Kim Maza
Vice President
Harris Nuclear Plant
5413 Shearon Harris Road
New Hill, NC 27562-9300

PROPRIETARY INFORMATION – WITHHOLD UNDER 10 CFR 2.390
UPON REMOVAL OF ATTACHMENT 1, THIS LETTER IS DECONTROLLED

10 CFR 50.90

December 20, 2019
Serial: RA-19-0453

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

Shearon Harris Nuclear Power Plant, Unit 1
Docket No. 50-400/Renewed License No. NPF-63

Subject: Response to Request for Additional Information Regarding License Amendment Request to Modify Departure from Nucleate Boiling Ratio Safety Limit to Address Transition to New Fuel Type

Ladies and Gentlemen:

By letter dated April 10, 2019 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19100A442), as supplemented by letter dated June 6, 2019 (ADAMS Accession No. ML19157A036), Duke Energy Progress, LLC (Duke Energy), submitted a license amendment request (LAR) for the Shearon Harris Nuclear Power Plant, Unit 1 (HNP). The proposed license amendment would modify Technical Specifications (TS) to address the departure from nucleate boiling ratio safety limit associated with the transition to the GAIA fuel design. Duke Energy also requested the review and approval of Revision 6 of DPC-NE-2005-P, “Thermal-Hydraulic Statistical Core Design Methodology,” for the addition of Appendix J addressing the application of the ORFEO-GAIA critical heat flux correlation.

The NRC staff reviewed the LAR and determined that additional information is needed to complete their review. Duke Energy received the request for additional information (RAI) from the NRC through electronic mail on November 27, 2019 (ADAMS Accession No. ML19331A400). Response to this request is required by December 27, 2019.

Attachments 1 and 3 (proprietary and non-proprietary, respectively) provides Duke Energy’s response to the RAI questions. Attachment 2 provides the affidavit from Duke Energy supporting the request for withholding information in Attachment 1 from public disclosure. The information contained within this submittal does not change the No Significant Hazards Consideration provided in the original submittal.

No regulatory commitments are contained in this letter.

In accordance with 10 CFR 50.91(b), HNP is providing the state of North Carolina with a copy of this response.

Should you have any questions regarding this submittal, 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 December 20, 2019.

Sincerely,

Kim Maza

Kim Maza

Attachment:

1. Response to Request for Additional Information [Proprietary]
2. Affidavit for Withholding of Proprietary Information
3. Response to Request for Additional Information [Non-Proprietary]

cc: J. Zeiler, NRC Senior Resident Inspector, HNP
W. L. Cox, III, Section Chief N.C. DHSR
T. Hood, NRC Project Manager, HNP
L. Dudes, NRC Regional Administrator, Region II

RA-19-0453

ATTACHMENT 2

AFFIDAVIT FOR WITHHOLDING OF PROPRIETARY INFORMATION

SHEARON HARRIS NUCLEAR POWER PLANT, UNIT 1

DOCKET NO. 50-400

RENEWED LICENSE NO. NPF-63

(4 pages including cover)

AFFIDAVIT of Steve Snider

1. I am 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 1 to Duke Energy letter RA-19-0453 regarding the response to the request for additional information pertaining to the application to revise technical specifications and the corresponding impact to report DPC-NE-2005-P-A, *Thermal-Hydraulic Statistical Core Design Methodology*.

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 1 to Duke Energy letter RA-19-0453 regarding the response to the request for additional information pertaining to the application to revise technical specifications and the corresponding impact to report DPC-NE-2005-P-A, *Thermal-Hydraulic Statistical Core Design Methodology*. This information enables Duke Energy to:

(a) Support license amendment requests for its Harris reactor.

(b) Support reload design calculations for Harris 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.

Steve Snider 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 December 16, 2019

Steve Snider

RA-19-0453

ATTACHMENT 3

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION [NON-PROPRIETARY]

SHEARON HARRIS NUCLEAR POWER PLANT, UNIT 1

DOCKET NO. 50-400

RENEWED LICENSE NO. NPF-63

(8 pages including cover)

By letter dated April 10, 2019 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19100A442), as supplemented by letter dated June 6, 2019 (ADAMS Accession No. ML19157A036), Duke Energy Progress, LLC (Duke Energy), submitted a license amendment request (LAR) for the Shearon Harris Nuclear Power Plant, Unit 1 (HNP). The proposed license amendment would modify Technical Specification (TS) 2.1.1.a to add the departure from nucleate boiling ratio safety limit associated with the transition to the GAIA fuel design from the current HTP fuel in the HNP reactor core. In addition, TS 6.9.1.6.2 would be revised to include the topical report approved by the Nuclear Regulatory Commission (NRC) for the critical heat flux correlation associated with the fuel design transition. Duke Energy also requested the review and approval of Revision 6 of DPC-NE-2005-P, “Thermal-Hydraulic Statistical Core Design Methodology,” for the addition of Appendix J addressing the application of the ORFEO-GAIA critical heat flux correlation.

