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PROPRIETARY INFORMATION - WITHHOLD UNDER 10 CFR 2.390
UPON REMOVAL OF ATTACHMENT 2 THIS LETTER IS UNCONTROLLED

Serial: RA-16-0036 10 CFR 50.90
October 3, 2016

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

SHEARON HARRIS NUCLEAR POWER PLANT, UNIT 1
DOCKET NO. 50-400 / RENEWED LICENSE NO. NPF-63

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261 / RENEWED LICENSE NO. DPR-23

SUBJECT: RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION (RAI) REGARDING APPLICATION TO REVISE TECHNICAL SPECIFICATIONS FOR METHODOLOGY REPORT DPC-NE-1008, REVISION 0

REFERENCES:

1. Duke Energy letter, *Application to Revise Technical Specifications for Methodology Report DPC-NE-1008-P Revision 0, "Nuclear Design Methodology Using CASMO-5/SIMULATE-3 for Westinghouse Reactors,"* dated August 19, 2015 (ADAMS Accession No. ML15236A044)
2. Duke Energy letter, *Supplemental Information for License Amendment Request Regarding Methodology Report DPC-NE-1008-P,* dated May 4, 2016 (ADAMS Accession No. ML16125A420)
3. NRC email, *Harris and Robinson RAIs – LAR to Adopt DPC-NE-1008-P, Revision 0 (MF6648 and MF6649)*, dated September 7, 2016 (ADAMS Accession No. ML16256A001)

Ladies and Gentlemen:

In Reference 1, Duke Energy Progress, LLC (formerly referred to as Duke Energy Progress, Inc.), referred to henceforth as "Duke Energy," submitted a request for an amendment to the Technical Specifications (TS) for Shearon Harris Nuclear Power Plant, Unit 1 (HNP) and H. B. Robinson Steam Electric Plant, Unit No. 2 (RNP). Specifically, Duke Energy requested NRC review and approval of DPC-NE-1008-P, Revision 0, "Nuclear Design Methodology Using CASMO-5/SIMULATE-3 for Westinghouse Reactors," and adoption of the methodology into the TS for HNP and RNP. In Reference 2, Duke Energy submitted a supplement to the amendment request that superseded Reference 1 in its entirety. In Reference 3, the NRC requested additional information (RAI) regarding this proposed amendment.

PROPRIETARY INFORMATION - WITHHOLD UNDER 10 CFR 2.390
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Attachment 2 provides Duke Energy's response to the Reference 3 RAI's. Attachment 2 contains information that is proprietary to Duke Energy. In accordance with 10 CFR 2.390, Duke Energy requests that Attachment 2 be withheld from public disclosure. An affidavit is included (Attachment 1) attesting to the proprietary nature of the information. A non-proprietary version of Attachment 2 is included in Attachment 3.

This submittal contains no new regulatory commitments. In accordance with 10 CFR 50.91, Duke Energy is notifying the states of North Carolina and South Carolina by transmitting a copy of this letter to the designated state officials. Should you have any questions concerning this letter, or require additional information, please contact Art Zaremba, Manager – Nuclear Fleet Licensing, at 980-373-2062.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on October 3, 2016.

Sincerely,

John Elnitsky
Senior Vice President – Nuclear Engineering

JBD

Attachments: 1. Affidavit of John Elnitsky
2. Response to NRC Request for Additional Information (Proprietary)
3. Response to NRC Request for Additional Information (Redacted)

cc: (all with Attachments unless otherwise noted)

C. Haney, Regional Administrator USNRC Region II
M. Riches, USNRC Senior Resident Inspector – HNP
J. Zeiler, USNRC Senior Resident Inspector – RNP
M. C. Barillas, NRR Project Manager – HNP
D. J. Galvin, NRR Project Manager – RNP
W. L. Cox, III, Section Chief, NC DHSR (Without Attachment 2)
S. E. Jenkins, Manager, Radioactive and Infectious Waste Management Section (SC) (Without Attachment 2)
A. Wilson, Attorney General (SC) (Without Attachment 2)
A. Gantt, Chief, Bureau of Radiological Health (SC) (Without Attachment 2)

bcc: (all with Attachments unless otherwise noted)

