UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

November 15, 2016

Vice President, Operations
Entergy Nuclear Operations, Inc.
Indian Point Energy Center
450 Broadway, GSB
P.O. Box 249
Buchanan, NY 10511-0249

SUBJECT: INDIAN POINT NUCLEAR GENERATING UNIT NOS. 2 AND 3 - ISSUANCE OF AMENDMENTS RE: CONDITIONAL EXEMPTION FROM END-OF-LIFE MODERATOR TEMPERATURE COEFFICIENT (CAC NOS. MF7193 AND MF7194)

Dear Sir or Madam:

The U.S. Nuclear Regulatory Commission has issued the enclosed Amendment No. 285 to Facility Operating License No. DPR-26 for the Indian Point Nuclear Generating Unit No. 2 and Amendment No. 261 to Facility Operating License No. DPR-64 for the Indian Point Nuclear Generating Unit No. 3. The amendments consist of changes to the Technical Specifications (TSs) in response to your application dated December 10, 2015, as supplemented by letters dated March 2, July 7, and October 6, 2016.

The amendments revise TS 3.1.3, "Moderator Temperature Coefficient (MTC)," and TS 5.6.5, "Core Operating Limits Report (COLR)," to allow exemption from the normally required near end-of-life MTC measurement by placing a set of conditions on reactor core operation. If these conditions are met, the MTC measurement could be replaced by a calculated value.

A copy of the related Safety Evaluation is enclosed. A Notice of Issuance will be included in the Commission's next biweekly *Federal Register* notice.

Sincerely,

Douglas V. Pickett

Douglas V. Pickett, Senior Project Manager
Plant Licensing Branch I-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-247 and 50-286

Enclosures:
1. Amendment No. 285 to DPR-26
2. Amendment No. 261 to DPR-64
3. Safety Evaluation

cc w/encls: Distribution via Listserv

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

ENTERGY NUCLEAR INDIAN POINT 2, LLC

ENTERGY NUCLEAR OPERATIONS, INC.

DOCKET NO. 50-247

INDIAN POINT NUCLEAR GENERATING UNIT NO. 2

AMENDMENT TO FACILITY OPERATING LICENSE

AND TECHNICAL SPECIFICATIONS

Amendment No. 285
License No. DPR-26

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Entergy Nuclear Operations, Inc. (the licensee) dated December 10, 2015, as supplemented by letters dated March 2, July 7, and October 6, 2016, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act) and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Facility Operating License No. DPR-26 is hereby amended to read as follows:

   (2) Technical Specifications

   The Technical Specifications contained in Appendices A, B and C, as revised through Amendment No. 285, are hereby incorporated in the license. ENO shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of the date of its issuance and shall be implemented within 30 days.

FOR THE NUCLEAR REGULATORY COMMISSION

Brenda L. Mozafari, Acting Chief
Plant Licensing Branch I-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment:
Changes to the License and
Technical Specifications

Date of Issuance: November 15, 2016

ATTACHMENT TO LICENSE AMENDMENT NO. 285

INDIAN POINT NUCLEAR GENERATING UNIT NO. 2

FACILITY OPERATING LICENSE NO. DPR-26

DOCKET NO. 50-247

Replace the following page of the License with the attached revised page. The revised page is identified by amendment number and contains marginal lines indicating the areas of change.

Remove Page	Insert Page
3	3

Replace the following pages of the Appendix A Technical Specifications with the attached revised pages. The revised pages are identified by amendment number and contain marginal lines indicating the areas of change.

Remove Pages	Insert Pages
3.1.3-2	3.1.3-2
5.6-4	5.6-4

instrumentation and radiation monitoring equipment calibration, and as fission detectors in amounts as required;

(4) ENO pursuant to the Act and 10 CFR Parts 30, 40 and 70, to receive, possess, and use in amounts as required any byproduct, source or special nuclear material without restriction to chemical or physical form, for sample analysis or instrument calibration or associated with radioactive apparatus or components; Amdt. 42 10-17-78

(5) ENO pursuant to the Act and 10 CFR Parts 30 and 70, to possess, but not separate, such byproduct and special nuclear materials as may be produced by the operation of the facility. Amdt. 220 09-06-01

C. This amended license shall be deemed to contain and is subject to the conditions specified in the following Commission regulations in 10 CFR Chapter I: Part 20, Section 30.34 of Part 30, Section 40.41 of Part 40, Sections 50.54 and 50.59 of Part 50, and Section 70.32 of Part 70; is subject to all applicable provisions of the Act and to the rules, regulations, and orders of the Commission now or hereafter in effect; and is subject to the additional conditions specified or incorporated below:

(1) Maximum Power Level

ENO is authorized to operate the facility at steady state reactor core power levels not in excess of 3216 megawatts thermal Amdt. 241 10-27-04

(2) Technical Specifications

The Technical Specifications contained in Appendices A, B, and C, as revised through Amendment No. 285, are hereby incorporated in the license. ENO shall operate the facility in accordance with the Technical Specifications.

(3) The following conditions relate to the amendment approving the conversion to Improved Standard Technical Specifications:

1. This amendment authorizes the relocation of certain Technical Specification requirements and detailed information to licensee controlled documents as described in Table R, "Relocated Technical Specifications from the CTS," and Table LA, "Removed Details and Less Restrictive Administrative Changes to the CTS" attached to the NRC staff's Safety Evaluation enclosed with this amendment. The relocation of requirements and detailed information shall be completed on or before the implementation of this amendment.

