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Site Vice President

NL-17-043

April 13, 2017

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
11555 Rockville Pike, TWFN-2F1
Rockville, MD 20852-2738

SUBJECT: Core Operating Limits Report for Cycle 20
Indian Point Nuclear Generating Unit No. 3
Docket No. 50-286
License No. DPR-64

Dear Sir or Madam:

Entergy Nuclear Operations, Inc. (Entergy) as holder of License No. DPR-64 is providing in the Enclosure a copy of the Core Operating Limits Report (COLR) for Indian Point Nuclear Generating Unit No. 3 Cycle 20. This report is submitted in accordance with Technical Specification 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. Robert W. Walpole, Regulatory Assurance Manager at (914) 254-6710.

Sincerely,

AJV/rl

Enclosure: 3-GRAPH-RPC-16, Revision: 10 Core Operating Limits Report

cc: Mr. Daniel H. Dorman, Regional Administrator, NRC Region I
Mr. Douglas Pickett, NRC, Sr. Project Manager, Division of Reactor Licensing
NRC Resident Inspector's Office
Ms. Bridget Frymire, New York State Department of Public Service
Mr. John B. Rhodes, President and CEO, NYSERDA

A001
NRR

ENCLOSURE TO NL-17-043

3-GRAPH-RPC-16, Revision: 10

Core Operating Limits Report

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

Entergy
Nuclear Northeast

Procedure Use Is:

☑ Continuous

☐ Reference

☐ Information

Control Copy: _____

Effective Date: 4/3/2017

This Procedure is
Quality Related

3-GRAPH-RPC-16 , Revision: 10

CORE OPERATING LIMITS REPORT

Approved By:

Tom Cramer Tom Cramer 3/30/17

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 20 changes. (EC-63102).

1.2 LBDR #3-COLR-2017-001

2.0 SUMMARY OF CHANGES

2.1 Made minor editorial changes.

2.2 Implemented TOC & TS Header changes to make uniform with actual TS titles.

2.3 Revised NOTE above TS 2.1.1 for Cycle 20 and revised "Safety Evaluation" to "an evaluation".

2.4 Revised TS 3.1.3 – Changed "–3pcm" to "Predictive Correction".

2.5 Revised CAUTION in TS 3.4.1 – "572°F" to "570°F", "should" to "SHALL", deleted second sentence. Also reversed order of a.& b. substeps for TS consistency.

2.6 Revised Attachment 1 & 2 – Overtemperature ΔT & Overpower ΔT "Where:" substeps for TS consistency.

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ATTACHMENTS

FIGURES

NOTE

The data presented in this report applies to Cycle 20 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 an evaluation to be performed in accordance with 10 CFR 50.59.

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 $\leq$ 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

The Revised Predicted near EOL 300 ppm MTC SHALL be calculated using the algorithm contained in WCAP-13749-P-A:

Revised Predicted MTC = Predicted MTC + AFD Correction + Predictive Correction

If the Revised Predicted MTC is less negative than the SR 3.1.3.2 300 ppm surveillance limit and all the benchmark data contained in the surveillance procedure are met, then an MTC measurement in accordance with SR 3.1.3.2 is not required to be performed.

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 ($F_Q(Z)$)

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 $P > .5$, $F_Q(Z) \leq (2.30 / P) \times K(Z)$

IF $P \leq .5$, $F_Q(Z) \leq (4.60) \times K(Z)$

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.

$F^N_{\Delta H} \leq 1.65 \{ 1 + 0.3 (1 - P) \}$

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 Reactor Protection System (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:

CAUTION

The RCS loop T_{avg} limit SHALL be decreased one degree for each degree that the full power T_{avg} is less than 570°F.

a. Pressurizer Pressure ≥ 2204 psig
b. Reactor Coolant System loop T_{avg} ≤ 574.7°F for full power T_{avg} = 570.0°F
c. Reactor Coolant System Total Flow Rate ≥ 364,700 gpm

