Southern Nuclear

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Enclosure 1 contains Proprietary Information. When separated from Enclosure 1, this transmittal document and remaining enclosures are decontrolled.

April 13, 2020

10 CFR 50.90

Docket Nos.: 50-348
50-364

NL-20-0403

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

Joseph M. Farley Nuclear Plant - Units 1 and 2
Response to Request for Additional Information Regarding License Amendment Request (LAR) to Update the Spent Fuel Pool Criticality Safety Analysis and Revise Technical Specification (TS) 3.7.15 "Spent Fuel Assembly Storage" and TS 4.3 "Fuel Storage"

Ladies and Gentlemen:

By letter dated September 30, 2019, Southern Nuclear Operating Company (SNC) submitted a license amendment request (LAR) to update the spent fuel pool criticality safety analysis and revise Technical Specification (TS) 3.7.15 "Spent Fuel Assembly Storage" and TS 4.3 "Fuel Storage" for the Joseph M. Farley Nuclear Plant (FNP) Units 1 and 2 (ML19275E310).

By letter dated February 28, 2020 (ML20055E975), the U.S. Nuclear Regulatory Commission (NRC) staff notified SNC that additional information is needed for the staff to complete their review.

Enclosure 1 provides a proprietary version of the SNC response to the NRC request for additional information (RAI). Enclosure 2 provides a non-proprietary version of the SNC response to the RAI. Enclosure 3 provides the Westinghouse Affidavit, CAW-20-5032, for Withholding Proprietary Information from Public Disclosure. The affidavit sets forth the basis upon which the information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in paragraph (b)(4) of Section 2.390 of the Commission's regulations. Accordingly, it is respectfully requested that the information that is proprietary to Westinghouse be withheld from public disclosure.

Correspondence with respect to the copyright or proprietary aspects of the items listed above or the supporting Westinghouse affidavit should reference CAW-20-5032 and should be addressed to Camille T. Zozula, Manager, Regulatory Compliance & Corporate Licensing, Westinghouse Electric Company, 1000 Westinghouse Drive, Suite 165, Cranberry Township, Pennsylvania 16066.

This letter contains no NRC commitments.

In accordance with 10 CFR 50.91, SNC is notifying the state of Alabama of this license amendment RAI response by transmitting a copy of this letter to the designated state official.

If you have any questions, please contact Jamie Coleman at 205.992.6611.

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

Executed on April 13, 2020.

C. A. Gayheart
Regulatory Affairs Director
Southern Nuclear Operating Company

CAG/was/scm

Enclosure 1: SNC Response to Request for Additional Information (RAI) (Proprietary)
Enclosure 2: SNC Response to Request for Additional Information (RAI) (Non-Proprietary)
Enclosure 3: Westinghouse Affidavit, CAW-20-5032, for Withholding Proprietary Information from Public Disclosure

cc: NRC Regional Administrator
NRC NRR Project Manager – Farley 1&2
NRC Senior Resident Inspector – Farley 1 & 2
Alabama - State Health Officer for the Department of Public Health
SNC Document Control R-Type: CFA04.054

Joseph M. Farley Nuclear Plant - Units 1 and 2
Response to Request for Additional Information Regarding License Amendment Request to Update the Spent Fuel Pool Criticality Safety Analysis and Revise Technical Specification (TS) 3.7.15 "Spent Fuel Assembly Storage" and TS 4.3 "Fuel Storage"

ENCLOSURE 2

SNC Response to Request for Additional Information (RAI)
(Non-Proprietary)

Enclosure 2
SNC Response to RAI (Non-Proprietary)

RAI No. 1

Proposed new TS 4.3.1.1.e states the following:

"New or partially spent fuel assemblies that must be stored according to their combination of discharge burnup and nominal enrichment, decay time since operation, required IFBA [integral fuel burnable absorber] (if applicable), and must comply with Figure 4.3-1, Table 4.3-1, and Tables 4.3-3 through 4.3-5 (as applicable). Each assembly ***should*** [emphasis added] be stored in an appropriate storage configuration according to its fuel category as specifically described in Table 4.3-1 and geometry based on Figure 4.3-1"

Justify each situation that the term "should" could be used or revise the proposed TS accordingly, for example, use the term "shall."