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.1.3.2	---------- **- NOTES -** 1. Not required to be performed until 7 effective full power days (EFPD) after reaching the equivalent of an equilibrium RTP all rods out (ARO) boron concentration of 300 ppm. 2. SR 3.1.3.2 is not required to be performed by measurement provided that the benchmark criteria in WCAP-13749-P-A are satisfied and the Revised Predicted MTC satisfies the 300 ppm surveillance limit specified in the COLR. 3. If the MTC is more negative than the 300 ppm Surveillance limit (not LCO limit) specified in the COLR, SR 3.1.3.2 shall be repeated once per 14 EFPD during the remainder of the fuel cycle. 4. SR 3.1.3.2 need not be repeated if the MTC measured at the equivalent of equilibrium RTP-ARO boron concentration of $\leq$ 60 ppm is less negative than the 60 ppm Surveillance limit specified in the COLR. ----------	
	Verify MTC is within lower limit.	Once each cycle

5.6 Reporting Requirements

5.6.5 CORE OPERATING LIMITS REPORT (COLR) (continued)

8. WCAP-12610-P-A, "VANTAGE+ Fuel Assembly Reference Core Report," April 1995;

9. WCAP-10079-P-A, "NOTRUMP, A Nodal Transient Small Break and General Network Code," August 1985;

10. WCAP-10054-P-A, "Westinghouse Small Break ECCS Evaluation Model Using the NOTRUMP Code," August 1985;

11. WCAP-10054-P-A, Addendum 2, Revision 1, "Addendum to the Westinghouse Small Break ECCS Evaluation Model Using the NOTRUMP Code: Safety Injection Into the Broken Loop and Cosi Condensation Model," July 1997;

12. WCAP-13749-P-A, "Safety Evaluation Supporting the Conditional Exemption of the Most Negative EOL Moderator Temperature Coefficient Measurement," March 1997;

13. WCAP-16045-P-A, "Qualification of the Two-Dimensional Transport Code PARAGON," August 2004; and

14. WCAP-10965-P-A, "ANC: A Westinghouse Advanced Nodal Computer Code," September 1986.

c. The core operating limits shall be determined such that all applicable limits (e.g., fuel thermal mechanical limits, core thermal hydraulic limits, Emergency Core Cooling Systems (ECCS) limits, nuclear limits such as SDM, transient analysis limits, and accident analysis limits) of the safety analysis are met.

d. The COLR, including any midcycle revisions or supplements, shall be provided to the NRC upon issuance for each reload cycle.

5.6.6 Post Accident Monitoring Report

When a report is required by Condition B or F of LCO 3.3.3, "Post Accident Monitoring (PAM) Instrumentation," a report shall be submitted within the following 14 days. The report shall outline the preplanned alternate method of monitoring, the cause of the inoperability, and the plans and schedule for restoring the instrumentation channels of the Function to OPERABLE status.

5.6.7 Steam Generator Tube Inspection Report

A report shall be submitted within 180 days after the initial entry into MODE 4 following completion of an inspection performed in accordance with the Specification 5.5.7, Steam Generator (SG) Program. The report shall include:

a. The scope of inspections performed on each SG,

b. Degradation mechanisms found,

c. Nondestructive examination techniques utilized for each degradation mechanism,

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ENTERGY NUCLEAR INDIAN POINT 3, LLC

ENTERGY NUCLEAR OPERATIONS, INC.

DOCKET NO. 50-286

INDIAN POINT NUCLEAR GENERATING UNIT NO. 3

AMENDMENT TO FACILITY OPERATING LICENSE

AND TECHNICAL SPECIFICATIONS

Amendment No. 261
License No. DPR-64

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Entergy Nuclear Operations, Inc. (the licensee) dated December 10, 2015, as supplemented by letters dated March 2, July 7, and October 6, 2016, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act) and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Facility Operating License No. DPR-64 is hereby amended to read as follows:

   (2) Technical Specifications

   The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 261, are hereby incorporated in the license. ENO shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of the date of its issuance and shall be implemented within 30 days.

FOR THE NUCLEAR REGULATORY COMMISSION

Brenda L. Mozafari, Acting Chief
Plant Licensing Branch I-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment:
Changes to the License and
Technical Specifications

Date of Issuance: November 15, 2016

ATTACHMENT TO LICENSE AMENDMENT NO. 261

INDIAN POINT NUCLEAR GENERATING UNIT NO. 3

FACILITY OPERATING LICENSE NO. DPR-64

DOCKET NO. 50-286

Replace the following page of the License with the attached revised page. The revised page is identified by amendment number and contains marginal lines indicating the areas of change.

Remove Page	Insert Page
3	3

Replace the following pages of the Appendix A Technical Specifications with the attached revised pages. The revised pages are identified by amendment number and contain marginal lines indicating the areas of change.

Remove Pages	Insert Pages
3.1.3-2	3.1.3-2
5.0-35	5.0-35
---	5.0-35a

(4) ENO pursuant to the Act and 10 CFR Parts 30, 40 and 70, to receive, possess, and use in amounts as required any byproduct, source or special nuclear material without restriction to chemical or physical form, for sample analysis or instrument calibration or associated with radioactive apparatus or components; Amdt. 203 11/27/00

(5) ENO pursuant to the Act and 10 CFR Parts 30 and 70, to possess, but not separate, such byproduct and special nuclear materials as may be produced by the operation of the facility. Amdt. 203 11/27/00

C. This amended license shall be deemed to contain and is subject to the conditions specified in the following Commission regulations in 10 CFR Chapter I: Part 20, Section 30.34 of Part 30, Section 40.41 of Part 40, Sections 50.54 and 50.59 of Part 50, and Section 70.32 of Part 70; and is subject to all applicable provisions of the Act and to the rules, regulations, and orders of the Commission now or hereafter in effect; and is subject to the additional conditions specified or incorporated below:

(1) Maximum Power Level

ENO is authorized to operate the facility at steady state reactor core power levels not in excess of 3216 megawatts thermal (100% of rated power).

