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NL-16-068

July 7, 2016

U.S. Nuclear Regulatory Commission  
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Rockville, MD 20852-2738

**SUBJECT** Response to Request for Additional Information Related to License Amendment Request Regarding Conditional Exemption from End-of-Life (EOL) Moderator Temperature Coefficient (MTC) Measurement (CAC Nos. MF-7193 and MF-7194) Indian Point Unit Numbers 2, and 3  
Docket Nos. 50-247 and 50-286  
License Nos. DPR-26 and DPR-64

**REFERENCES:**

1. Entergy Letter NL-15-144 to NRC Regarding License Amendment Request – Conditional Exemption from End-of-Life (EOL) Moderator Temperature Coefficient (MTC) Measurement, dated December 10, 2015.
2. Entergy Letter NL-16-027 to NRC Regarding Response to Request for Additional Information Related to License Amendment Request Regarding Conditional Exemption from End-of-Life (EOL) Moderator Temperature Coefficient (MTC) Measurement, dated March 2, 2016.
3. NRC Letter to Entergy Request For Additional Information Related to License Amendment Request Regarding Moderator Temperature Coefficient Measurement Change (CAC NOS. MF7193 and MF7194), dated June 10, 2016

Dear Sir or Madam:

Pursuant to 10 CFR 50.90, Entergy Nuclear Operations, Inc. (Entergy) requested a License Amendment for Indian Point No.2 (IP2), Operating License DPR-26, Docket No. 50-247, and for Indian Point No.3 (IP3), Operating License DPR-64, Docket No. 50-286 in Reference 1. This was supplemented in Reference 2. The purpose of this letter is to submit additional information in response to an NRC request for additional information transmitted via Reference 3.

The License Amendment Request proposed to change the near-end of life (EOL) Moderator Temperature Coefficient (MTC) Surveillance Requirement (SR) 3.1.3.2 and Specification 5.6.5 for Indian Point Units 2 and 3 by placing a set of conditions on reactor core operation, which if

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met, would allow exemption from the required MTC measurement. Attachments 1 and 2 (Attachment 2 is marked as proprietary and it is requested, as supported by the Enclosed Affidavit, that the material in Attachment 2 be withheld from public disclosure pursuant to 10 CFR 2.390(b)(4)) provide the response to the request for additional information contained in Reference 3. There are no additional changes to the TS pages from those submitted in Reference 2.

In accordance with 10 CFR 50.91(b)(1), "State Consultation," a copy of this letter and its associated Attachments is being provided to the designated New York State officials.

This letter contains no new NRC commitments. Should you have any questions concerning this letter, or require additional information, please contact Robert Walpole, Manager, Regulatory Assurance at (914) 254-6710.

I declare under penalty of perjury that the foregoing is true and correct. Executed on July 7, 2016.

Sincerely,

 Richard J. Burroni for Larry Cyle 7/7/16

LC/sp

- Attachment: 1. Response to Request for Additional Information regarding Conditional Exemption from End-of-Life (EOL) Moderator Temperature Coefficient (MTC) Measurement
2. PROPRIETARY Response to Request for Additional Information regarding Conditional Exemption from End-of-Life (EOL) Moderator Temperature Coefficient (MTC) Measurement.
- Enclosure: Application for Withholding Proprietary Information from Public Disclosure

cc: Mr. Douglas Picket, Senior Project Manager, NRC NRR DORL  
Mr. Daniel H. Dorman, Regional Administrator, NRC Region 1  
NRC Resident Inspector's Office  
Mr. Francis J. Murray, Jr., President and CEO, NYSERDA Ms.  
Bridget Frymire, New York State Dept. of Public Service

ATTACHMENT 1 TO NL-16-068

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION  
REGARDING CONDITIONAL EXEMPTION FROM END-OF-LIFE (EOL)  
MODERATOR TEMPERATURE COEFFICIENT (MTC) MEASUREMENT

ENTERGY NUCLEAR OPERATIONS, INC.  
INDIAN POINT NUCLEAR GENERATING UNIT NOS. 2 AND 3  
DOCKET NOS. 50-247 AND 50-286

Response to Request for Additional Information Regarding Conditional  
Exemption from End-Of-Life (EOL) Moderator Temperature  
Coefficient (MTC) Measurement

NRC Question

In the application of December 10, 2015, as supplemented, the licensee stated that a comparison of PARAGON/ANC, without the application of the intermediate NEXUS code, would result in similar calculated values since NEXUS automates multiple PARAGON lattice transport calculations to generate a suite of cross-sections for ANC calculation. Since the licensee is seeking approval for use of the end of life moderator temperature coefficient (EOL MTC) Exemption Methodology with PARAGON, the Nuclear Regulatory Commission staff is asking the licensee to provide additional justification for this statement by providing the results for PARAGON for the same benchmarking data points provided in the licensee's letter dated December 10, 2015, Attachment 5, Table 1 of the Beaver Valley Power Station request for additional information Question 2.

