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NL-19-034

April 4, 2019

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

SUBJECT: Core Operating Limits Report for Cycle 21
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 21. 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/mm

ADD
NRR

Enclosure: 3-GRAPH-RPC-16, Revision: 11 Core Operating Limits Report

cc: Mr. David Lew, Regional Administrator, NRC Region 1
Mr. Richard V. Guzman, Senior Project Manager, NRR/DORL, NRC
Ms. Alicia Barton, President and CEO, NYSERDA (w/o Attachment)
Ms. Bridget Frymire, New York State Dept. of Public Service (w/o Attachment)
NRC Resident Inspector's Office

ENCLOSURE TO NL-19-034

3-GRAPH-RPC-16, Revision: 11

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: 4/3/2019

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This Procedure is
Quality Related

3-GRAPH-RPC-16 , Revision: 11
CORE OPERATING LIMITS REPORT

Approved By:

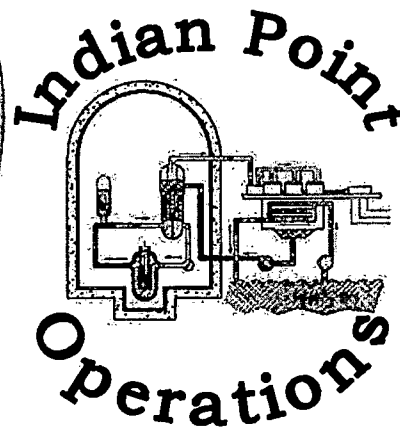
KEVIN MCKENNA  | 3-16-2019

Procedure Sponsor, DM/Designee

Date

Team 3B

Procedure Owner



PARTIAL REVISION

REVISION SUMMARY

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1.0 REASON FOR REVISION

- 1.1 Incorporate Cycle 21 changes. (EC-76679).
- 1.2 LBDR #3-COLR-2019-001

2.0 SUMMARY OF CHANGES

- 2.1 Made minor editorial changes.
- 2.2 Revised TS 2.1.1 and NOTE per markup.
- 2.3 Revised TS 3.1.3 per markup.
- 2.4 Revised TS 3.1.5 per markup.
- 2.5 Revised TS 3.1.6 per markup.
- 2.6 Revised TS 3.4.1 per markup.
- 2.7 Revised TS 3.9.1 per markup.

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NOTE

The data presented in this report applies to Cycle 21 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. Changes to this document are administratively controlled in accordance with Technical Specification Section 5.6.5.

TS 2.1.1 Reactor Core SLs

In MODES 1 and 2, the combination of thermal power level, Reactor Vessel inlet temperature, and pressurizer pressure **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 $\leq 0.0 \Delta k/k/^\circ F$ at hot zero power.

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

-38.0 pcm/ $^\circ F$ @ 300 ppm boron
-44.5 pcm/ $^\circ F$ @ 60 ppm boron
-47.0 pcm/ $^\circ F$ @ 0 ppm boron

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 + -3 pcm/ $^\circ F$

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 in MODE 2 with any control bank not fully inserted. 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 $k_{\text{eff}} \geq 1.0$ 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.

Control Bank withdrawal sequence is A-B-C-D. The insertion sequence is the reverse of the withdrawal sequence.

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 ($F_{\Delta H}^N$)**NOTE**

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

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

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 \pm 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**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.

The following DNB related parameters are applicable in MODE 1:

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

TS 3.9.1 Boron Concentration

When required by Technical Specification 3.9.1, the minimum boron concentration in the Reactor Coolant System and the refueling cavity (which includes the refueling canal) 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:

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

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, $\leq 572.0^\circ\text{F}$.
 P is the measured pressurizer pressure, psig.
 P' is the nominal RCS operating pressure, ≥ 2235 psig.

$$K_1 \leq 1.26 \qquad K_2 \geq 0.022/^\circ\text{F} \qquad K_3 \geq 0.00070/\text{psig}$$

$$\tau_1 \geq 25.0 \text{ sec} \qquad \tau_2 \leq 3.0 \text{ sec}$$

$$f_1(\Delta I) = \begin{array}{ll} 4.00[-15.75 - (qt - qb)] & \text{when } qt - qb \leq -15.75\% \text{ RTP} \\ 0\% \text{ of RTP} & \text{when } -15.75\% \text{ RTP} < qt - qb \leq 6.9\% \text{ RTP} \\ +3.33[(qt - qb) - 6.9] & \text{when } qt - qb > 6.9\% \text{ RTP} \end{array}$$