SNC Response:

Southern Nuclear agrees to substitute the word "shall" in place of the word "should" as described above. The proposed new TS 4.3.1.1.e would then read as follows:

> "New or partially spent fuel assemblies that must be stored according to their combination of discharge burnup and nominal enrichment, decay time since operation, required Integral Fuel Burnable Absorber (IFBA) (if applicable), and must comply with Figure 4.3-1, Table 4.3-1, and Tables 4.3-3 through 4.3-5 (as applicable). Each assembly shall be stored in an appropriate storage configuration according to its fuel category as specifically described in Table 4.3-1 and geometry based on Figure 4.3-1"

RAI No. 2

Proposed Note 3.c. for new TS Figure 4.3-1 states the following:

> "For assemblies with Initial Enrichment (En) values greater than or equal to the values in Table 4.3-2, the required Minimum Burnup value (in MWd/MTU) for each Fuel Category is calculated based on initial enrichment, decay time, and the appropriate fitting coefficients."

This statement implies the analysis is acceptable for initial enrichments above 5.0 weight percent (wt/%) U-235. However, the licensee did not propose a change to its current TS 4.3.1.1.a, which limits its fuel to a maximum U-235 enrichment of 5.0 weight percent (wt/%). Since TS 4.3.1.1.a is not being revised, the NRC staff considers U-235 enrichment above 5.0 wt/% out of scope of the license amendment request (LAR). Please confirm the applicability of Note 3.c. relative to TS 4.3.1.1.a.

SNC Response:

Southern Nuclear confirms that applicability of the analysis and LAR to U^{235} enrichments greater than 5.0 weight percent is out of scope.

RAI No. 3

It is not apparent what fuel assembly power history was used for the depletion analysis. WCAP-18414-P, Section 4.2.2.4, "Maximum Average Assembly Power," states [[

]] However, the power history used in the analysis is not stated nor is the power history used in the analysis justified as it relates to Farley. With respect to the power history used in the analysis, please provide the following information:

a. Clearly state the power histories used in the analysis and justify their use for Farley.
b. Table 4.2 lists a [[ ]] What is the basis and justification for these values?
c. Table 4.2 lists a [[ ]]. In what respect are these values [[ ]]?
d. Are [[ ]] and [[ ]] referenced below Table 4-2 the same parameter?
e. Use of the [[ ]] implies a non-bounding power history was used or may be acceptable. Considering the potential variations and timing of those variations in a fuel assembly's power history, justify the use of a non-bounding power history. Describe any limitations on the use of [[ ]] and how the licensee will control those limitations.
f. Describe the effects of a non-bounding power history on Fuel Temperature and Operating History and Specific Power as described in WCAP-18414-P, Sections 4.2.2.2 and 4.2.2.3, respectively.
g. If the power history is non-bounding, the Axial Moderator Temperature Profile Selection as described in WCAP-18414-P, Section 4.2.3.2, may be adversely affected. Justify the continued use of the selected Axial Moderator Temperature Profiles.

SNC Response:

Each spent fuel pool (SFP) Criticality Fuel Design from Table 3-3 (referenced in Table 4-2) of Reference 1 is analyzed using a bounding power history experienced by actual assemblies operated in Farley Units 1 and 2. The Criticality Fuel Designs were developed to bound previous operation and expected future operation at Farley. [

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e.) The Burnup Averaged Assembly Power (Equation 4-2 of Reference 1) is not a design input used to develop the burnup limits in Reference 1, therefore its use will not be justified for this purpose. The design input values are the values for Burnup Averaged Assembly Thermal Power listed in Table 4-2, which are determined as bounding high thermal powers. See the response to (d) for more information.

f.) As discussed in the response to (e), assembly power histories modeled for each Criticality Fuel Design in Reference 1 (Table 4-2) are not considered “non-bounding.” The Burnup Averaged Assembly Thermal Power from Table 4-2 of Reference 1 used is bounding and was used to create the SFP depleted isotopics in Reference 1. Therefore, Operating History, Specific Power, and Fuel Temperature as described in Sections 4.2.2.2 and 4.2.2.3 of Reference 1 are conservatively included (or conservatively determined as in the case of Fuel Temperature).

g.) As discussed in the response to (e), assembly power histories modeled for each Criticality Fuel Design in Reference 1 (Table 3-3) are not considered “non-bounding.” The Burnup

Averaged Assembly Thermal Power from Table 4-2 of Reference 1 is bounding and was used to create the SFP depleted isotopics in Reference 1. The Axial Moderator Temperature Profile is conservatively chosen as described in Section 4.2.3.2 of Reference 1 and is not impacted.

References:

1. WCAP-18414-P, "J. M. Farley Units 1 and 2 Spent Fuel Pool Criticality Safety Analysis," September 2019.

2. WCAP-9272-P, "Westinghouse Reload Safety Evaluation Methodology" July 1998.

3. NUREG/CR-6665, "Review and Prioritization of Technical Issues Related to Burnup Credit for LWR Fuel," U.S. Nuclear Regulatory Commission, February 2000.