In lieu of providing additional benchmarking results, a more detailed justification could be provided on how the results of the benchmarking of PHOENIX-P to PARAGON in the NRC approved methodology WCAP-16045 and the results of the benchmarking of PARAGON to NEXUS in the NRC approved methodology WCAP-16045 1-A can be used to support the use of PARAGON for the EOL MTC Exemption Methodology.

Entergy Response

It is the expert opinion of Westinghouse that all the code systems used by Westinghouse, in core design analysis, predict comparable MTC parameters. Therefore, a more detailed justification for the use of PARAGON is provided to address this request for additional information (RAI) question in lieu of providing additional benchmarking results.

The nomenclature for this response is based on the nomenclature used in WCAP-16045-P-A, Addendum 1. This addendum utilizes the boron letdown (BL) nomenclature to signify the cross sections created using a cycle specific boron letdown curve. This will be used throughout the response to signify when cross sections are created utilizing a cycle specific boron letdown curve. PARAGON can be used both with and without utilizing the cycle specific boron letdown methodology. When a cycle specific boron letdown curve is not used it is referred to as NEXUS. PHOENIX-P is only utilized with the cycle specific boron letdown curve method.

All the industrial core design code systems are founded on a two-step approach. The first step entails using a two-dimensional transport based lattice physics code to generate the two-group data that will be used in the second step to simulate the three-dimensional core using diffusion theory. The methodology of how the data is tabulated by the lattice code differs from package to package but has one common "reproducibility" rule which is the ability to reproduce the lattice results in all conditions (nominal and off-nominal) by the nodal code. If the same single two-dimensional assembly case was modelled both in the lattice and the nodal code (using the tabulated data from the lattice code), the results of the simulations must be comparable for all conditions (especially the conditions not directly included in the tabulation points). The two-group data tabulation covers all possible conditions that an assembly will see in its lifetime during the operation of the reactor core.

The underlying physics governing the reactor simulations is basically confined in the lattice code and the nodal code. The way the data is communicated between the two codes is a common mathematical process that would not affect the results as long as the reproducibility rule is adopted. The overall acceptability of the current code sets used by Westinghouse have been accepted in the ANC, PHOENIX-P, and PARAGON WCAPs.

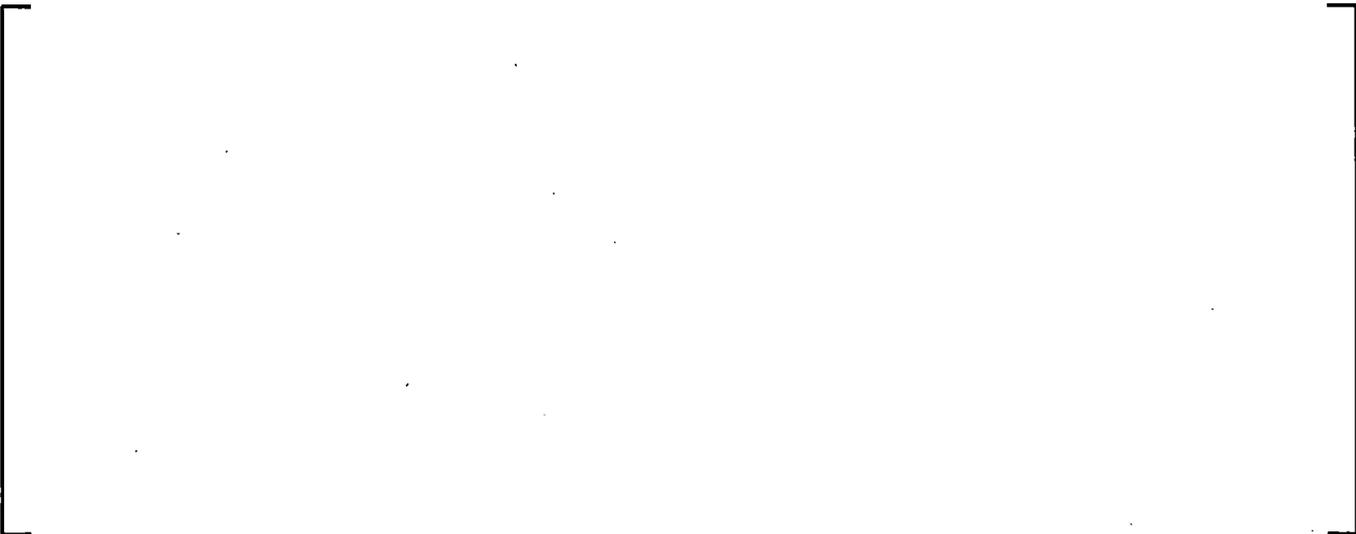
Currently, Westinghouse uses three code packages for core design applications, namely:

- PHOENIX-P/ANC(BL), where PHOENIX-P is the lattice code and ANC(BL) is the nodal code using the boron letdown methodology for the two-group data tabulation. This is the code system used initially to license the end of life (EOL) moderator temperature coefficient (MTC) exemption methodology. The boron letdown methodology utilizes a cycle specific boron letdown curve when developing the steady state cross section set for use in the nodal code.
- PARAGON/ANC(BL), [ ]<sup>a,c</sup> where PARAGON is the lattice code and the same ANC(BL) nodal code with the same boron letdown tabulation methodology as the PHOENIX-P/ANC(BL) system. The only difference in this case is the lattice code. This code system was proved to be equivalent to PHOENIX-P/ANC(BL) in the topical report WCAP-16045-P-A. Table 4-16 of the WCAP-16045-P-A shows how the EOL MTC predictions of the two codes (PARAGON and PHOENIX-P) are very similar and the Table 4-3 of the same report shows also the similarity of the hot zero power (HZP) isothermal temperature coefficients (ITC) values of the two codes.
- NEXUS/ANC, where the system uses the same PARAGON lattice code and the same nodal code ANC as the previous system (PARAGON/ANC(BL)). The difference between PARAGON/ANC(BL) and NEXUS/ANC resides in the way the two-group data are tabulated. NEXUS system is based on the once-through cross section methodology, where the cross sections (and other parameters) are generated upfront once for the entire lifetime of an assembly. All cross sections and physics parameter lattice code calculations in the NEXUS code are completed by PARAGON. The overall tabulation style is different between NEXUS/ANC and PARAGON/ANC(BL) but the same lattice code is used to determine cross sections and other physics parameters. The tabulation style differences do not affect the calculation of the moderator temperature coefficient (MTC) by ANC. The once-through and boron letdown methodologies are proved to be equivalent in the topical report WCAP-16045-P-A, Addendum 1. Table 19 of this topical report shows a comparison of the ITC and MTC predictions of the two systems.

Since the ANC nodal code is common to the three code systems, then any difference in the MTC predictions between the three systems should result from the differences in the lattice codes of these systems, e.g. PHOENIX-P and PARAGON.

PHOENIX-P and PARAGON share many modules that make them similar. The main components that affect the physics of these codes are compared in the following sections:

[ ]<sup>a,c</sup>



[ ]<sup>a,c</sup> This can be explained by the fact that MTC is a differential parameter and the calculation of MTC is performed by a small incremental perturbation of the fuel and coolant temperatures, thus the differential term is not expected to be affected by [ ]<sup>a,c</sup>

It has been shown in Table 1 of the BVPS RAI question 2 response that PHOENIX-P/ANC(BL) and NEXUS/ANC have an equivalent behavior for the important characteristics pertinent to WCAP-13749-P-A. [ ]<sup>a,c</sup>

This data shows a similar statistical and predictive profile between PARAGON and PHOENIX-P based ANC(BL) models making it an acceptable substitute for PHOENIX-P in regards to WCAP-13749-P-A.

Table 19 of WCAP-16045-P-A, Addendum 1 shows BOC HZP ITC values for several cycles. The overall predictive M-P shows a very comparable difference between NEXUS/ANC and PARAGON/ANC(BL). PARAGON/ANC(BL) compares favorably through both methodology and results comparison with either PHOENIX-P/ANC(BL) or NEXUS/ANC. Both PHOENIX-P/ANC(BL) and NEXUS/ANC have been accepted for use with EOL MTC exemption WCAP-13749-P-A. The overall comparable results between PHOENIX-P/ANC(BL), PARAGON/ANC(BL), and NEXUS/ANC make any of the code packages used by Westinghouse suitable for use with EOL MTC exemption WCAP-13749-P-A.

From the above discussion, it can be concluded that for EOL MTC calculations, PHOENIX-P and PARAGON predictions are indistinguishable. NEXUS/ANC is already proved similar in EOL MTC parameters to PHOENIX-P/ANC(BL) in Table 1 of the original BVPS RAI question 2 response. If PARAGON/ANC(BL) (instead of NEXUS/ANC) was used in Table 1 of the BVPS RAI question 2, it would lead to the same conclusion that PARAGON/ANC(BL) and PHOENIX-P/ANC(BL) predict similar EOL MTC parameters as discussed in the WCAP-13749-P-A licensed methodology.