The NRC staff reviewed the LAR and determined that additional information is needed to complete their review. Duke Energy received the request for additional information (RAI) from the NRC through electronic mail on November 27, 2019 (ADAMS Accession No. ML19331A400). Response to this request is provided below.

RAI-1

Figure J-2 in the LAR shows the radial power distribution (RPD) used in the VIPRE-01 core model for performing the SCD [statistical core design] analysis for the core with GAIA fuel design at Harris. With the VIPRE-01 core model in Figure J-2 rotated 90 degrees back to the original core model applying to the HTP fuel, the RPD are identical to that shown in Figure I-2 of Appendix I of Revision 5 to DPC-NE-2005-P-A (ADAMS Accession No. ML15075A221) for high thermal performance (HTP) fuel at Harris. The licensee indicated in Section 5.3 of DPC-NE-3008 (ADAMS Accession No. ML15323A351) that the RPD used is intended to be a bounding and conservative RPD for fuel at Harris. Clarify what the licensee does to assure that the RPD remains bounding throughout the fuel transition from the HTP fuel to GAIA fuel design.

Duke Energy Response to RAI-1

The [ ] model reference power distribution shown in Figure J-2 of the LAR is a flat radial power distribution using a limiting pin radial peaking factor of [ ]. It was designed for the [ ] model such that sub-channel 5 (which is a guide tube sub-channel surrounded by other sub-channels and not any lumped channels) yielded the most limiting minimum departure from nucleate boiling ratio (MDNBR). To accomplish this, the pin powers for all fuel rods surrounding sub-channel 5 are set at the same [ ] peaking factor. A radial power distribution can be no more conservative than by assuming all pins contribute the same relative power to a subchannel. The reference power distribution was tested using various axial peaks and shapes to ensure that sub-channel 5 remained the most limiting sub-channel.

Furthermore, the process Duke Energy uses to calculate departure from nucleate boiling (DNB) margin uses maximum allowable radial peaking (MARP) limits as described in

DPC-NE-2011-P-A, Revision 2, "Nuclear Design Methodology Report for Core Operating Limits of Westinghouse Reactors" (ADAMS Accession No. ML16125A420), and involves scaling the reference power distribution up or down to achieve a target MDNBR value for the given conditions. This scaling of the reference power distribution is also performed in the statistical design limit (SDL) calculation process.

The combination of the flat radial power distribution surrounding the limiting guide tube channel and the MARP calculation process ensures that the reference radial power distribution is bounding and conservative for MDNBR calculations for both HTP and GAIA fuel throughout the fuel transition.

RAI-2

Table J-5 in the LAR contains a list of the parameters for uncertainty consideration and the associated values of the uncertainty used for the statistical design limit (SDL) analysis. The table indicates that the values of the uncertainties for eight parameters are the same as that discussed in Appendix I of the NRC-approved Revision 5 to DPC-NE-2005-P-A for use of the SDL analysis for the HTP fuel at Harris. These eight parameters are: core power, coolant flow measurement, bypass flow, radial power measurements, radial power engineering uncertainties, axial power peak prediction uncertainty (from the physics code), axial peak location uncertainty, and thermal-hydraulic code uncertainties. The table also shows that the values of uncertainties are changed from the approved uncertainties values for three parameters. They are: (a) core exit pressure (changed to ±50 psia); (b) core inlet temperature (changed to ±5.0°F); and (c) DNBR correlation uncertainty change. Justify the changes of the uncertainties for the core exit pressure and core inlet temperature.

Duke Energy Response to RAI-2

The uncertainties documented in Table I-5 of DPC-NE-2005-P-A, Revision 5, were based on existing calculations at that time. The changes shown in Table J-5 are not specific to GAIA fuel but are updated to reflect recent revisions to uncertainty calculations.

For core exit pressure, the SDL accounts for instrument uncertainty and an operational allowance used by operations at the plant. The new value was selected to bound indication uncertainty and controller uncertainty and provide operational allowance used by operations at the plant. The operational allowance is the difference between the +/- 50 psi uncertainty assumed in the SDL and the indication uncertainty. The indication uncertainty is a function of how the indication is processed and number of channels available and is used in the pressurizer pressure surveillance associated with TS 3.2.5. For example, the uncertainty is provided in Table 2-1 below.

Table 2-1: Core Exit Pressure Uncertainty

	Control Board Uncertainty (psi)
One control board indicator	33.76
Average of two control board indicators	23.87
Average of three control board indicators	19.49
	Computer Channel Uncertainty (psi)
One computer point	27.20
Average of two computer points	19.24
Average of three computer points	15.71

An uncertainty of +/-50 psi is used in the SDL to bound instrument uncertainty and provide operating margin.

Core inlet temperature uncertainty is dependent upon the uncertainty in Reactor Coolant System (RCS) average temperature. RCS average temperature uncertainty in Revision 5 of DPC-NE-2005-P-A was based on the RCS average temperature uncertainty at that time. Following the NRC's approval of DPC-NE-2005-P-A, Revision 5, the RCS average temperature controller uncertainty was updated and uncertainty was determined to be +4.88 °F/-4.68 °F. The indicator uncertainties used in the surveillance of RCS average temperature in TS 3.2.5 were also updated as provided in Table 2-2 below.

