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Lawrence Coyle
Site Vice President

NL-16-070

June 15, 2016

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

SUBJECT: Core Operating Limits Report
Indian Point Nuclear Generating Unit Number 2
Docket No. 50-247
License No. DPR-26

Dear Sir / Madam:

Entergy Nuclear Operations Inc. (Entergy), as holder of License No. DPR-26, is providing in the Enclosure a copy of the Core Operating Limits Report (COLR) for Indian Point 2 Cycler 23 in accordance with Technical Specification 5.6.5.d.

This letter contains no new regulatory commitments. If you have any questions please contact Mr. Robert Walpole, Manager, Regulatory Assurance at (914) 254-6710.

Sincerely,

LC/sp

Enclosure: 2-GRAPH-PPC-6, Rev. 17, Core Operating Limits Report (COLR)

cc: Mr. Douglas Pickett, Senior Project Manager, NRC NRR DORL
Mr. Daniel H. Dorman, Regional Administrator, NRC Region 1
NRC Senior Resident Inspector
Mr. John B. Rhodes, President and CEO, NYSERDA
Ms. Bridget Frymire, New York State Dept. of Public Service

A001
NRR

ENCLOSURE TO NL-16-070

2-GRAPH-PPC-6, REV. 17,

CORE OPERATING LIMITS REPORT (COLR)

ENTERGY NUCLEAR OPERATIONS, INC.
INDIAN POINT NUCLEAR GENERATING UNIT NO. 2
DOCKET NO. 50-247

Entergy
Nuclear Northeast

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

Procedure Use Is:

☐ Continuous

☐ Reference

☑ Information

Control Copy: _____

Effective Date: 3/16/2016

2-GRAPH-RPC-6, Revision: 17

CORE OPERATING LIMITS REPORT (COLR)

Indian Point Operations

Approved By:

Tom Cramer 3/15/16

Procedure Sponsor, RPO / Designee Date

Team Staff

Procedure Owner

PARTIAL REVISION

REVISION SUMMARY

(Page 1 of 2)

1.0 REASON FOR REVISION

1.1 Incorporate Cycle 23 changes from EC 52275 markup.

2.0 SUMMARY OF CHANGES

2.1 Format changes (no rev bars). **[Editorial 4.6.7]**

2.2 Made NOTE box prior to TS 2.1.1., and revised second sentence to use "may" like IP3. Revised NOTE to Cycle 23.

2.3 Added new CAUTION box to TS 3.4.1 and reordered substeps.

TABLE OF CONTENTS

NOTE

The data presented in this report applies to Cycle 23 ONLY and may NOT be used for other cycles of operation. Any technical change to this document **may** require a Safety Evaluation to be performed in accordance with 10 CFR 50.59

TS 2.1.1 Reactor Core SLs

In MODES 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. 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.

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:

-36.5 pcm/°F@ 300 ppm
-43.0 pcm/°F@ 60 ppm
-45.5 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 $\geq$ 223 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 ≥ 223 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 following RCS T_{AVG} limits should be decreased one degree for each degree that the full power T_{AVG} is less than 565°F. For example, if the full power T_{AVG} is equal to 562°F, then the RCS average T_{AVG} limit is ≤ 565.1°F and the highest loop T_{AVG} limit is ≤ 568.1°F.

a. Pressurizer Pressure ≥ 2216 psia
b. Reactor Coolant System average T_{AVG} ≤ 568.1°F and highest loop T_{AVG} ≤ 571.1°F for full power T_{AVG} of 565.0°F
c. Reactor Coolant System Total Flow Rate ≥ 348,300 gpm

TS 3.9.1 Refueling Boron Concentration

When required by Technical Specification 3.9.1, the minimum boron concentration in the RCS, Refueling 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
(Page 1 of 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:

$$\Delta T \leq \Delta T_0 \left\{ K_1 - K_2 \frac{(1+\tau_1 s)}{(1+\tau_2 s)} [T - T'] + K_3 (P - P') - f_1(\Delta I) \right\}$$

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

ΔT_0 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, ≤ 572 °F.

P is the measured pressurizer pressure, psig.