(2) Technical Specifications

The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 261 are hereby incorporated in the License. ENO shall operate the facility in accordance with the Technical Specifications.

(3) (DELETED) Amdt. 205 2-27-01

(4) (DELETED) Amdt. 205 2-27-01

D. (DELETED) Amdt.46 2-16-83

E. (DELETED) Amdt.37 5-14-81

F. This amended license is also subject to appropriate conditions by the New York State Department of Environmental Conservation in its letter of May 2, 1975, to Consolidated Edison Company of New York, Inc., granting a Section 401 certification under the Federal Water Pollution Control Act Amendments of 1972.

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.1.3.1	Verify MTC is within upper limit.	Once prior to entering MODE 1 after each refueling
SR 3.1.3.2	----------NOTES---------- 1. Not required to be performed until 7 effective full power days (EFPD) after reaching the equivalent of an equilibrium RTP all rods out (ARO) boron concentration of 300 ppm. 2. SR 3.1.3.2 is not required to be performed by measurement provided that the benchmark criteria in WCAP-13749-P-A are satisfied and the Revised Predicted MTC satisfies the 300 ppm surveillance limit specified in the COLR. 3. If the MTC is more negative than the 300 ppm Surveillance limit (not LCO limit) specified in the COLR, SR 3.1.3.2 shall be repeated once per 14 EFPD during the remainder of the fuel cycle. 4. SR 3.1.3.2 need not be repeated if the MTC measured at the equivalent of equilibrium RTP-ARO boron concentration of ≤ 60 ppm is less negative than the 60 ppm Surveillance limit specified in the COLR. ---------- Verify MTC is within lower limit.	Once each cycle

5.6.5 CORE OPERATING LIMITS REPORT (COLR) (continued)

Position CPB 4.3-1, Westinghouse Constant Axial Offset Control (CAOC), Rev. 2, July 1981. (Specification 3.2.3, Axial Flux Difference (AFD) (Constant Axial Offset Control));

3. WCAP-12945-P-A, Volume 1 (Revision 2) and Volumes 2 through 5 (Revision 1), "Code Qualification Document for Best-Estimate Loss-of-Coolant-Accident Analysis," March 1998 (Westinghouse Proprietary);

4. WCAP-11397-P-A, "Revised Thermal Design Procedure," April 1989 (Specification 2.1, Safety Limits (SL)) and Specification 3.4.1, (RCS Pressure, Temperature, and Flow Departure from Nucleate Boiling (DNB) Limits);

5. WCAP-8745-P-A, "Design Bases for the Thermal Overpower ΔT and Thermal Overtemperature ΔT Trip Functions," September 1986 (Specification 2.1, Safety Limits (SL));

6a. WCAP-10054-P-A, "SMALL BREAK ECCS EVALUATION MODEL USING NOTRUMP CODE," (W Proprietary). (Specification 3.2.1, Heat Flux Hot Channel Factor (FQ(Z));

6b. WCAP-10054-P-A, Addendum 2, Revision 1, "Addendum to the Westinghouse Small Break ECCS Evaluation Model Using the NOTRUMP Code; Safety Injection into the Broken Loop and Cosi Condensation Model," July 1997 (Specification 3.2.1, Heat Flux Hot Channel Factor (FQ(Z)));

6c. WCAP-10079-P-A, "NOTRUMP NODAL TRANSIENT SMALL BREAK AND GENERAL NETWORK CODE," (W Proprietary). (Specification 3.2.1, Heat Flux Hot Channel Factor (FQ(Z)));

7. WCAP-12610, "VANTAGE+ Fuel Assembly Report," (W Proprietary). (Specification 3.2.1, Heat Flux Hot Channel Factor);

8. WCAP-13749-P-A, "Safety Evaluation Supporting the Conditional Exemption of the Most Negative EOL Moderator Temperature Coefficient Measurement," March 1997. (Specification 3.1.3, Moderator Temperature Coefficient);

9. WCAP-16045-P-A, "Qualification of the Two-Dimensional Transport Code PARAGON," August 2004. (Specification 3.1.1, Shutdown Margin, Specification 3.1.3, Moderator Temperature Coefficient, Specification 3.1.5, Shutdown Bank Insertion Limits, Specification 3.1.6, Control Bank Insertion Limits, Specification 3.2.1, Heat Flux Hot Channel Factor (FQ(Z)), Specification 3.2.2, Nuclear Enthalpy Rise Hot Channel Factor, Specification 3.2.3, Axial Flux Difference (AFD), Specification 3.9.1, Boron Concentration); and

10. WCAP-10965-P-A, "ANC: A Westinghouse Advanced Nodal Computer Code," September 1986. (Specification 3.1.1, Shutdown Margin, Specification 3.1.3, Moderator Temperature Coefficient, Specification 3.1.5, Shutdown Bank Insertion Limits, Specification 3.1.6, Control Bank Insertion Limits, Specification 3.2.1, Heat Flux Hot Channel Factor (FQ(Z)), Specification 3.2.2, Nuclear Enthalpy Rise Hot

(continued)

5.6.5 CORE OPERATING LIMITS REPORT (COLR) (continued)

Channel Factor, Specification 3.2.3, Axial Flux Difference (AFD), Specification 3.9.1, Boron Concentration).

c. The core operating limits shall be determined such that all applicable limits (e.g., fuel thermal mechanical limits, core thermal hydraulic limits, Emergency Core Cooling Systems (ECCS) limits, nuclear limits such as SDM, transient analysis limits, and accident analysis limits) of the safety analysis are met.

d. The COLR, including any midcycle revisions or supplements, shall be provided for each reload cycle to the NRC.