4. NEI-12-16, Revision 3, "Guidance for Performing Criticality Analyses of Fuel Storage a Light Water Reactor Power Plants," March 2018.

RAI No. 4

Section 5.2.3.1.13 of WCAP-18414-NP, "Eccentric Fuel Assembly Positioning Bias," states:

> The fuel assemblies are assumed to be nominally located in the center of the storage rack cell; however, it is recognized that an assembly could in fact be located eccentrically within its storage cell.

With respect to the Eccentric Fuel Assembly Positioning Bias analysis, please provide the following information.

a. Describe the models used.
b. Justify the perturbed cases used.
c. Compare the perturbed cases to nominal case.

SNC Response:

Model Description

The combination of physical geometry represented explicitly by input, combined with boundary conditions, determine the actual modeled spent fuel pool (SFP) system. To clarify the eccentric positioning modeling for Arrays A, B, C and D, the explicitly represented geometry modeling specified by the input is given below for each storage array. Also given are the boundary conditions utilized for each storage array. [

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Array A:

[

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Figure 1: Array A Schematic of Eccentrically Placed Fuel (shown are the assemblies represented by fuel category, eccentrically placed close together)

Array B:

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Figure 2: Array B Schematic of Eccentrically Placed Fuel (shown are the assemblies represented by fuel category, eccentrically placed close together)

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Array C:

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Figure 3: Array C Schematic of Eccentrically Placed Fuel (shown are the assemblies represented by fuel category, eccentrically placed close together)

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Array D:

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[a,c]

Figure 4: Array D Schematic of Eccentrically Placed Fuel (shown are the assemblies represented by fuel category, eccentrically placed close together)

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Justification of the Perturbed Cases Used

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Array D is conservatively represented in full, as it is a single area in the spent fuel pool for storage of damaged fuel. All possible assemblies are eccentrically located. A buffer of empty cells is in place around all damaged fuel assemblies (and is part of the array).

Comparisons of the perturbed and nominal cases.

Table 1 contains the eccentric positioning results by array. Equation 5-2 from Reference 1 is used to determine the "Delta K_{eff}" to the nominal, non-eccentrically located fuel model in Table 1 below. [

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Table 1: Eccentric Positioning Results by Array

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Table 1: Eccentric Positioning Results by Array (cont.)

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Table 1: Eccentric Positioning Results by Array (cont.)

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References:

1. WCAP-18414-P, "J. M. Farley Units 1 and 2 Spent Fuel Pool Criticality Safety Analysis," September 2019.
2. NEI-12-16, Revision 3, "Guidance for Performing Criticality Analyses of Fuel Storage at Light Water Reactor Power Plants," March 2018.

RAI No. 5

Section 5.2.3.1.14 of WCAP-18414-P, "SFP [Spent Fuel Pool] Temperature Bias," discusses the determination of the most reactive temperature in the Farley SFP. With respect to the SFP Temperature Bias analysis, please provide the SFP keff at each temperature analyzed.

SNC Response:

Reference 1 (WCAP-18414-P), Section 5.2.3.1.14 details the calculation of Temperature Bias on a per-Array/Fuel Type/Enrichment basis. For each storage array (Arrays A through D), [

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Data in Table 1 herein is taken from Reference 1 and the individual storage configuration analyses. Only the maximum reactivity delta is taken as the Temperature Bias and reported in Reference 1.

To reiterate, the Temperature Biases reported in Tables 5-4 through 5-10 of Reference 1 are for the individual fuel storage arrays. Considerations for normal condition and accident condition fuel temperatures are discussed in Sections 5.4 and 5.5.2.2 of Reference 1 respectively.

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Table 1: Temperature Bias Results per Array

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Table 1: Temperature Bias Results per Array (cont.)

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Table 1: Temperature Bias Results per Array (cont.)

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Table 1: Temperature Bias Results per Array (cont.)

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Table 1: Temperature Bias Results per Array (cont.)

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Table 2: Updated Table 5-6 from Reference 1

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Table 3: Updated Table 5-7 from Reference 1

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References:

1. WCAP-18414-P, "J. M. Farley Units 1 and 2 Spent Fuel Pool Criticality Safety Analysis," September 2019.

RAI No. 6

Section 5.4.2 of WCAP-18414-P, "Type 2 Normal Conditions," includes fuel rods with empty lattice locations. The section states:

[[

]]"

With respect to fuel rods with empty lattice locations, please provide the following information.

a. Will the fuel assemblies be considered as [[ ]]? Justify the requirement.
b. Can [[ ]] fuel assemblies with empty lattices be more reactive than [[ ]]?