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

$K_1 \leq 1.22$ $K_2 \geq 0.020/°F$ $K_3 \geq 0.00070/$ psig
$\tau_1 \geq 25$ sec $\tau_2 \leq 3$ sec

$f_1(\Delta I) =$ $-1.97 \{30 + (q_t - q_b)\}$ when $q_t - q_b \leq -30\%$ RTP
0% of RTP when -30% RTP $< q_t - q_b \leq 7\%$ RTP
$2.25 \{(q_t - q_b) - 7\}$ when $q_t - q_b > 7\%$ RTP

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

Attachment 2
(Page 1 of 1)

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:

$$\Delta T \leq \Delta T_0 \left\{ K_4 - K_5 \frac{\tau_3 s}{(1+\tau_3 s)} T - K_6 (T - T'') - f_2(\Delta I) \right\}$$

Where: ΔT is measured RCS ΔT, °F.

ΔT_0 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, ≤ 572 °F.

$K_4 \leq 1.074$ $K_5 \geq 0.0188$/°F for increasing T_{avg}; 0/°F for decreasing T_{avg} $K_6 \geq 0.0015$/°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
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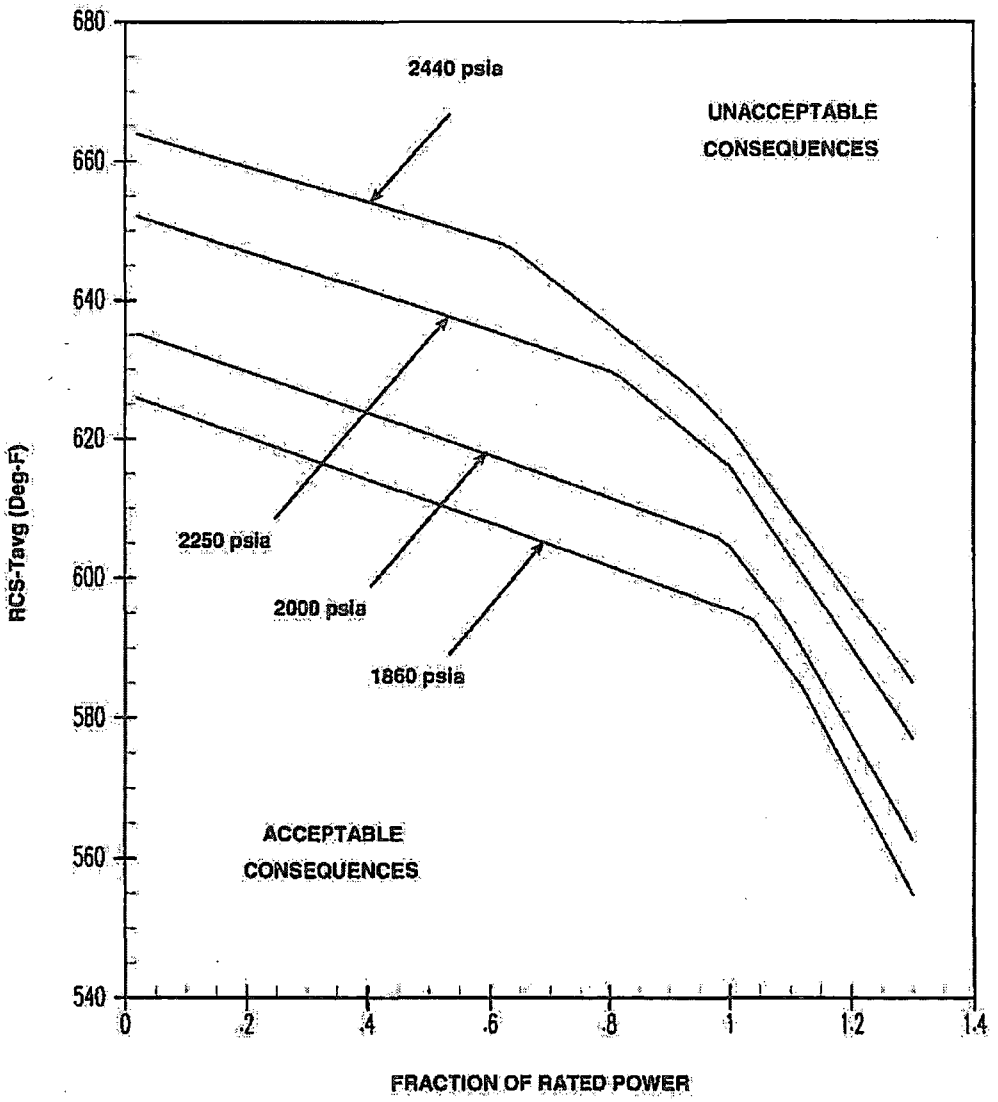