5.6.6 NOT USED

(continued)

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 285

TO FACILITY OPERATING LICENSE NO. DPR-26

AND AMENDMENT NO. 261

TO FACILITY OPERATING LICENSE NO. DPR-64

ENTERGY NUCLEAR INDIAN POINT 2, LLC

ENTERGY NUCLEAR INDIAN POINT 3, LLC

AND ENTERGY NUCLEAR OPERATIONS, INC.

INDIAN POINT NUCLEAR GENERATING UNIT NOS. 2 AND 3

DOCKET NOS. 50-247 AND 50-286

1.0 INTRODUCTION

By letter dated December 10, 2015 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML15350A011), as supplemented by letters dated March 2, July 7, and October 6, 2016 (ADAMS Accession Nos. ML16069A311, ML16197A172, and ML16291A547, respectively), Entergy Nuclear Operations, Inc. (Entergy, or the licensee), submitted a request for changes to the Indian Point Nuclear Generating Unit Nos. 2 and 3 (IP2 and IP3) Technical Specifications (TSs).

The proposed changes would revise TS 3.1.3, "Moderator Temperature Coefficient (MTC)," and TS 5.6.5, "Core Operating Limits Report (COLR)," to allow an exemption from the normally required near end-of-life (EOL) MTC measurement by placing a set of conditions on reactor core operation. If these conditions are met, the MTC measurement could be replaced by a calculated value.

The supplemental letters dated March 2 and July 7, 2016, provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change the NRC staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on April 5, 2016 (81 FR 19647).

2.0 BACKGROUND

On October 9, 1996, the Nuclear Regulatory Commission (NRC) approved Westinghouse Electric Company LLC (Westinghouse) Topical Report WCAP-13749-P-A, "Safety Evaluation Supporting the Conditional Exemption of the Most Negative EOL Moderator Temperature Coefficient Measurement," for referencing in licensing applications. NRC's safety evaluation (SE) conclusion stated that "the analysis for the proposed TS change is acceptable, provided (1) only PHOENIX/ANC calculation methods are used for the individual plant analyses relevant to the determinations for the EOL MTC plant methodology, and (2) the predictive correlation is reexamined if changes in core fuel designs or continued MTC calculation/measurement data show significant effect on the predictive correction."

On March 18, 2004, the NRC approved Westinghouse topical report WCAP-16045-P-A, "Qualification of the Two-Dimensional Transport Code PARAGON" (ADAMS Accession No. ML040780402). PARAGON, a lattice physics code, provides cross-sections to the Westinghouse nodal core simulator code, ANC, replacing PHOENIX-P. The conclusion of the SE states, in part that, "(i)n addition, the [NRC] staff considers the new PARAGON code to be well qualified as a stand-alone code replacement for the PHOENIX-P lattice code, wherever the PHOENIX-P code is used in NRC-approved methodologies. The NRC staff considers it acceptable for licensing applications." The licensee is seeking approval to use PARAGON/ANC with WCAP-13749-P-A as opposed to PHOENIX/ANC.

Topical Report WCAP-16045-P-A was later supplemented with Addendum 1-A, "Qualification of the NEXUS Nuclear Data Methodology" (ADAMS Accession No. ML070320398), which was approved for licensing applications by the NRC staff on February 23, 2007. NEXUS includes both a re-parameterization of the PARAGON output and a new power reconstruction approach in ANC, and therefore serves to link the two codes (i.e. PARAGON and ANC). The NRC staff's SE for NEXUS states, in part, that "the NEXUS/ANC code system is adequate to replace the PARAGON/ANC code system wherever the latter is used in NRC-approved methodologies. The NRC staff, furthermore, has determined that NEXUS/ANC is qualified as a stand-alone code system so long as its use is limited by the provisions listed in Section 4.0 of this safety evaluation." The sole condition limits the usage of NEXUS to uranium-fueled pressurized-water reactors (PWRs).

The licensee is not seeking approval to use NEXUS/ANC in this license amendment request (LAR); however, NEXUS/ANC was used for benchmarking for critical boron, isothermal temperature coefficient (ITC), MTC, and rod worths in Table 1 of the Beaver Valley Power Station (BVPS) request for additional information (RAI) Question 2 in Attachment 5 of the LAR. The benchmarking calculations were performed to demonstrate that the NEXUS/ANC code system would produce comparable results to the PHOENIX-P/ANC code system. The NRC staff questioned the use of NEXUS/ANC code system in lieu of PARAGON/ANC for these benchmarking calculations. The licensee provided a detailed justification for use of NEXUS/ANC versus the PARAGON/ANC in its RAI response by letter dated July 7, 2016. The licensee concluded that if PARAGON/ANC would be used instead of the NEXUS/ANC code system for the calculations in Table 1 of the BVPS RAI Question 2 in Attachment 5 of the LAR, the same conclusion would be reached that PARAGON/ANC could be used for the EOL MTC calculations. The licensee stated that the NEXUS/ANC code system uses the same PARAGON lattice code and the ANC nodal code as the previously approved code system (i.e.,

