Entergy

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Robert Walpole
Licensing Manager

NL-10-034

May 3, 2010

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

SUBJECT: Revised Core Operating Limits Report for Indian Point Unit 2
Docket No. 50-247
License No. DPR-26

Dear Sir or Madam:

Please find attached Core Operating Limits Report (COLR) for Indian Point Unit 2 Cycle 20 in accordance with the Indian Point 2 Technical Specifications 5.6.5.d. Enclosure 1 provides the cycle-specific operating limits for the operation of Indian Point Unit 2.

There are no new commitments being made in this submittal. If you have any questions or require additional information, please contact my office at (914) 734-6710.

Sincerely,

RW/dmt

Enclosure: 1. Indian Point 2 COLR – Cycle 20

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

A001
NRR

ENCLOSURE 1 TO NL-10-034

Indian Point 2 COLR – Cycle 20

ENTERGY NUCLEAR OPERATIONS, INC.
INDIAN POINT NUCLEAR GENERATING UNIT NO. 2
DOCKET NO. 50-247
LICENSE NO. DPR-26

Entergy
Nuclear Northeast

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

Procedure Use Is:

☐ Continuous

☐ Reference

☑ Information

Control Copy: _____

Effective Date: 3/17/2010

2-GRAPH-RPC-6, Revision: 13

CORE OPERATING LIMITS REPORT (COLR)

Indian Point Operations

Approved By:

3-10-10

Procedure Sponsor, RPO / Designee — Date

Team Staff

Procedure Owner

GENERAL REVISION

REVISION SUMMARY

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1.0 REASON FOR REVISION

1.1 Incorporate Cycle 20 changes per NF-IP-09-30

2.0 SUMMARY OF CHANGES

2.1 Added TS 3.2.1, "Heat Flux Hot Channel Factor (FQ(Z))" to the Table of Contents. **[Editorial 4.6.6]**

2.2 Added parentheses around "$F^N_{\Delta H}$" in the Table of Contents, TS 3.2.2. **[Editorial 4.6.1]**

2.3 Changed "RPS Instrumentation" to "Reactor Protection System (RPS) Instrumentation" in the Table of Contents, TS 3.3.1. **[Editorial 4.6.9]**

2.4 Separated Attachment 1 into Attachments 1 and 2 in the Table of Contents. **[Editorial 4.6.2]**

2.5 Deleted the note at the top of page 3, as it is no longer needed. **[Editorial 4.6.12]**

2.6 Deleted "Reference Graph RV-12 for cycle specific predicted MTC" in TS 3.1.3, as Westinghouse cannot validate that statement. **[Editorial 4.6.13]**

2.7 Added the statement "Each Control Bank shall be considered fully withdrawn at ≥ 223 steps" to TS 3.1.6 for consistency with the Unit 3 COLR wording, but quoting the correct number of steps for Unit 2. **[Editorial 4.6.13]**

2.8 Added the definition of "P" to the Note in TS 3.2.1. **[Editorial 4.6.11]**

2.9 Added parentheses around "$F^N_{\Delta H}$ " in the title of TS 3.2.2. **[Editorial 4.6.1]**

2.10 Replaced "Refer to Attachment 1" with "Refer to Attachment 2" in TS 3.3.1, Item 2. **[Editorial 4.6.2]**

2.11 Changed "Refuel" to "Refueling" in TS 3.9.1. . **[Editorial 4.6.9]**

2.12 Changed "(page 1 of 2)" to "(page 1 of 1)" in Attachment 1, "Overtemperature ΔT Allowable Value" (see page 5 of 11). . **[Editorial 4.6.7]**

2.13 Changed "Overtemperature ΔT" in Attachment 1 to "Overtemperature ΔT Allowable Value" (see page 5 of 11). . **[Editorial 4.6.9]**

2.14 Specified 572°F in the definition of T′ in Attachment 1. . **[Editorial 4.6.9]**

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2.15 Changed "(page 2 of 2)" to "(page 1 of 1)" in Attachment 2, "Overpower ΔT Allowable Value" (see page 6 of 11). . **[Editorial 4.6.7]**