Figure 2
Rod Bank Insertion Limits
(Four Loop Operation)
100 Step Overlap
(Page 1 of 1)

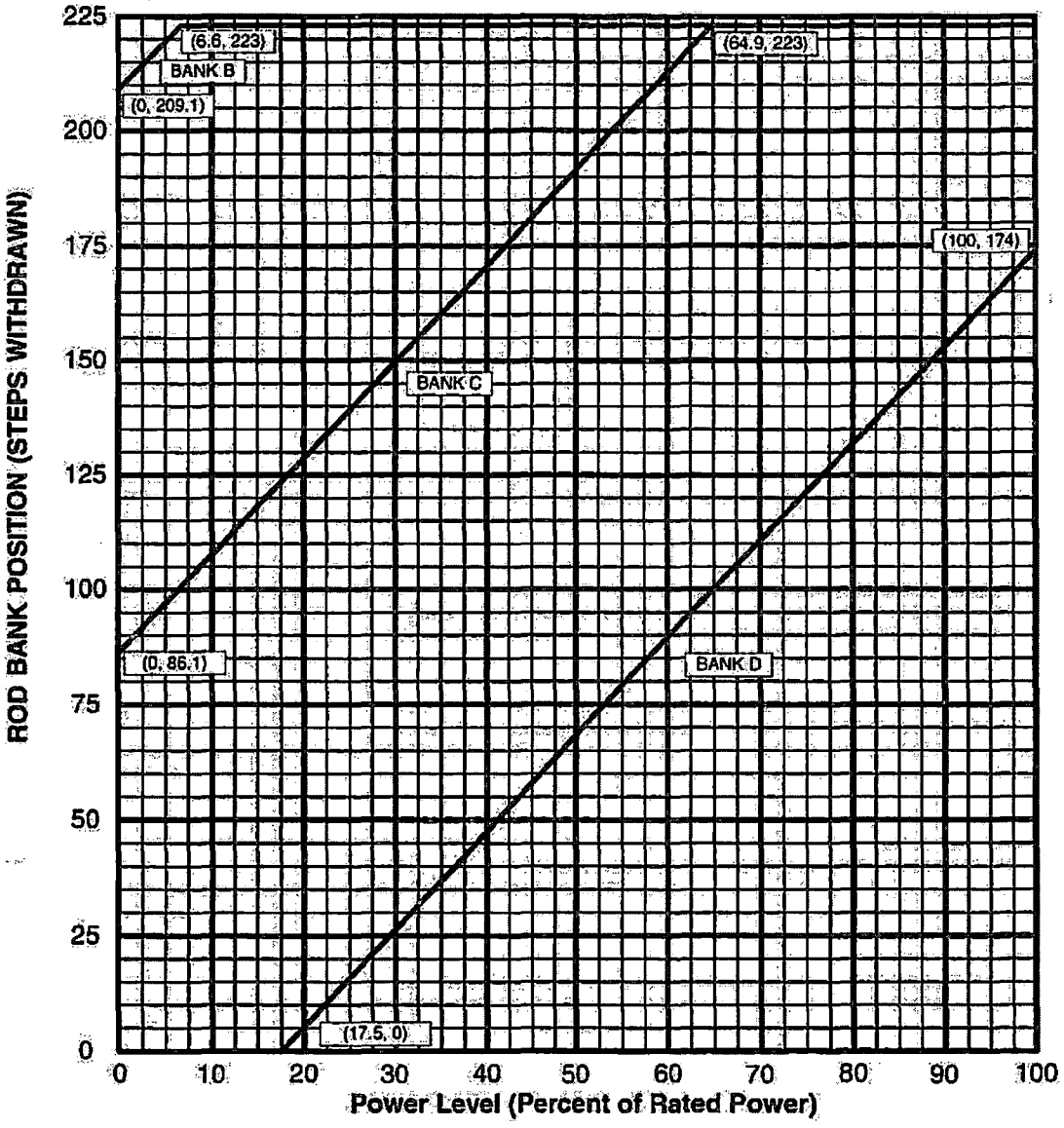

Figure 3
Hot Channel Factor Normalized Operating Envelope
(For S. G. Tube Plugging up to 5%)
(Page 1 of 1)