PARAGON/ANC - WCAP-16045-P-A). Additionally, the licensee stated that all cross sections and physics parameter lattice code calculations in the NEXUS/ANC code are completed by PARAGON and that the overall tabulation style is different between NEXUS/ANC and PARAGON/ANC but the same lattice code is used to determine cross sections and other physics parameters. The licensee pointed to benchmarks between the code systems provided in WCAP-16045-P-A, Addendum 1, Table 19. In addition, the NRC has approved the use of PARAGON/ANC for use with the EOL MTC exemption in previous applications (ADAMS Accession No. ML16120A473). The NRC reviewed the discussion in the letter dated July 7, 2016, and the benchmark results provided in WCAP-16045-P-A, Addendum 1, Table 19 and concluded that the use of NEXUS/ANC in lieu of PARAGON/ANC for the BVPS RAI Question 2 in Attachment 5 of the LAR would result in the same conclusion (i.e., that PARAGON/ANC would produce comparable results to the PHOENIX-P/ANC code system).

3.0 REGULATORY EVALUATION

The following explains the applicability of General Design Criteria (GDC) for IP2 and IP3. The construction permits (CPs) for IP2 and IP3 were issued by the Atomic Energy Commission (AEC) on October 14, 1966, and August 13, 1969, respectively, and the operating licenses were issued on September 28, 1973, and December 12, 1975, respectively. The plant GDC are discussed in the Updated Final Safety Analysis Report (UFSAR) Chapter 1.3, "General Design Criteria," with more details given in the applicable UFSAR sections. The AEC published the final rule that added Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix A, "General Design Criteria for Nuclear Power Plants," in the *Federal Register* (36 FR 3255) on February 20, 1971, with the rule effective on May 21, 1971. In accordance with an NRC staff requirements memorandum from S. J. Chilk to J. M. Taylor, "SECY-92-223 - Resolution of Deviations Identified During the Systematic Evaluation Program," dated September 18, 1992 (ADAMS Accession No. ML003763736), the Commission decided not to apply the Appendix A GDC to plants with CPs issued prior to May 21, 1971. Therefore, the GDC, which constitute the licensing bases for IP2 and IP3, are those in the UFSARs.

As discussed in the UFSARs, the licensees for IP2 and IP3 have made some changes to the facilities over the life of the units that have committed to some of the GDCs from 10 CFR Part 50, Appendix A. The extent to which the Appendix A GDC have been invoked can be found in specific sections of the UFSARs and in other IP2 and IP3 licensing basis documentation, such as license amendments.

Section 50.36(c)(2) of 10 CFR provides the requirement for the establishment of technical specification limiting conditions for operation (LCOs), stating:

> (ii) A technical specification limiting condition for operation of a nuclear reactor must be established for each item meeting one or more of the following criteria: ...
>
> (B) *Criterion 2,* A process variable, design feature, or operating restriction that is an initial condition of a design basis accident or transient analysis that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.

Section 50.36(c)(3) of 10 CFR provides additional regulations for the establishment of surveillance requirements (SRs), stating:

> (3) *Surveillance requirements.* Surveillance requirements are the requirements relating to test, calibration, or inspection to assure that the necessary quality of systems and components is maintained, that facility operation will be within safety limits, and that the limiting conditions for operation will be met.

MTC is one of the process variables that fits Criterion 2 of 10 CFR 50.36(c)(2)(ii), with limits established in LCO 3.1.3 for IP2 and IP3. These limits, which are verified by SR 3.1.3.2, provide reasonable assurance that the value of the coefficient remains bounded by the condition assumed in the UFSAR accident and transient analyses. Operation within the design basis documented in the UFSAR helps provide reasonable assurance that the reactor will be operated in a safe manner.

Appendix A to 10 CFR Part 50, GDC 11, "Reactor inherent protection," provides design criteria regarding the plant design and its ability to compensate for a rapid increase in reactivity, and specifically states:

> The reactor core and associated coolant systems shall be designed so that in the power operating range the net effect of the prompt inherent nuclear feedback characteristics tends to compensate for a rapid increase in reactivity.

MTC is a process variable that is measured in order to verify that the plant will continue to be able to compensate for a rapid increase in reactivity. Given that the core and the reactor coolant system are not being modified by the proposed LAR, the NRC staff's review will focus on the appropriate implementation of WCAP-13749-P-A, which would exempt the licensee from the 300 parts per million (ppm) surveillance limit.

The LCO limits and SR acceptance criteria for IP2 and IP3 are contained within the plants' respective COLRs. The use of the COLR is supported by the guidance in NRC Generic Letter (GL) 88-16, "Removal of Cycle-Specific Parameter Limits from Technical Specifications," dated October 4, 1988 (ADAMS Accession No. ML031130447), which indicates that it is acceptable for licensees to control reactor physics parameter limits by specifying an NRC-approved calculation methodology. These parameter limits may be removed from the TSs and placed in an administratively-controlled cycle-specific COLR, which is defined in the TSs and required to be submitted to the NRC every operating cycle or each time it is revised. As recommended by GL 88-16, the IP2 and IP3 TSs include lists of references for the NRC-approved calculation methodologies used to generate the cycle-specific operating limits. The change requested to TS 5.6.5 would add WCAP-13749-P-A as a COLR reference in this list.