TS 3.9.1 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
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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.
ΔT_o is the indicated ΔT at RTP, °F.
s is the Laplace transform operator, sec^{-1}.
T is the measured RCS average temperature, °F.
T′ is the nominal T_{avg} at RTP, ≤ 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 2
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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.
ΔT_o is the indicated ΔT at RTP, °F.
s is the Laplace transform operator, sec^{-1}.
T is the measured RCS average temperature, °F.
T'' is the nominal T_{avg} at RTP, ≤ 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 $T > T''$
0/°F for decreasing T_{avg} 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
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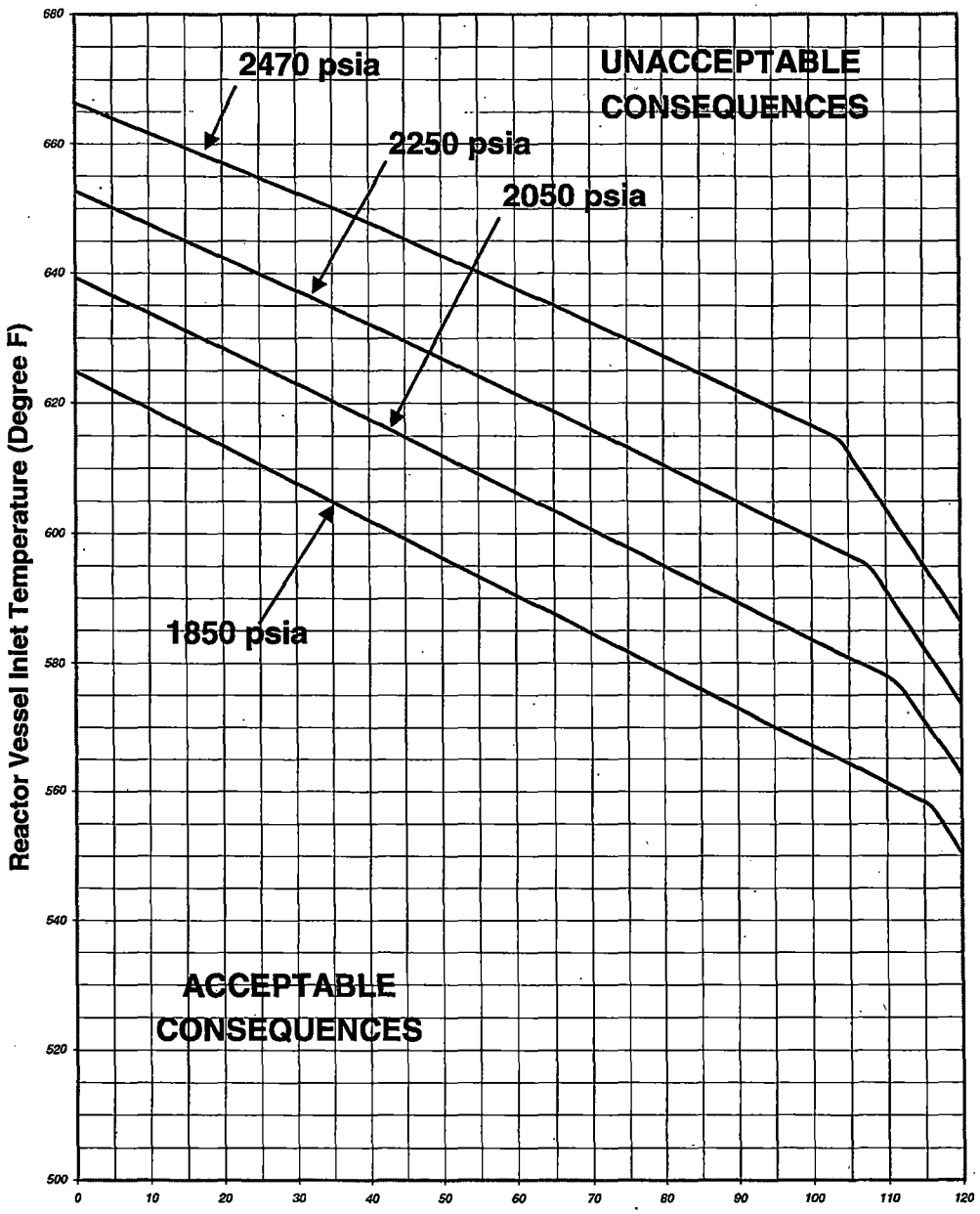