2.16 Changed "Overpower ΔT" in Attachment 2 to "Overpower ΔT Allowable Value" (see page 6 of 11). **[Editorial 4.6.9]**

2.17 Specified 572°F in the definition of T" in Attachment 2. **[Editorial 4.6.9]**

2.18 Changed "Operation" to "Consequences" in two places on Figure 1. **[Editorial 4.6.1]**

2.19 Added "(Page 1 of 1)" to Figures 1 through 4. **[Editorial 4.6.7]**

TABLE OF CONTENTS

The data presented in this report applies to Cycle 20 ONLY and may NOT be used for other cycles of operation. Any technical change to this document requires 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 ≥ 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 $P > .5$, $F_Q(Z) \leq (2.50 / P) \times K(Z)$

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 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:

a. Reactor Coolant System average $T_{AVG} \leq 568.1°F$ and highest loop $T_{AVG} \leq 571.1°F$ for full power T_{AVG} of 565.0°F
b. Pressurizer Pressure $\geq$ 2216 psia
c. Reactor Coolant System Total Flow Rate $\geq$ 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 $\geq$ 2050 ppm or that which is sufficient to provide a shutdown margin $\geq$ 5% $\Delta k/k$.

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.

$K_1 \leq 1.22$ $K_2 \geq 0.020/°F$ $K_3 \geq 0.00070/psi$
$\tau_1 \geq 25$ 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
(Page 1 of 1)

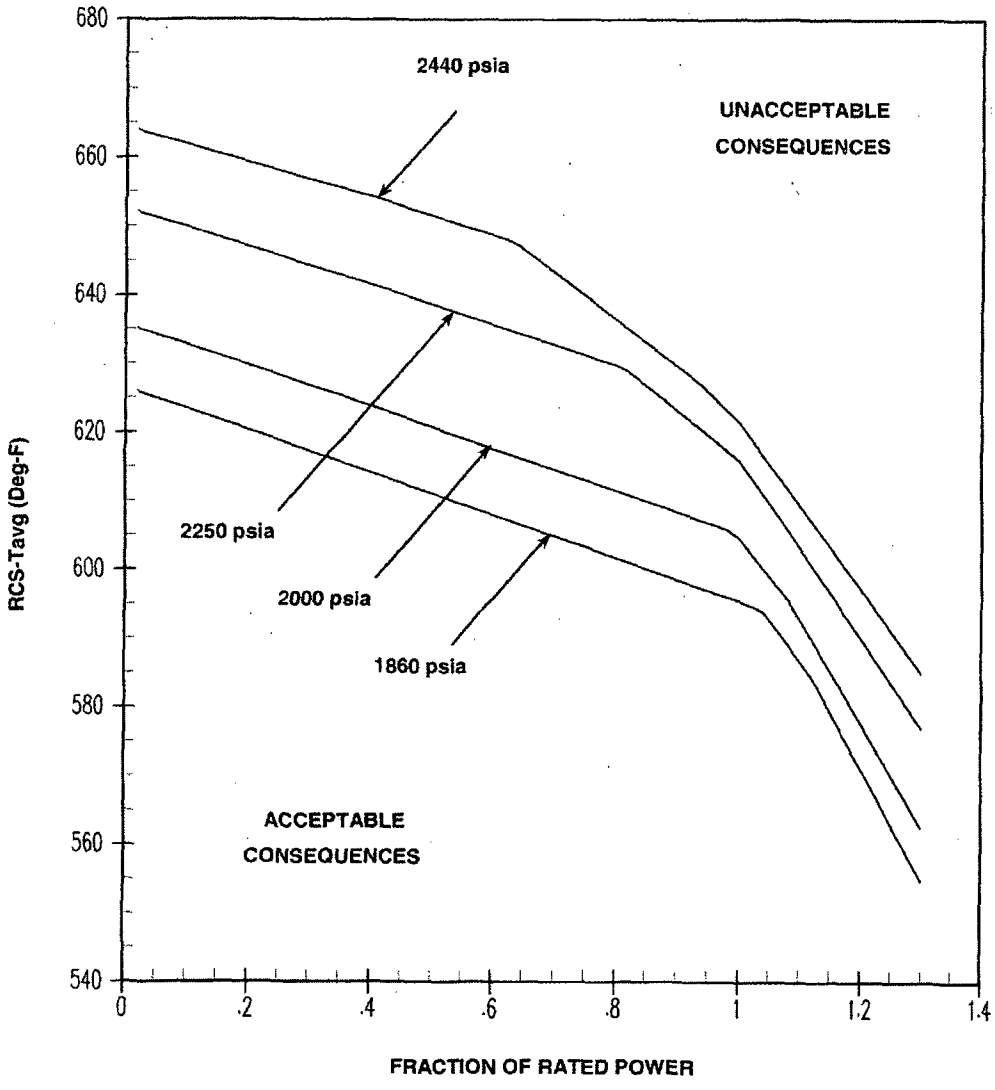

Figure 2
Rod Bank Insertion Limits
(Four Loop Operation)
100 Step Overlap
(Page 1 of 1)