Topical Reports WCAP-13749-P-A, WCAP-16045-P-A, and WCAP-10965-P-A have all been reviewed and approved by the NRC staff. This review will therefore focus on verifying that the methodologies are applicable at IP2 and IP3 and that the conditions and limitations of the generic approval are satisfied for the IP2 and IP3 specific applications.

4.0 TECHNICAL EVALUATION

4.1 Description of Changes

The proposed changes are:

1) SR 3.1.3.2 would be revised to exempt the requirement for a near-EOL MTC measurement, if the specified benchmark criteria and COLR requirements for near-EOL MTC are satisfied. Specifically a note is added to SR 3.1.3.2 that states:

   SR 3.1.3.2 is not required to be performed by measurement provided that benchmark criteria in WCAP-13749-P-A are satisfied and the Revised Predicted MTC satisfies the 300 ppm surveillance limit specified in the COLR.

2) A revision to TS 5.6.5, "Core Operating Limits Report," that would add the following topical reports to the list of references for the IP2 and IP3 COLRs:

   - WCAP-13749-P-A, "Safety Evaluation Supporting the Conditional Exemption of the Most Negative EOL Moderator Temperature Coefficient Measurement," March 1997
   - WCAP-16045-P-A, "Qualification of the Two-Dimensional Transport Code PARAGON," August 2004
   - WCAP-10965-P-A, "ANC: A Westinghouse Advanced Nodal Computer Code," September 1986.

4.1.1 Reason for Change

As previously discussed, TS 3.1.3 places limits on the MTC such that plant operation will be bounded by the accident analysis assumptions. TS 3.1.3 currently requires two measurements of MTC: one at hot zero power (HZP) beginning-of-cycle (BOC) conditions to verify that the plant will operate within the most positive MTC limit, and a second at hot full power (HFP) near-EOC conditions to verify that the plant will operate within the most negative MTC limit. MTC is not directly measured; rather, it is obtained by subtracting calculated values of the Doppler temperature coefficient from measurements of the ITC.

The most negative MTC LCO limit requires the MTC to be less negative than the specified limit for a condition that corresponds to all-rods-out EOC rated thermal power operation. To demonstrate compliance with the most negative MTC LCO, the surveillance required by SR 3.1.3.2 entails verification of the MTC after an equilibrium core boron concentration of 300 ppm is reached. From the time that a 300 ppm boron concentration is reached at the end of the cycle, the HFP MTC will gradually become more negative due to boron concentration reduction and additional core burnup. To account for this effect, there is sufficient margin between the 300 ppm MTC surveillance limit and the EOC LCO limit (i.e., the 300 ppm MTC surveillance limit is sufficiently less negative than the EOC LCO limit) to ensure that the LCO limit will be met as long as the 300 ppm MTC surveillance limit is met.

At BOC HZP conditions, the ITC measurement is relatively accurate and simple to perform because it is done at isothermal conditions and is not complicated by changes in the core enthalpy rise or the presence of xenon. According to the licensee, the EOC HFP MTC measurement is much more difficult to perform because it is made at or near HFP conditions. HFP operation may result in minor perturbations to the soluble boron concentration, xenon concentration and distribution, fuel temperature, enthalpy rise, and other significant parameters. Any or all of these parameters may have an impact on the MTC and potentially result in significant measurement uncertainty, yielding inaccurate measurement results if not accounted for properly during the test.

The licensee also indicated that a motivating factor for the conditional EOC MTC measurement exemption is that the MTC measurement includes time at reduced power in order to perform the measurement. As well, the test deliberately introduces a perturbation into normal reactor operations, and the licensee is concerned that the measurement increases the potential for human performance errors involving reactivity manipulation. The use of this conditional exemption method was therefore proposed by the licensee to improve plant availability and minimize perturbations on plant operation.

4.2 Evaluation of TS Changes

The licensee proposed implementation of the methodology described in WCAP-13749-P-A, which was approved by the NRC with the following conditions:

1. Only PHOENIX/ANC calculation methods should be used for the plant-specific analyses for the determination of the EOL MTC, and

2. The predictive correction shall be reexamined if changes in core fuel designs or continued MTC calculation/measurement data show significant effect on the predictive correction.

The LAR provided dispositions to the two conditions, both of which concluded that IP2 and IP3 would meet both of the conditions.

4.2.1 WCAP-13749-P-A Condition 1

The licensee states that the core design calculations have transitioned from nuclear calculations that were performed with the PHOENIX-P lattice code to generate cross section data to those that are performed with the PARAGON lattice code.

The licensee also stated that PARAGON/ANC has been qualified as a direct substitute for the PHOENIX-P/ANC code system citing language from the Conditions and Limitations section of the NRC SE for WCAP-16045-P-A:

> The PARAGON code can be used as a replacement for the PHOENIX-P lattice code, whenever the PHOENIX-P code is used in NRC approved methodologies."

To further support the claim, the licensee provided additional quantitative data in Attachment 5 of the LAR. Similar data was requested by the NRC staff in previous reviews of the application of WCAP-13749-P-A for BVPS and Joseph M. Farley Nuclear Plant/Vogtle Electric Generating

Plant. The data included measured and calculated BOC HZP ITC for recent cycles at IP2 and IP3. The licensee clarified in its response to RAI 3 by letter dated March 2, 2016, that PHOENIX-P/ANC calculated the IP2, Cycle 20 and 21 and IP3, Cycle 17 values, while the PARAGON/ANC code system predicted IP2, Cycle 22 and IP3, Cycle 18 and 19. Additionally, the data included benchmarks comparing PHOENIX-P/ANC and NEXUS/ANC computations of critical boron concentration, BOC HZP ITC, and EOC HFP MTC based on calculations and measurements from recent cores throughout the PWR fleet.