[Conservative relative to 3188.4 MWt; use as-is for operation at 3188.4 MWt]

Figure 2
Rod Bank Insertion Limits
(Page 1 of 1)
(Four Loop Operation)
104 Step Overlap

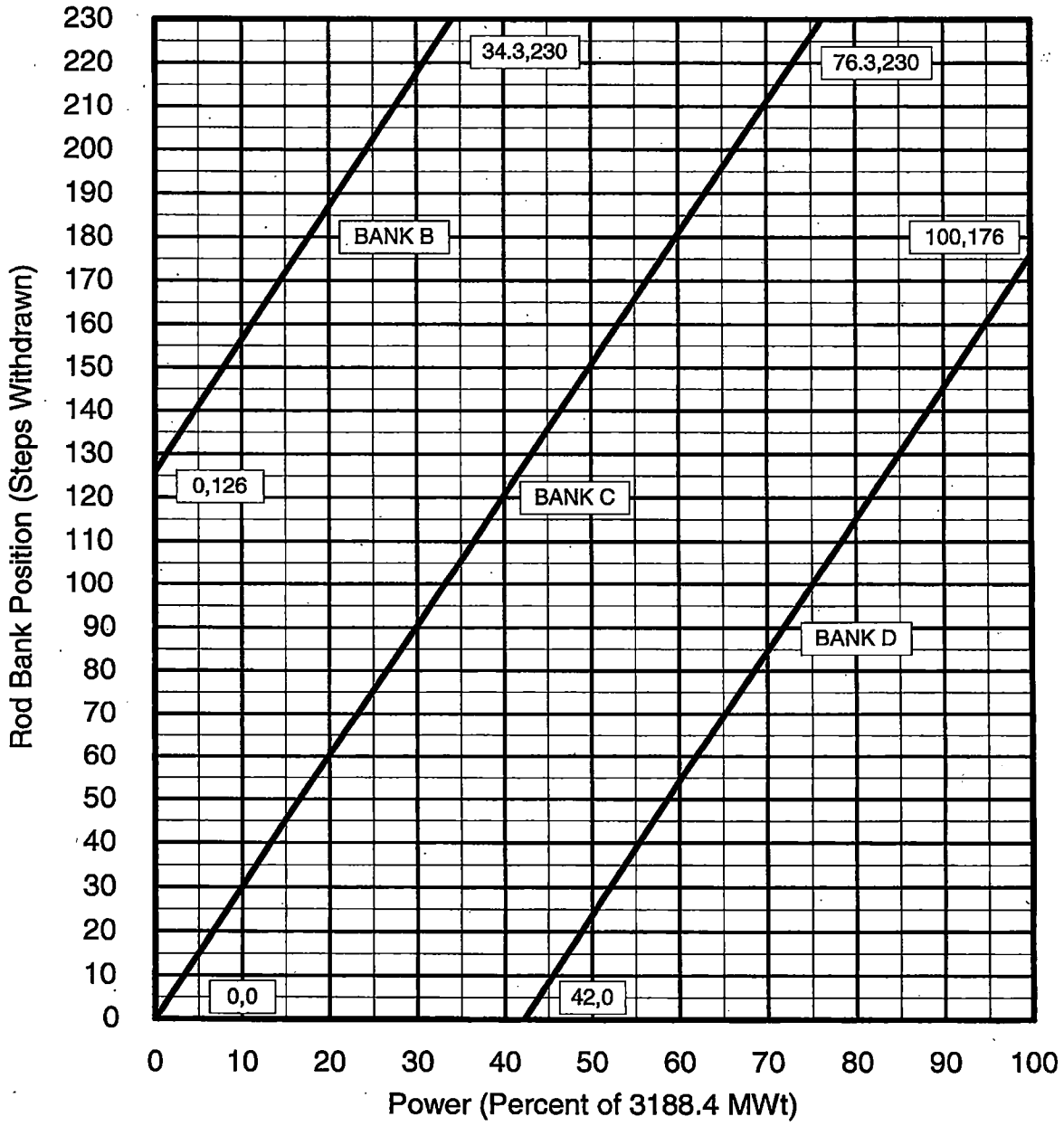

Figure 3
Hot Channel Factor Normalized Operating Envelope