SNC Response:

Fuel Category 1 and Fuel Category 2 Designation Differences

Fuel assemblies at Farley Units 1 and 2 with empty lattice locations (i.e., an assembly with a removed fuel rod that was not replaced creating a water filled lattice location) are able to be stored as either Fuel Category 1 or Fuel Category 2 as seen in Reference 1. However, the process for these missing-lattice-location (MLL) assemblies to be designated as Fuel Category 1 and Fuel Category 2 are different.

Fuel Category 1

Farley 1 and 2 MLL assemblies can be designated as Fuel Category 1 and stored in Reference 1 Array A without restriction. Table 1 below shows that Array A has more than 0.05600 Δk of reactivity margin to the regulatory limit (via Target k_{eff} comparison) for both OFA and STD fuel. This margin was calculated by finding the difference between the Target k_{eff} from Tables 5-4 and 5-5 of Reference 1 and the nominal design basis assembly (DBA) reactivity in Array A plus twice the Monte Carlo calculational uncertainty of the nominal case.

Table 1: Reference 1 Array A Reactivity Margin to Regulatory Limit

Fuel Type	Target k_{eff}	Array A Nominal k_{eff}	2 * σ	Array A Margin (Δk)
STD	0.98715	0.91838	0.00020	0.06857
OFA	0.98591	0.92875	0.00022	0.05694

Previously, Westinghouse has [

]a,c Regardless of the number of missing fuel rods considered, Table 1 shows the conservative calculation methods employed provide sufficient margin to store MLL assembles as Fuel Category 1 in Array A of Reference 1 without additional consideration.

Fuel Category 2

It is possible for Farley Unit 1 and 2 MLL assemblies to be stored as Fuel Category 2 in Array B of Reference 1. However, a specific analysis is required to ensure the incident assembly is less reactive than the Reference 1 fresh design basis assembly (DBA) modeled in Array B. All fuel assemblies that are to be stored as Fuel Category 2 and contain less than 264 fuel rods will be analyzed to confirm that storage in Array B is acceptable. The confirmatory evaluation will be performed using the following equation for Array B Fuel Category 2 storage acceptability.

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Conclusions

1. Reference 1 states that if a fuel rod(s) is removed from a Farley assembly and a stainless steel or naturally enriched uranium replacement fuel rod is inserted in its place, the incident assembly can be stored as normal; following the SFP burnup vs. enrichment storage requirements. The minimum IFBA requirements for the Fuel Category 2 assembly in Array B must still be followed.

2. If a fuel rod(s) is removed and not replaced, the incident assembly may be stored as a Fuel Category 1 assembly in Array A.
3. If a fuel rod(s) is removed and not replaced, the assembly may also be analyzed using the methods described herein and in Reference 1, to determine if the incident assembly meets the requirements of Fuel Category 2 in Array B.

Reactivity of Assemblies with Missing Lattice Locations

Fuel assemblies with empty lattice locations can indeed be more reactive in SFP scenarios than their identical assemblies with all fuel rod locations intact. The amount that reactivity will increase, if any depends on factors such as number of missing rods, incident assembly burnup, and SFP boron concentration. However realistic SFP conditions lessen the reactivity effect of missing fuel rods.

Westinghouse fuel assembly studies have shown that [

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For Farley 1 and 2, sufficient margin exists to store assemblies with any number of missing fuel rod locations as Fuel category 1. For Fuel Category 2, the reactivity of an assembly with missing fuel rod locations must be evaluated using the methods detailed herein.

References:

1. WCAP-18414-P, “J. M. Farley Units 1 and 2 Spent Fuel Pool Criticality Safety Analysis,” September 2019.

RAI No. 7

Section 5.6 of WCAP-18414-P, “Rodded Operation,” references NUREG/CR-6759, “Parametric Study of the Effect of Control Rods for PWR [Pressurized Water Reactor] Burnup Credit,” (ADAMS Accession No. ML020810111). WCAP-18414-NP states in part:

> Any assemblies incurring significant rodded operation going forward must not credit the rodded burnup.

And also states,

> Any impact from short term operation at reduced power levels with rods inserted will be negligible.

The significance and negligibility of a reactivity impact needs to be judged against the margin in the analysis. The Recommendations section in NUREG/CR-6759 states, in part:

> Consequently, it is concluded that, based on the assumption that U.S. PWRs do not use CRs [Control Rods] to a significant extent (i.e., CRs are not inserted deeper than the top ~20 cm of the active fuel and CRs are not inserted for extended burnups), the effect of CRs on discharge reactivity is relatively small (less than 0.2% Δk)."