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
(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:

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

- 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.

$$K_4 \leq 1.10 \quad K_5 \geq 0.0175/^\circ\text{F for increasing } T_{\text{avg}} \quad K_6 \geq 0.0015/^\circ\text{F when } T > T''$$

$$0/^\circ\text{F for decreasing } T_{\text{avg}} \quad 0/^\circ\text{F when } T \leq T''$$

$$\tau_3 \geq 10 \text{ sec}$$

$$f_2(\Delta I) = 0$$

Figure 1
Reactor Core Safety Limit – Four Loops in Operation
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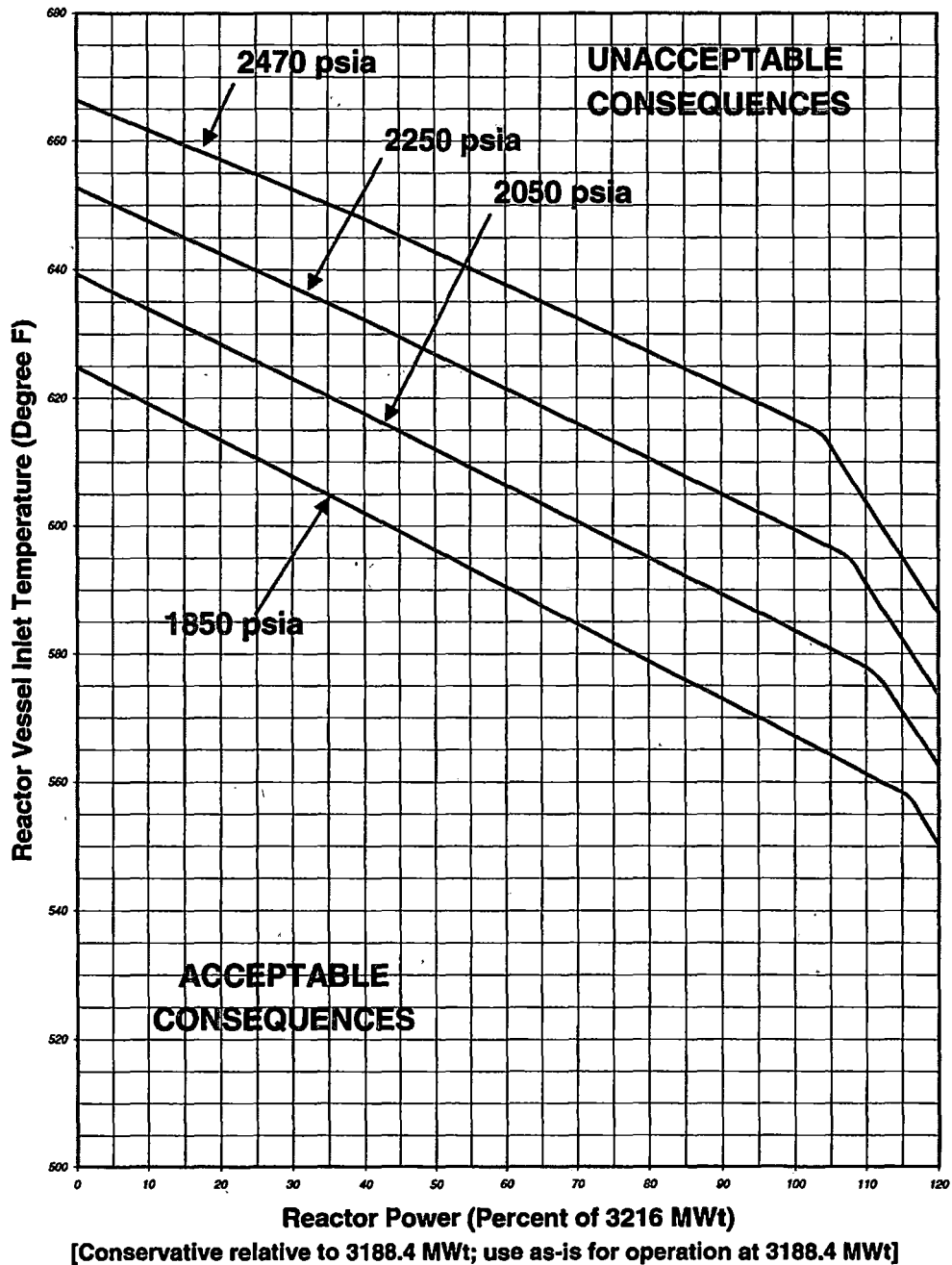