References

1. H. Matsumoto, M. Ouisloumen and T. Takeda, "*Development of Spatially Dependent Resonance Shielding Method*," J.Nucl.Sci.Technol.vol.42, No.8 pp.688-694(2005).

ENCLOSURE TO NL-16-068

APPLICATION FOR WITHHOLDING PROPRIETARY  
INFORMATION FROM PUBLIC DISCLOSURE

ENERGY NUCLEAR OPERATIONS, INC.  
INDIAN POINT NUCLEAR GENERATING UNIT NOS. 2 AND 3  
DOCKET NOS. 50-247 AND 50-286



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CAW-16-4435

June 20, 2016

APPLICATION FOR WITHHOLDING PROPRIETARY  
INFORMATION FROM PUBLIC DISCLOSURE

Subject: CE-16-325, Attachment 1, "Request for Additional Information (RAI) Response Clarification on NEXUS and PARAGON Differences for Indian Point EOL MTC Elimination" (Proprietary)

The Application for Withholding Proprietary Information from Public Disclosure is submitted by Westinghouse Electric Company LLC (Westinghouse), pursuant to the provisions of paragraph (b)(1) of Section 2.390 of the Commission's regulations. It contains commercial strategic information proprietary to Westinghouse and customarily held in confidence.

The proprietary information for which withholding is being requested in the above-referenced report is further identified in Affidavit CAW-16-4435 signed by the owner of the proprietary information, Westinghouse Electric Company LLC. The Affidavit, which accompanies this letter, sets forth the basis on which the information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in paragraph (b)(4) of 10 CFR Section 2.390 of the Commission's regulations.

Accordingly, this letter authorizes the utilization of the accompanying Affidavit by Entergy Nuclear Operations, Inc.

Correspondence with respect to the proprietary aspects of the Application for Withholding or the Westinghouse Affidavit should reference CAW-16-4435, and should be addressed to James A. Gresham, Manager, Regulatory Compliance, Westinghouse Electric Company, 1000 Westinghouse Drive, Building 3 Suite 310, Cranberry Township, Pennsylvania 16066.

A handwritten signature in black ink, appearing to read 'J. A. Gresham'.

James A. Gresham, Manager  
Regulatory Compliance

June 20, 2016

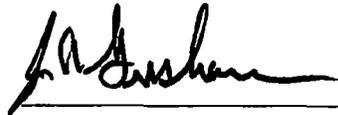
AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

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COUNTY OF BUTLER:

I, James A. Gresham, am authorized to execute this Affidavit on behalf of Westinghouse Electric Company LLC (Westinghouse), and that the averments of fact set forth in this Affidavit are true and correct to the best of my knowledge, information, and belief.



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James A. Gresham, Manager  
Regulatory Compliance

- (1) I am Manager, Regulatory Compliance, Westinghouse Electric Company LLC (Westinghouse), and as such, I have been specifically delegated the function of reviewing the proprietary information sought to be withheld from public disclosure in connection with nuclear power plant licensing and rule making proceedings, and am authorized to apply for its withholding on behalf of Westinghouse.
- (2) I am making this Affidavit in conformance with the provisions of 10 CFR Section 2.390 of the Commission's regulations and in conjunction with the Westinghouse Application for Withholding Proprietary Information from Public Disclosure accompanying this Affidavit.
- (3) I have personal knowledge of the criteria and procedures utilized by Westinghouse in designating information as a trade secret, privileged or as confidential commercial or financial information.
- (4) Pursuant to the provisions of paragraph (b)(4) of Section 2.390 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld.
  - (i) The information sought to be withheld from public disclosure is owned and has been held in confidence by Westinghouse.
  - (ii) The information is of a type customarily held in confidence by Westinghouse and not customarily disclosed to the public. Westinghouse has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system constitute Westinghouse policy and provide the rational basis required.

Under that system, information is held in confidence if it falls in one or more of several types, the release of which might result in the loss of an existing or potential competitive advantage, as follows:

    - (a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where prevention of its use by any of Westinghouse's competitors without license from Westinghouse constitutes a competitive economic advantage over other companies.