Chris Nolan
Art Zaremba
Leo Martin
Bob Harvey
Kate Nolan
David Cummings
File: (Corporate)
Electronic Licensing Library (ELL)

Ben Waldrep
John Caves
Gregg Simmons
Bentley Jones
Tanya Hamilton
Brian McCabe
Jim Eayres
Donald Griffith
Sean O'Connor
HNP NSRB
Lisa Crain (For HNP Licensing/Nuclear Records Files)

Mike Glover
Tony Pilo
Heidi Walters (For RNP Licensing/Nuclear Records Files)

Attachment 1

Affidavit of John Elnitsky

AFFIDAVIT of John Elnitsky

1. I am Senior Vice President of Nuclear Engineering, Duke Energy Corporation, and as such have the responsibility of reviewing the proprietary information sought to be withheld from public disclosure in connection with nuclear plant licensing and am authorized to apply for its withholding on behalf of Duke Energy.

2. I am making this affidavit in conformance with the provisions of 10 CFR 2.390 of the regulations of the Nuclear Regulatory Commission (NRC) and in conjunction with Duke Energy's application for withholding which accompanies this affidavit.

3. I have knowledge of the criteria used by Duke Energy in designating information as proprietary or confidential. I am familiar with the Duke Energy information contained in Attachment 2 to Duke Energy RAI response letter RA-16-0036 regarding application to revise technical specifications for report DPC-NE-1008-P.

4. Pursuant to the provisions of paragraph (b) (4) of 10 CFR 2.390, the following is furnished for consideration by the NRC 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 by Duke Energy and has been held in confidence by Duke Energy and its consultants.

    (ii) The information is of a type that would customarily be held in confidence by Duke Energy. Information is held in confidence if it falls in one or more of the following categories.

        (a) The information requested to be withheld reveals distinguishing aspects of a process (or component, structure, tool, method, etc.) whose use by a vendor or consultant, without a license from Duke Energy, would constitute a competitive economic advantage to that vendor or consultant.

        (b) The information requested to be withheld consist of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), and the application of the data secures a competitive economic advantage for example by requiring the vendor or consultant to perform test measurements, and process and analyze the measured test data.

        (c) Use by a competitor of the information requested to be withheld would reduce the competitor's expenditure of resources, or improve its competitive position, in the design, manufacture, shipment, installation assurance of quality or licensing of a similar product.

        (d) The information requested to be withheld reveals cost or price information, production capacities, budget levels or commercial strategies of Duke Energy or its customers or suppliers.

(e) The information requested to be withheld reveals aspects of the Duke Energy funded (either wholly or as part of a consortium) development plans or programs of commercial value to Duke Energy.

(f) The information requested to be withheld consists of patentable ideas.

The information in this submittal is held in confidence for the reasons set forth in paragraphs 4(ii)(a) and 4(ii)(c) above. Rationale for this declaration is the use of this information by Duke Energy provides a competitive advantage to Duke Energy over vendors and consultants, its public disclosure would diminish the information's marketability, and its use by a vendor or consultant would reduce their expenses to duplicate similar information. The information consists of analysis methodology details, analysis results, supporting data, and aspects of development programs, relative to a method of analysis that provides a competitive advantage to Duke Energy.

(iii) The information was transmitted to the NRC in confidence and under the provisions of 10 CFR 2.390, it is to be received in confidence by the NRC.

(iv) The information sought to be protected is not available in public to the best of our knowledge and belief.

(v) The proprietary information sought to be withheld is that which is marked in Attachment 2 to Duke Energy RAI response letter RA-16-0036 regarding application to revise technical specifications for report DPC-NE-1008-P. This information enables Duke Energy to:

(a) Support license amendment requests for its Harris and Robinson reactors.

(b) Support reload design calculations for Harris and Robinson reactor cores.

(vi) The proprietary information sought to be withheld from public disclosure has substantial commercial value to Duke Energy.