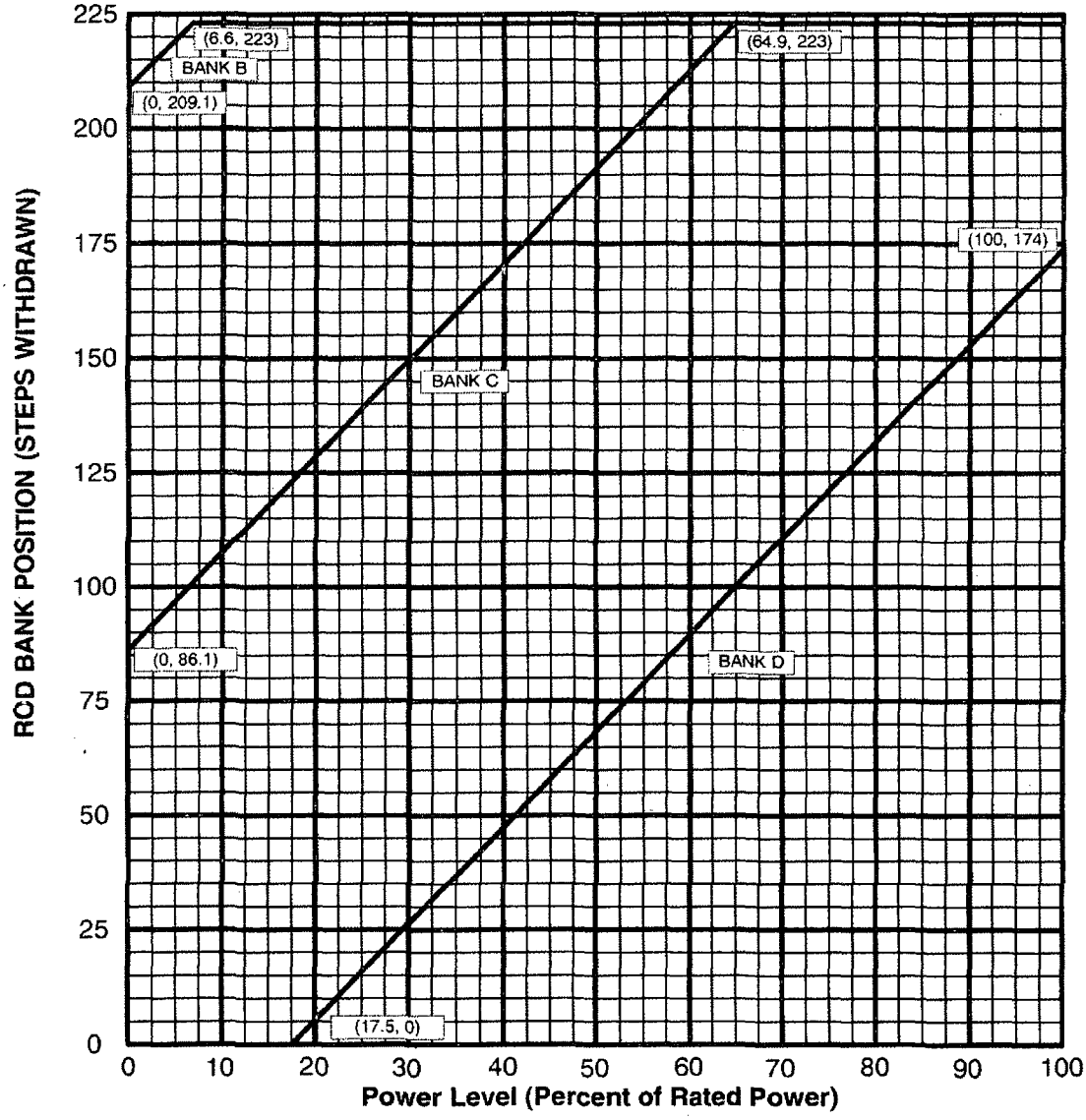

Figure 3
Hot Channel Factor Normalized Operating Envelope
(For S. G. Tube Plugging up to 10%)
(Page 1 of 1)