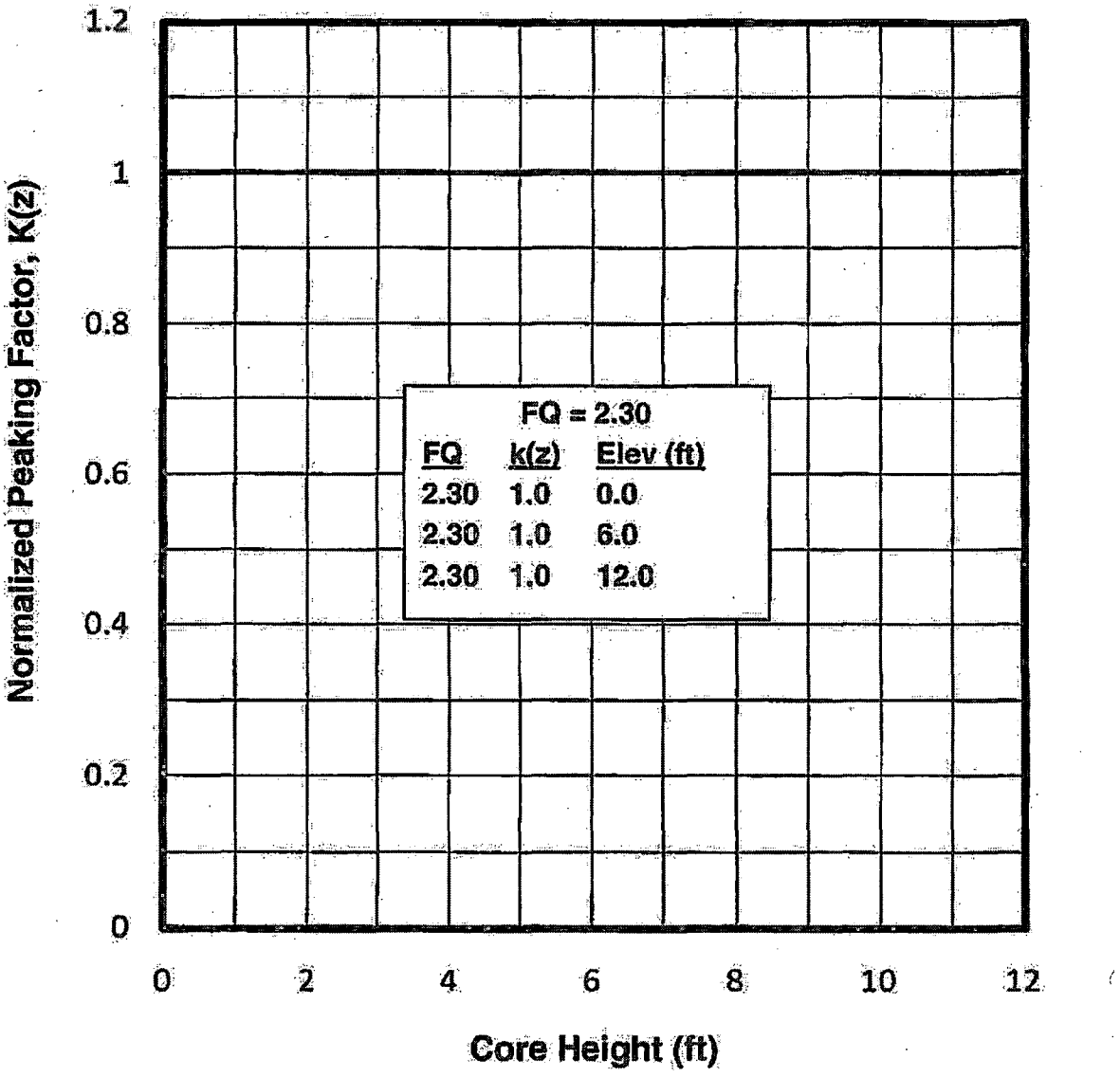

Figure 4
Axial Flux Difference Envelope Limits
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