(a) Duke Energy uses this information to reduce vendor and consultant expenses associated with supporting the operation and licensing of nuclear power plants.

(b) Duke Energy can sell the information to nuclear utilities, vendors, and consultants for the purpose of supporting the operation and licensing of nuclear power plants.

(c) The subject information could only be duplicated by competitors at similar expense to that incurred by Duke Energy.

5. Public disclosure of this information is likely to cause harm to Duke Energy because it would allow competitors in the nuclear industry to benefit from the results of a significant development program without requiring a commensurate expense or allowing Duke Energy to recoup a portion of its expenditures or benefit from the sale of the information.

John Elnitsky affirms that he is the person who subscribed his name to the foregoing statement, and that all the matters and facts set forth herein are true and correct to the best of his knowledge.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on October 3, 2016.

John Elnitsky

Attachment 3

Response to NRC Request for Additional Information (Redacted)

NRC RAI 1*:*

Section 3.2.1 of DPC-NE-1008-P discusses comparisons of CASMO-5/SIMULATE-3 calculations of critical boron concentration (CBC) to measurements taken at HNP, RNP, and MNS. Critical boron concentration is a parameter that may be used as a surrogate for core reactivity. The report states that a boron-10 concentration of 19.76 atom percent is used in the CASMO-5/SIMULATE-3 calculations and the CBC measurements are "corrected" for boron-10 depletion effects to set it at the same boron-10 abundance as the calculations.

Section III.7 of SRP 4.3 asks NRC staff to ensure that analytical methods are verified "by comparing calculated results with measurements obtained from critical experiments and operating reactors." The SRP then asks the reviewer to ascertain that "the conclusions of the applicant are acceptable" regarding the analytical methods. In order to ensure that Duke Energy's conclusions regarding the accuracy of the CBC predictions – and thus the reactivity predictions – are acceptable, the NRC staff must understand how the CBC measurements are put on an equal basis to the predictions for comparison. Describe how CBC measurements are corrected for boron-10 depletion?

Duke Energy Response:

Soluble boron in the form of boric acid in the reactor coolant system (RCS) is primarily used to compensate for changes in core reactivity resulting from the depletion of fuel and burnable absorbers, and to offset the effects of changing xenon concentrations resulting from power level changes. Soluble boron is also used to ensure shutdown margin requirements are satisfied following a reactor shutdown. The depletion of B-10 during reactor operation occurs through neutron absorption and results in a decrease in the B-10 concentration and reactivity worth of boron. B-10 depletion is important because the plant measures (through titration) the concentration of natural boron in the RCS, not the B-10 concentration. Consequently, a failure to account for the effects of B-10 depletion could result in an over-estimation of the negative reactivity associated with a given boron concentration or the amount of excess core reactivity at a given burnup.

Design predictions used to verify shutdown margin limits assumed in the safety analysis and for reactivity balance calculations are based on a B-10 concentration of 19.76 a/o in natural boron. Measured boron concentrations are corrected to this reference B-10 concentration to avoid reactivity errors associated with different B-10 concentrations assumed in the prediction relative to the measurement. Correcting the measured boron concentration to be consistent with the predicted B-10 concentration precludes unintended consequences of B-10 depletion (e.g. mis-prediction of a critical condition during a mid-cycle startup), provides an accurate characterization of the design model's predictive capability with respect to reactivity, and ensures safety analysis and reactivity balance assumptions are satisfied.

The B-10 concentration in natural boron is determined using a mass spectrometer. Measurements are typically performed prior to startup following a refueling outage and then quarterly. Additional measurements may also be performed following a mid-cycle outage or following a large power reduction. The initial measured B-10 concentration is [

] [a,c] Equation 1 shows the formulation used.