Figure 2
Rod Bank Insertion Limits
(Page 1 of 1)
(Four Loop Operation)
104 Step Overlap

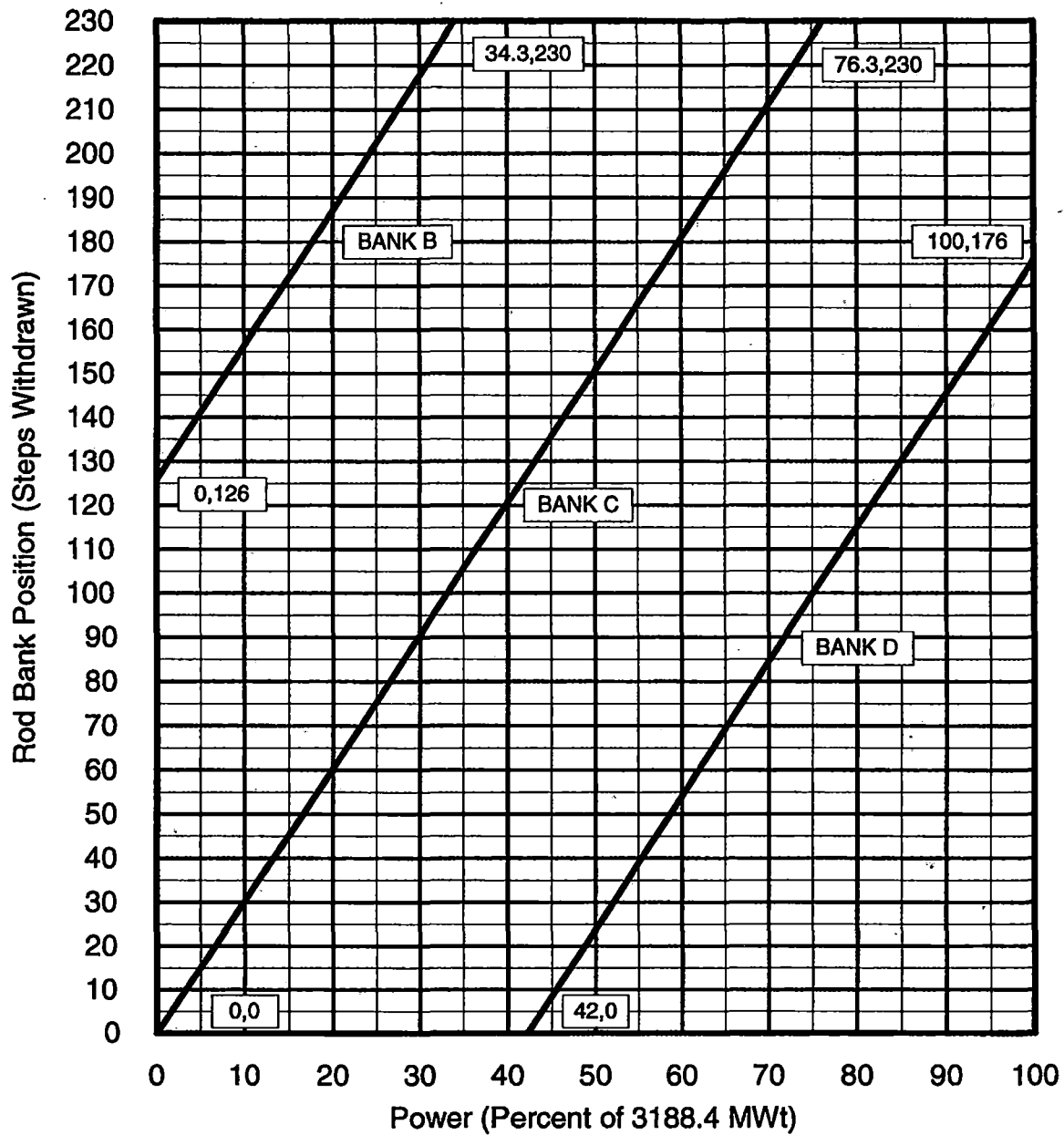


Figure 3
Hot Channel Factor Normalized Operating Envelope
(For S. G. Tube Plugging up to 10%)