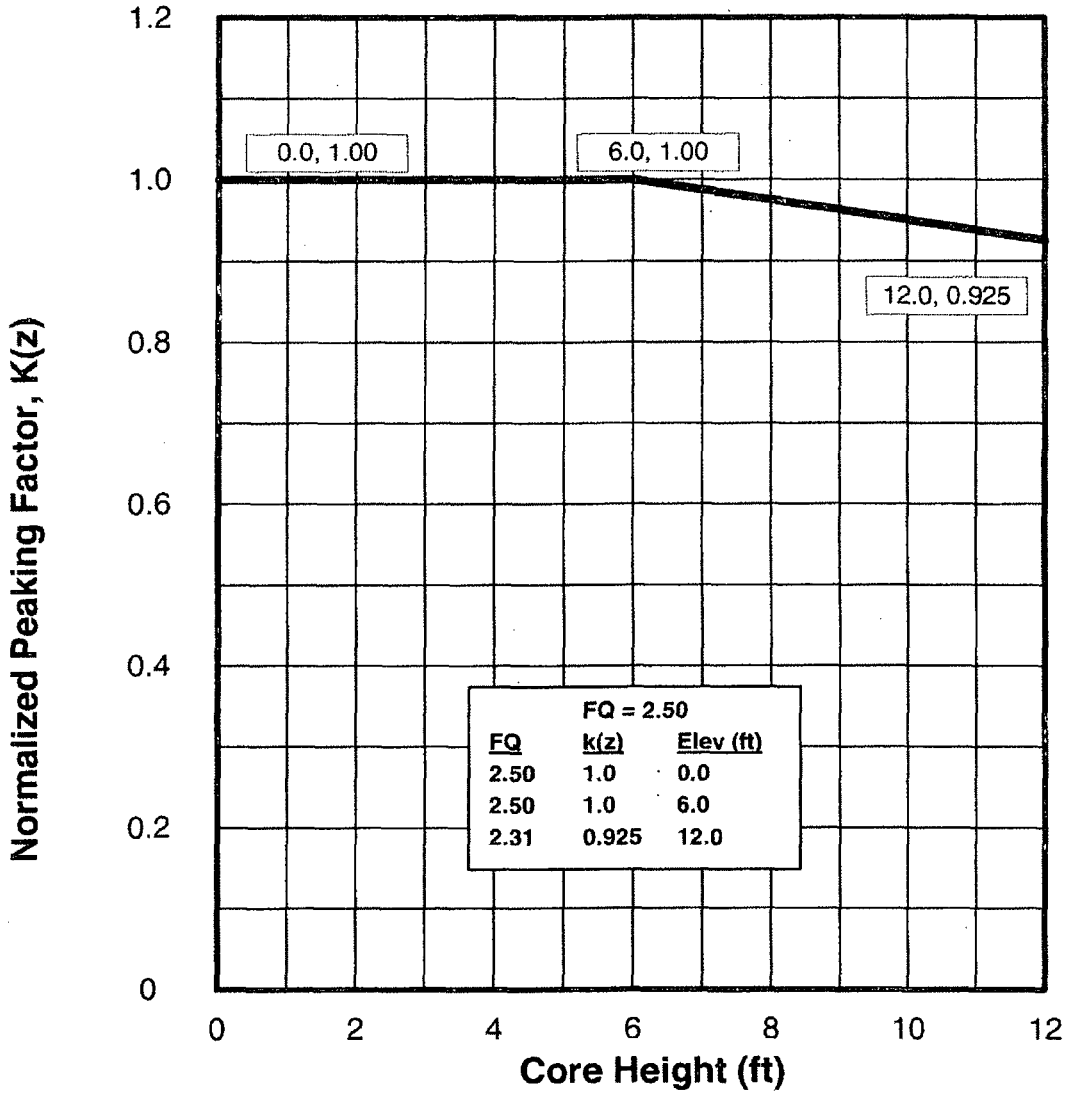

Figure 4
Axial Flux Difference Envelope Limits
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