[ ] a,c (eq. 1)

where,

[ ] a,c

The predicted B-10 concentration from equation 1 [

] a,c

Measured critical boron concentrations are corrected using the B-10 concentration from equation 1 as shown in equation 2.

$$Corrected\ Boron = (Measured\ Boron) * \frac{A^{BE}_{B-10}}{A^{Ref}_{B-10}} \qquad \text{(eq. 2)}$$

where,

A^{BE}_{B-10} = Best estimate B-10 concentration (a/o) in the RCS at a user defined burnup from equation 1
A^{Ref}_{B-10} = Reference B-10 concentration of 19.76 a/o assumed in the predictions

B-10 corrected boron concentrations are then compared to the predicted concentrations to confirm that the reactor core is operating as designed, to assess the fidelity of the design model and to ensure safety analysis assumptions are satisfied.

NRC RAI 2*:*

The error in CBC predictions presented in Figures 3-4 through 3-7 of DPC-NE-1008-P appears to depend on both burnup and the plant at which the measurements are taken. As discussed throughout SRP 4.3, thorough understanding of the uncertainty associated with code predictions of physics parameters is necessary so that they may be accounted for in determining whether design limits are met. At the audit, Duke Energy stated that the error in CBC calculations is characterized with burnup-dependent CBC biases for each power plant. Describe the methodology used to calculate these biases.

Duke Energy Response:

Differences in measured and predicted critical boron concentrations are expected. They are the result of [

] a,c The differences observed for the CASMO-5/SIMULATE-3 methodology benchmarks are comparable with the differences observed for other NRC-approved methodologies (i.e. CASMO-4/SIMULATE-3 methodology for McGuire and Catawba).

Predicted critical boron concentrations used in the verification of the Safety Analysis, and used to support the startup and operation of the reactor core, are adjusted by a measured-to-predicted critical boron concentration bias. This bias is developed based on the following process.

[ ] a,c

An example bias calculation is shown for Harris using data contained in Table 3-3 of the report. Figure 1 shows an example bias calculation using a two segment linear bias. The first segment is applicable for the first 175 EFPD of the cycle and the second segment for the remainder of the cycle. Figure 2 shows the measured minus predicted deviations with the bias applied to the predicted boron concentrations.

The acceptability of the reactivity bias developed is confirmed on a cycle-specific basis as part of Duke Energy's normal reload design process. [

] a,c

Figure 1
Harris Example HFP Measured Minus Predicted Boron Bias

a,c

Figure 2
Harris HFP Measured Minus Predicted Boron Concentration
Comparison Based on Biased Predicted Boron Concentrations

a,c

NRC RAI 3:

Section 3.2.3 of DPC-NE-1008-P presents comparisons between control bank worths as predicted by CASMO-5/SIMULATE-3 and those measured at HNP, RNP, and MNS. The NRC staff examined the measured and predicted data provided in Table 3-5 and found that the error is not consistent between the three plants and is seemingly not able to be statistically pooled.

As discussed in the previous RAI, SRP 4.3 indicates the need for the uncertainty associated with analytical methods to be understood so that the uncertainty may be accounted for in evaluating design limits. Given that the control bank worth measurements do not appear to be poolable among the different sites discussed in DPC-NE-1008-P, clarify the control bank uncertainty to be used in the safety analysis and provide a basis for this uncertainty.

Duke Energy Response:

The control bank worth deviations observed in the CASMO-5/SIMULATE-3 benchmark are within Duke Energy's experience base for other code benchmarks. The minimum and maximum total bank worth deviations for the CASMO-5/SIMULATE-3 methodology are [ ] [a,c] (from Table 3-5 in the report). The mean deviation for all cycles evaluated is [ ] [a,c] Table 1 compares CASMO-5/ SIMULATE-3 measured-to-predicted total bank worth deviations to those calculated for the CASMO-4/SIMULATE-3 code system. The comparisons demonstrate that the accuracy of the bank worth predictions for the CASMO-5/SIMULATE-3 and CASMO-4/SIMULATE-3 methodologies are comparable. The CASMO-4/SIMULATE-3 data included in Table 1 is from the NRC-approved methodology reports DPC-NE-1005-PA and DPC-NE-1006-PA.