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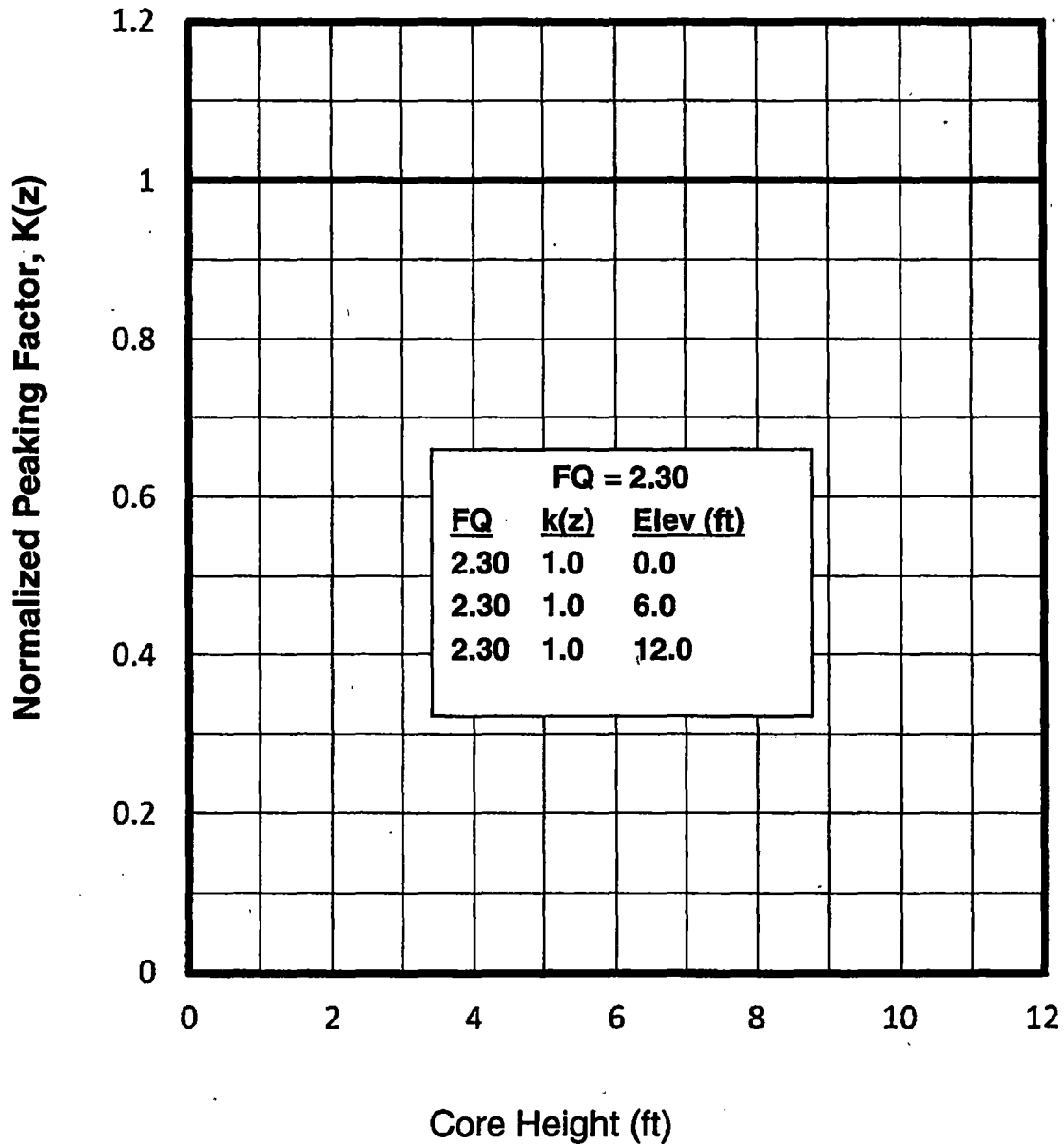


Figure 4
Axial Flux Difference Envelope Limits
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