The licensee is not seeking approval to use NEXUS/ANC in this LAR; however, NEXUS/ANC was used for benchmarking for critical boron, ITC, MTC, and rod worths in Table 1 of the BVPS RAI Question 2 in Attachment 5 of the LAR. The benchmarking calculations were performed to demonstrate that the NEXUS/ANC code system would produce comparable results to the PHOENIX-P/ANC code system. The NRC staff questioned the use of NEXUS/ANC code system in lieu of PARAGON/ANC for these benchmarking calculations. The licensee provided a detailed justification for use of NEXUS/ANC versus the PARAGON/ANC in its RAI response by letter dated July 7, 2016. The licensee concluded that if PARAGON/ANC were to be used instead of the NEXUS/ANC code system, the same conclusion would be reached that PARAGON/ANC could be used for the EOL MTC calculations. The licensee stated that the NEXUS/ANC code system uses the same PARAGON lattice code and the ANC nodal code as the previously approved code system (i.e., PARAGON/ANC - WCAP-16045-P-A). Additionally, the licensee stated that all cross sections and physics parameter lattice code calculations in the NEXUS/ANC code are completed by PARAGON and that the overall tabulation style is different between NEXUS/ANC and PARAGON/ANC but the same lattice code is used to determine cross sections and other physics parameters. The licensee pointed to benchmarks between the code systems provided in WCAP-16045-P-A, Addendum 1, Table 19. In addition, the NRC staff has approved the use of PARAGON/ANC for use with the EOL MTC exemption (ADAMS Accession No. ML16120A473). The NRC staff reviewed the discussion in the RAI response and the benchmark results provided in WCAP-16045-P-A, Addendum 1, Table 19 and concludes that the use of NEXUS/ANC in lieu of PARAGON/ANC for the BVPS RAI Question 2 in Attachment 5 of the LAR would result in the same conclusion (i.e., that PARAGON/ANC would produce comparable results to the PHOENIX-P/ANC code system).

The NRC staff analyzed the data provided in Attachment 5 of the LAR to determine whether the numerical value of the predictive correction approved in WCAP-13749-P-A remained valid for the new neutronics codes and core designs. The predictive correction term is based largely on the variance of the measured minus predicted BOC HZP ITC, which is combined with two other factors to get the BOC HZP MTC as discussed in WCAP-13749-P-A. As the two other factors in the predictive correction term are not changed in the LAR, the staff focused on the BOC HZP ITC data provided by the licensee. The measured, minus predicted values, for recent cores of IP2 and IP3 was not statistically distinguishable from that of historic cores originally shown in WCAP-13749-P-A. The data provided also showed that NEXUS/ANC provides a more precise (lower variance) calculation of BOC HZP ITC than originally provided in WCAP-13749-P-A with approximately the same accuracy.

The licensee also addressed the deviation between measured and predicted critical boron concentration throughout the cycle. The licensee stated that the predictions assume the nominal boron-10 fractions and that the effect of boron-10 depletion was largest at middle of cycle. The licensee's description explains the observed increase in measured minus predicted

for middle of cycle. The NRC staff determined that this explanation adequately addressed the observed response.

Based on the previous discussion, the NRC staff has therefore determined that the variance in measured, minus predicted BOC HZP ITC using PARAGON/ANC for contemporary cores, will be bounded by the value presented in WCAP-13749-P-A. The staff also determined that the licensee adequately explained the increased error in the critical boron concentration for the new cores and codes. The staff concludes that the predictive correction approved by the NRC for WCAP-13749-P-A is reproducible for the PARAGON/ANC code system as used in the analysis of contemporary cores. The licensee, therefore, satisfies the first condition.

4.2.2 WCAP-13749-P-A Condition 2

The second condition requires the predictive correction to be re-evaluated if new measured, minus predicted EOC HFP MTC data, shows a "significant effect" on the predictive correction or if core fuel design changes could have such an effect. Neither the NRC contractor's technical report on WCAP-13749-P-A nor the NRC staff's SE provide a definition of what constitutes a "significant effect." However, the NRC staff has previously stated that when reviewing applications of WCAP-13749-P-A, a significant effect would be a change in the standard deviation of measured, minus predicted EOC HFP MTC, such that the predictive correction discussed is no longer bounding.

The NRC staff considers the second condition to mean that the EOC HFP MTC measurement will be performed in the cycle following a plant change that could cause a significant effect by altering the standard deviation of the measured, minus predicted data, or the behavior of MTC in the reactor. The NRC staff considers such changes to include, but not be limited to, the following:

1. An increase in the allowable core thermal power of greater than two percent rated thermal power,

2. A change in design operating cycle length from the current strategy, or

3. The introduction of a new reload batch fuel product line (excluding Lead Test Assembly programs).

The licensee's disposition of Condition 2 in the LAR states that prior to the use of the conditional exemption technique, the licensee will confirm that core design changes and MTC calculation and measurement data do not show a significant impact on the predictive correction. The administrative controls for this confirmation will reside in the Indian Point procedure that controls the EOL MTC surveillance. If a significant effect is found, the use of the predictive correction will be re-examined.