(For S. G. Tube Plugging up to 10%)
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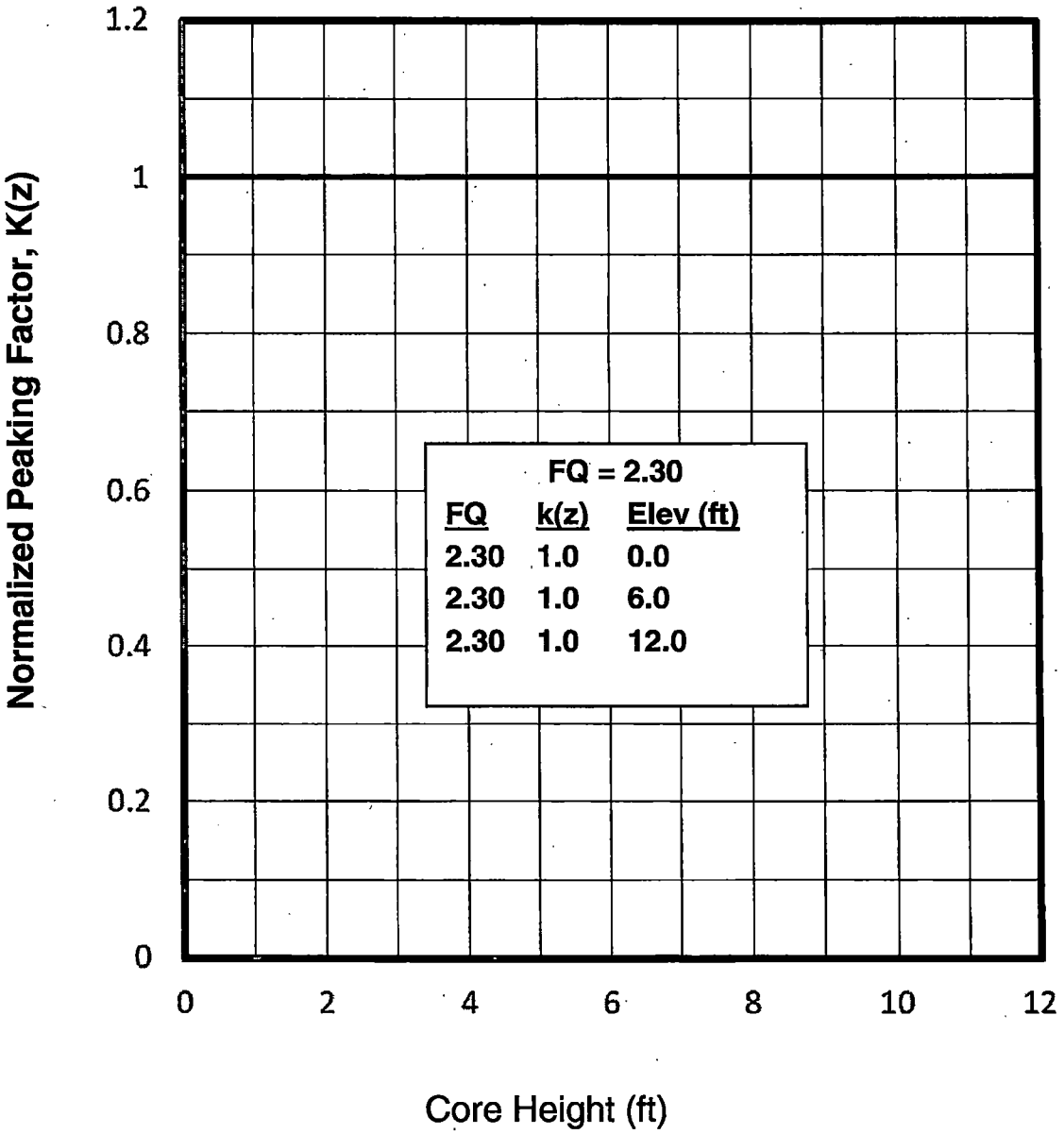

Figure 4
Axial Flux Difference Envelope Limits
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