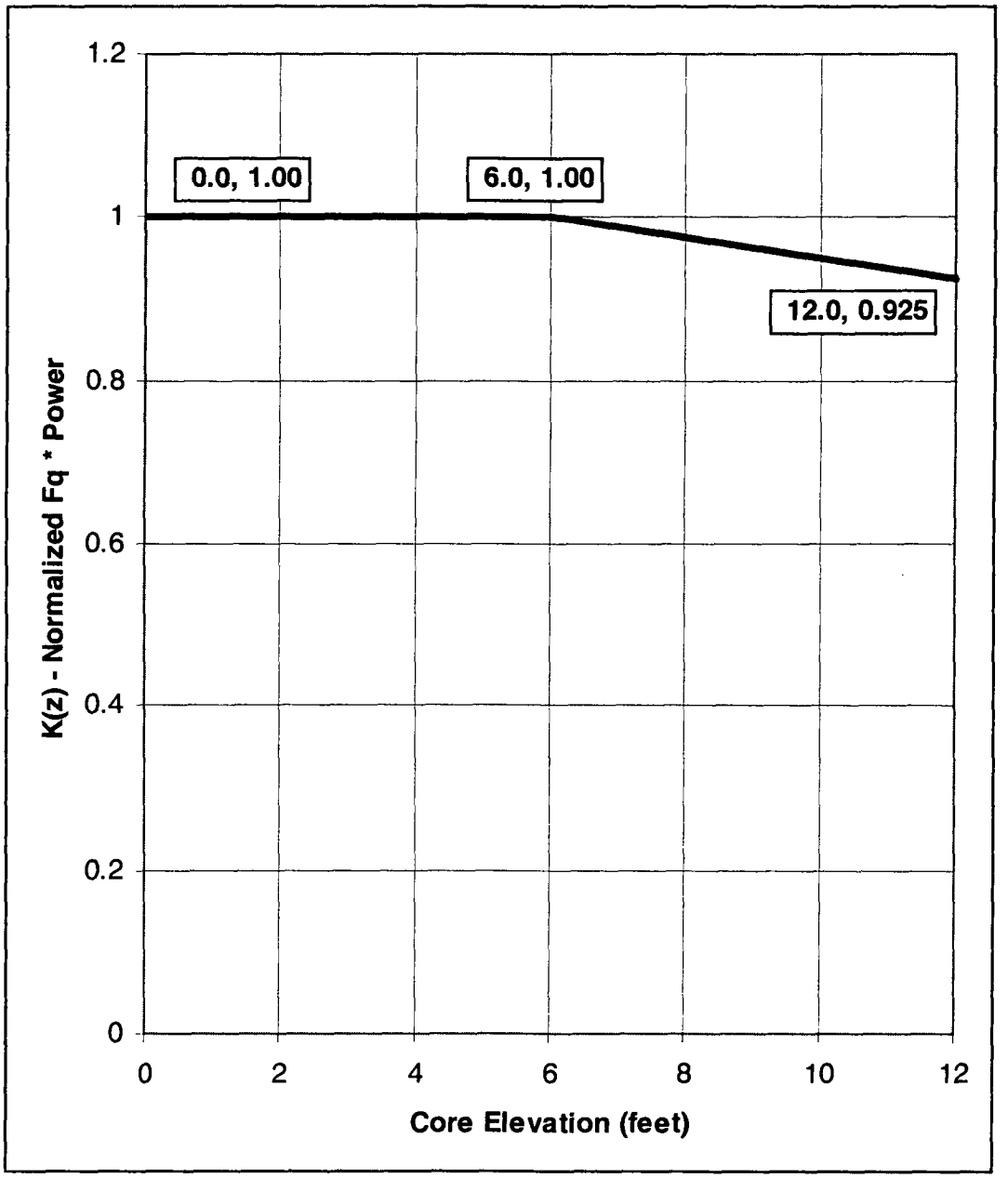


Figure 4
Axial Flux Difference Envelope Limits