Table 2-2: Core Inlet Temperature Uncertainty

	Control Board Uncertainty (°F)
One control board indicator	3.71
Average of two main control board indicators	2.85
Average of three main control board indicators	2.46
	Computer Channel Uncertainty (°F)
One computer channel	2.65
Average of two computer points	2.10
Average of three computer points	1.85

An uncertainty of +/-5 °F is used in the SDL to bound the calculated RCS average temperature indicator and controller uncertainties.

RAI-3

The licensee indicates in Section 3.4.3 of the LAR that it has performed an analysis to determine SDL for mixed core conditions. The methodology and plant conditions used are the same as that used for HTP fuel, except the VIPRE-01 core model representing an HTP fuel assembly surrounded by GAIA fuel. The licensee indicates that the analysis verifies that the SDL for mixed core conditions is the same as that calculated for a full-core with the HTP fuel.

1. Provide the results of the SDL calculation, including similar information in Tables I-4 and I-6 of Revision 5 to DPC-NE-2005-P-A, for the mixed core conditions with an HTP fuel assembly surrounded by GAIA fuel.

2. Clarify whether an SDL analysis is performed for a mixed core representing a GAIA fuel assembly surrounded by HTP fuel. If the analysis is not performed, provide the rationale. If the analysis is performed, provide the results of the SDL analysis.

Duke Energy Response to RAI-3

RAI 3.1 Response

Since the NRC's approval of Revision 5 of DPC-NE-2005-P-A, the SDL value for HTP fuel at HNP has been conservatively increased to 1.35 as a result of conservatively increasing uncertainties and expanding the applicable range in accordance with the approved methodology. The SDL value calculated for mixed core conditions with HTP fuel surrounded by GAIA assemblies does not exceed the 1.35 value used for full core HTP fuel.

Table 3-1 below includes the state point conditions for the mixed core HTP fuel SDL calculation.

Table 3-1: Harris Nuclear Plant SCD Statepoints (Mixed Core, HTP Center Assembly)

Statepoint #	Core Exit Pressure (psia)	Core Inlet Temperature (°F)	Core Inlet Flow (%)	Core Power (% FP)	Axial Peak Magnitude Location (Fz)	Z	Radial Peak (F∆H)
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

Statepoint #	Core Exit Pressure (psia)	Core Inlet Temperature (°F)	Core Inlet Flow (%)	Core Power (% FP)	Axial Peak Magnitude Location (Fz)	Z	Radial Peak (FΔH)
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							

Table 3-2 on the next page provides the results of the mixed core HTP SDL calculation, for 500 runs.

Table 3-2: HNP Statepoint Statistical Results - Mixed Core (HTP Center Assembly)
HTP CRITICAL HEAT FLUX CORRELATION (500 CASE RUNS)

Statepoint #	Mean	Standard Deviation	Coefficient of Variation	Statistical DNBR Limit
1 2				
3 4				
5 6				
7 8				
9 10				
11 12				
13 14				
15 16				
17 18				
19 20				
21 22				
23 24				
25 26				
27 28				
29 30				
31 32				
33 34				
35 36				
37 38				
39 40				

Statepoint #	Mean	Standard Deviation	Coefficient of Variation	Statistical DNBR Limit
41 42				
43 44				
45 46				
47 48				
49 50				

Table 3-3 below gives the results of the mixed core HTP SDL calculation, for 10,000 case runs.

Table 3-3: Harris Statepoint Statistical Results - Mixed Core (HTP Center Assembly)
HTP CRITICAL HEAT FLUX CORRELATION (10,000 CASE RUNS)

Statepoint #	Mean	Standard Deviation	Coefficient of Variation	Statistical DNBR Limit
5				
7				
9				
27				
39				

<u>RAI 3.2 Response</u>

The SDL analysis is not performed for a mixed core representing a GAIA fuel assembly surrounded by HTP fuel assemblies. This is because scoping analyses have demonstrated that the MDNBR for GAIA fuel surrounded by HTP assemblies is slightly higher than the MDNBR for the same power distribution in a full core GAIA model. Duke Energy is not crediting this configuration and is instead using the full core GAIA model to calculate peaking limits for GAIA fuel in a mixed core configuration as discussed in Section 3.4.1 of the LAR. In contrast, the penalty for HTP fuel in a mixed core configuration, which is significantly greater (more than 3 times greater) than the benefit for GAIA fuel in a mixed core configuration, only results in the SDL for the worst 10,000 case run increasing from [ ] for a full core of HTP to [ ] for a mixed core HTP configuration. Consequently, it is not expected that the much smaller deviation in GAIA MDNBR results will translate into an SDL change that would be significant. Therefore, no GAIA mixed core SDL cases were executed.