While 0.2% Δk may be thought of as relatively small, it would be a large portion of the Administrative Margin in the licensee's analysis. Please provide the following information:

a. What the licensee considers significant/non-negligible rodded operation.
b. How the licensee will identify and control any fuel assembly that experiences significant/non-negligible rodded operation.

SNC Response:

Significant/non-negligible rodded operation

Reference 1 seeks to support fuel storage for a historical baseload power operational approach and does not intend to cover Flexible Power Operations (FPO) scenarios. Significant/non-negligible rodded operation is defined as [

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Identification and Control of any fuel assembly that experiences significant/non-negligible rodded operation

Rodded burnup in assemblies under rodded locations for any [

]^{a,c} The final burnup of these assemblies will be adjusted to reflect this impact with regards to spent fuel pool storage.

References:

1. WCAP-18414-P, "J. M. Farley Units 1 and 2 Spent Fuel Pool Criticality Safety Analysis," September 2019.

RAI No. 8

Section 6.2 of WCAP-18414-NP, "Analysis Area of Applicability"

a. States in part,

> This section details the area of applicability of the analysis concerning assembly characteristics and associated fuel management, including a summary of the data which needs to be confirmed to assure that the results presented here remain valid.

With respect to the area of applicability, please explain how the licensee will verify that the area of applicability is met for all fuel assemblies.

b. WCAP-18414-P states, in part,

[[

]]

Please provide the methodology that will be used.

SNC Response:

A.) Reference 1 (WCAP-18414-P), Section 6.2, Table 6-15 lists the spent fuel pool (SFP) area of applicability (AOA) for Farley Units 1 and 2. Confirmation of the fuel assembly mechanical parameters and core operational data via the requirements of Table 6-15 of Reference 1 guarantees assemblies are bounded by the design basis assembly. Without significant changes to the fuel mechanical design or licensing basis of the plant itself, these parameters will remain conservative for the criticality analysis. Any change to the licensing basis will be captured as part of the Reload Safety and Licensing Checklist and evaluated on a cycle-specific basis, as described in Reference 2.

Reference 1 can be consulted with regard to the analysis of record for Max. Cycle Average Soluble Boron concentration and its determination, as well as the bounding Relative Burnup Profile, with cycle-specific checks developed in the reload analysis following the guidance of Reference 2. Rodded operation is described in the response to RAI #7.

All previously operated and discharged assemblies at Farley Units 1 (through the end of Operating Cycle 29) and 2 (through the end of Operating Cycle 26) have been explicitly considered within Reference 1. No further action is needed on the part of the licensee to ensure past assemblies meet the Reference 1, Table 6-15 requirements. Adhering to applicable burnup vs. enrichment storage requirements is all that is necessary for these previously operated and discharged assemblies currently in the SFP and/or explicitly modeled in Reference 1.

B.) The methodology used to [

]^{a,c} require the SFP analysis of record (Reference 1 as-submitted) to be revised.

Test fuel assemblies or single-use fuel assemblies [

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References:

1. WCAP-18414-P, “J. M. Farley Units 1 and 2 Spent Fuel Pool Criticality Safety Analysis,” September 2019.
2. WCAP-9272-P-A, “Westinghouse Reload Safety Evaluation Methodology,” July 1985.

Joseph M. Farley Nuclear Plant - Units 1 and 2
Response to Request for Additional Information Regarding License Amendment Request to Update the Spent Fuel Pool Criticality Safety Analysis and Revise Technical Specification (TS) 3.7.15 "Spent Fuel Assembly Storage" and TS 4.3 "Fuel Storage"

ENCLOSURE 3

Westinghouse Affidavit, CAW-20-5032, for Withholding Proprietary Information from Public Disclosure

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:
COUNTY OF BUTLER:

(1) I, Zachary S. Harper, have been specifically delegated and authorized to apply for withholding and execute this Affidavit on behalf of Westinghouse Electric Company LLC (Westinghouse).

(2) I am requesting the proprietary portions of NL-20-0403 be withheld from public disclosure under 10 CFR 2.390.

(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 10 CFR 2.390, 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 and is not customarily disclosed to the public.

(ii) 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.

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(5) Westinghouse has policies in place to identify proprietary information. 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.

(6) The attached documents are bracketed and marked to indicate the bases for withholding. The justification for withholding 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

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lower case letters refer to the types of information Westinghouse customarily holds in confidence identified in Sections (5)(a) through (f) of this Affidavit.

I declare that the averments of fact set forth in this Affidavit are true and correct to the best of my knowledge, information, and belief.

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

Executed on: 4/9/2020

Zachary S. Harper, Manager
Licensing Engineering