Table 1
Comparison of Model Performance for Total Bank Worth

Parameter	DPC-NE-1008-P	DPC-NE-1005-PA McGuire/Catawba	DPC-NE-1005-PA Sequoyah	DPC-NE-1006-PA Oconee	DPC-NE-1006-PA Three Mile Island
Data Source	Table 3-5 (1)	Table 3-4 (1)	Tables B3-5 to B3-9 (1)	Table 3-3 (1)	Table 3-10 (1)
Mean, %	[ ] [a,c]	[ ] [a,c]	-2.49	[ ] [a,c]	-3.59
Std. Dev., %	[ ] [a,c]	[ ] [a,c]	1.72	[ ] [a,c]	0.89

(1) The mean of the total bank worth deviations are calculated from the bank worth data contained in the referenced Tables using equation 3.

$$Bank\ Worth\ deviation\ (\%) = \frac{(M-P)}{P} * 100 \qquad \text{eq. 3}$$

where,

$P =$ Predicted worth
$M =$ Measured worth

The benchmark results demonstrate the fidelity of the core models for calculating rod worths for reactor cores containing both zirconium diboride (IFBA) and gadolinia integral burnable absorbers. The variation in the McGuire, Harris and Robinson measured-to-predicted bank worth results [

] [a,c] As discussed in Section 3.2.3, each of the reactor sites employs a different measurement technique. The boron dilution technique is employed for all Robinson control rod measurements, while the Rod Swap measurement technique is used for all Harris measurements, and the Dynamic Rod Worth Measurement (DRWM) technique is used for all McGuire control rod measurements. [

] [a,c]

A 10% total bank worth uncertainty is assumed in the Safety Analysis. This uncertainty is applied in both shutdown margin and trip reactivity calculations where only 90% of the total available control rod worth is credited. The 10% uncertainty value is confirmed each cycle through bank worth measurements performed as part of the Startup and Physics Testing program following each refueling outage. The total bank worth acceptance criteria at Harris and Robinson is the sum of the measured worths must be within 10% of the sum of the predicted worths, while the total bank worth acceptance criteria for McGuire is the sum of the measured worths must be greater than or equal to 90% of the predicted worth. The above acceptance criteria definitions are consistent with the American Nuclear Society American National Standard for Reload Startup Physics Tests for Pressurized Nuclear Reactors, ANSI/SNS-19.6.1-2011, which states that acceptance criteria are those criteria that have a direct association with the Safety Analysis or are defined by Technical Specifications.

The key result from the CASMO-5/SIMULATE-3 bank worth benchmarks is the predictive accuracy of the CASMO-5/SIMULATE-3 methodology is well within the 10% total bank worth uncertainty assumed in the Safety Analysis. Accordingly, a 10% total bank worth uncertainty is appropriate for use in the Safety Analysis worth predictions using the CASMO-5/SIMULATE-3 methodology. The measured to predicted bank worth deviations for the CASMO-5/SIMULATE-3 methodology are also within expected ranges as compared to previously approved methodologies.

NRC RAI 4*:*

The previous questions in part are to ensure that the analytical methods for core physics analyses are sufficiently described such that DPC-NE-1008-P is acceptable to be included in the COLR section of the TS. Duke Energy will need to submit a revision to DPC-NE-1008-P that incorporates applicable portions of the responses of the preceding questions so that the neutronics analysis methodology is sufficiently described.

Duke Energy Response:

Duke Energy will revise and republish the DPC-NE-1008-P methodology report within 90 days of receiving the NRC safety evaluation approving the use of the nuclear design methodology described in this report for safety related analyses applicable to the Harris Unit 1 and Robinson Unit 2 Nuclear Plants. The updated report will be designated DPC-NE-1008-P-A and will include the NRC Safety Evaluation, the original report sent to the NRC for review and approval (updated as necessary to respond to any SE restrictions), and the Duke Energy responses to NRC request(s) for additional information. Retyped technical specification pages reflecting the addition of "-A" in DPC-NE-1008-P-A will be provided to the NRC Project Manager prior to issuance of the requested amendment.