The WCAP-13749-P-A methodology also requires certain core performance criteria, such as startup physics tests and cycle reactivity measurements, to be met to allow exemption of the EOC HFP MTC measurement. This requirement is captured in the proposed changes to SR 3.1.3.2 for IP2 and IP3. The NRC staff determined that Condition 2 is satisfied because the licensee stated that the effects of core design changes will be verified relative to the use of the

predictive correction and IP2 and IP3 will be required by the TS to adhere to the acceptance criteria of WCAP-13749-P-A.

4.2.3 SR 3.1.3.2 Conclusion

The NRC staff, therefore, determines that the implementation of WCAP-13749-P-A is acceptable as the basis for modification of SR 3.1.3.2 because both conditions of WCAP-13749-P-A are satisfied. The staff reviewed the proposed changes to SR 3.1.3.2 in this context and determined that they are acceptable.

4.2.4 Changes to TS 5.6.5

The licensee proposed changes to TS 5.6.5 to add WCAP-13749-P-A as a reference methodology used in the preparation of the COLR. The proposed changes to TS 5.6.5 are acceptable because the implementation of WCAP-13749-P-A is acceptable as found in this SE.

In past licensing efforts involving implementation of WCAP-13749-P-A, the NRC staff has required licensees to include WCAP-16045-P-A (i.e. PARAGON) in the list of COLR references. In the RAI 2 response by letter dated March 2, 2016, the licensee proposed to add WCAP-16045-P-A and, additionally WCAP-10965-P-A (i.e., ANC), to the TS 5.6.5 COLR reference list as part of the current LAR review. Both WCAP-16045-P-A and WCAP-10965-P-A are generically approved methodologies and are used, in concert with WCAP-13749-P-A, to support the conditional exemption of the 300 ppm surveillance limit MTC measurement. Additionally, both methodologies are currently being used for core design calculations at IP2 and IP3. Thus, the NRC staff finds the implementation of these methodologies into the list of COLR references is acceptable for IP2 and IP3

The NRC staff reviewed the information provided by the licensee and determined that WCAP-13749-P-A, "Safety Evaluation Supporting the Conditional Exemption of the Most Negative EOL Moderator Temperature Coefficient Measurement," is applicable and implemented appropriately at both IP2 and IP3 with the PARAGON/ANC nuclear methodology described in WCAP-16045-P-A. The staff also evaluated the licensee's proposed modifications to TS SR 3.1.3.2, "Moderator Temperature Coefficient," and TS 5.6.5, "Core Operating Limits Report." The staff concludes that the proposed TS SR 3.1.3.2 modifications for IP2 and IP3 are acceptable based on the applicability of the WCAP-13749-P-A methodology and the licensee meeting all conditions specified in the WCAP-13749-P-A SE. Therefore, the proposed modifications to TS 5.6.5 are determined to be acceptable based on the applicability of the WCAP-13749-P-A methodology.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the New York State official was notified of the proposed issuance of the amendment. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendments change a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 and changes surveillance requirements. The NRC staff has determined that the amendments involve no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendments involve no significant hazards consideration, published in the *Federal Register* on April 5, 2016 (81 FR 19647), and there has been no public comment on such finding. Accordingly, the amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendments.

6.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) there is reasonable assurance that such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendments will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributor: Joshua M. Borromeo, NRR/DSS/SRXB

Date: November 15, 2016

November 15, 2016

Vice President, Operations
Entergy Nuclear Operations, Inc.
Indian Point Energy Center
450 Broadway, GSB
P.O. Box 249
Buchanan, NY 10511-0249

SUBJECT: INDIAN POINT NUCLEAR GENERATING UNIT NOS. 2 AND 3 - ISSUANCE OF AMENDMENTS RE: CONDITIONAL EXEMPTION FROM END-OF-LIFE MODERATOR TEMPERATURE COEFFICIENT (CAC NOS. MF7193 AND MF7194)

Dear Sir or Madam:

The U.S. Nuclear Regulatory Commission has issued the enclosed Amendment No. 285 to Facility Operating License No. DPR-26 for the Indian Point Nuclear Generating Unit No. 2 and Amendment No. 261 to Facility Operating License No. DPR-64 for the Indian Point Nuclear Generating Unit No. 3. The amendments consist of changes to the Technical Specifications (TSs) in response to your application dated December 10, 2015, as supplemented by letters dated March 2, July 7, and October 6, 2016.

The amendments revise TSs 3.1.3, "Moderator Temperature Coefficient (MTC)," and 5.6.5, "Core Operating Limits Report (COLR)," to allow exemption from the normally required near end-of-life MTC measurement by placing a set of conditions on reactor core operation. If these conditions are met, the MTC measurement could be replaced by a calculated value.

A copy of the related Safety Evaluation is enclosed. A Notice of Issuance will be included in the Commission's next biweekly *Federal Register* notice.

Sincerely,
/RA/
Douglas V. Pickett, Senior Project Manager
Plant Licensing Branch I-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-247 and 50-286

Enclosures:
1. Amendment No. 285 to DPR-26
2. Amendment No. 261 to DPR-64
3. Safety Evaluation

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ADAMS ACCESSION NO.: ML16215A243

OFFICE	NRR/DORL/LPL1-1/PM	NRR/DORL/LPL1-1/LA	NRR/DSS/SRXB/BC(A)
NAME	DPickett	PBlechman for KGoldstein	EOesterle by memo dated
DATE	08/17/16	08/16/16	07/21/16
OFFICE	NRR/DSS/STSB/BC	OGC	NRR/DORL/LPL1-1/BC(A)
NAME	AKlein	STurk NLO w/comments	BMozafari (RPascarelli for)
DATE	08/19/16	08/26/16	11/15/16

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