- (b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage, e.g., by optimization or improved marketability.
  - (c) Its use by a competitor would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing a similar product.
  - (d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of Westinghouse, its customers or suppliers.
  - (e) It reveals aspects of past, present, or future Westinghouse or customer funded development plans and programs of potential commercial value to Westinghouse.
  - (f) It contains patentable ideas, for which patent protection may be desirable.
- (iii) There are sound policy reasons behind the Westinghouse system which include the following:
- (a) The use of such information by Westinghouse gives Westinghouse a competitive advantage over its competitors. It is, therefore, withheld from disclosure to protect the Westinghouse competitive position.
  - (b) It is information that is marketable in many ways. The extent to which such information is available to competitors diminishes the Westinghouse ability to sell products and services involving the use of the information.
  - (c) Use by our competitor would put Westinghouse at a competitive disadvantage by reducing his expenditure of resources at our expense.
  - (d) Each component of proprietary information pertinent to a particular competitive advantage is potentially as valuable as the total competitive advantage. If competitors acquire components of proprietary information, any one component

may be the key to the entire puzzle, thereby depriving Westinghouse of a competitive advantage.

- (e) Unrestricted disclosure would jeopardize the position of prominence of Westinghouse in the world market, and thereby give a market advantage to the competition of those countries.
  - (f) The Westinghouse capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.
- (iv) The information is being transmitted to the Commission in confidence and, under the provisions of 10 CFR Section 2.390, is to be received in confidence by the Commission.
  - (v) The information sought to be protected is not available in public sources or available information has not been previously employed in the same original manner or method to the best of our knowledge and belief.
  - (vi) The proprietary information sought to be withheld in this submittal is that which is appropriately marked in CE-16-325, Attachment 1, "Request for Additional Information (RAI) Response Clarification on NEXUS and PARAGON Differences for Indian Point EOL MTC Elimination" (Proprietary), for submittal to the Commission, being transmitted by Entergy Nuclear Operations, Inc. letter and Application for Withholding Proprietary Information from Public Disclosure, to the Document Control Desk. The proprietary information as submitted by Westinghouse is that associated with Entergy Nuclear Operations, Inc. request for NRC approval of Indian Point Units 2 and 3 Docket Nos. 50-247 and 50-286 License Amendment Request NL-15-144 Conditional Exemption from End-of-Life Moderator Temperature Coefficient (MTC) Measurement, and may be used only for that purpose.

- (a) This information is part of that which will enable Westinghouse to assist Entergy Nuclear Operations, Inc. obtain NRC approval of Indian Point Units 2 and 3 Docket Nos. 50-247 and 50-286 License Amendment Request NL-15-144 Conditional Exemption from End-of-Life Moderator Temperature Coefficient (MTC) Measurement.
- (b) Further, this information has substantial commercial value as follows:
- (i) Westinghouse plans to sell the use of similar information to its customers for the purpose of End-of-Life Moderator Temperature Coefficient (MTC) Measurement.
  - (ii) Westinghouse can sell support and defense of industry guidelines and acceptance criteria for plant-specific applications.
  - (iii) The information requested to be withheld reveals the distinguishing aspects of a methodology which was developed by Westinghouse.

Public disclosure of this proprietary information is likely to cause substantial harm to the competitive position of Westinghouse because it would enhance the ability of competitors to provide similar technical evaluation justifications and licensing defense services for commercial power reactors without commensurate expenses. Also, public disclosure of the information would enable others to use the information to meet NRC requirements for licensing documentation without purchasing the right to use the information.

The development of the technology described in part by the information is the result of applying the results of many years of experience in an intensive Westinghouse effort and the expenditure of a considerable sum of money.

In order for competitors of Westinghouse to duplicate this information, similar technical programs would have to be performed and a significant manpower effort, having the requisite talent and experience, would have to be expended.

Further the deponent sayeth not.

## **PROPRIETARY INFORMATION NOTICE**

Transmitted herewith are proprietary and non-proprietary versions of a document, furnished to the NRC in connection with requests for generic and/or plant-specific review and approval.

In order to conform to the requirements of 10 CFR 2.390 of the Commission's regulations concerning the protection of proprietary information so submitted to the NRC, the information which is proprietary in the proprietary versions is contained within brackets, and where the proprietary information has been deleted in the non-proprietary versions, only the brackets remain (the information that was contained within the brackets in the proprietary versions having been deleted). The justification for claiming the information so designated as proprietary is indicated in both versions by means of lower case letters (a) through (f) located as a superscript immediately following the brackets enclosing each item of information being identified as proprietary or in the margin opposite such information. These lower case letters refer to the types of information Westinghouse customarily holds in confidence identified in Sections (4)(ii)(a) through (4)(ii)(f) of the Affidavit accompanying this transmittal pursuant to 10 CFR 2.390(b)(1).

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