Southern Nuclear

Regulatory Affairs

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WITHHOLD FROM PUBLIC DISCLOSURE UNDER 10 CFR 2.390 (DECONTROLLED UPON REMOVAL OF ENCLOSURE 2 ATTACHMENT 1)

January 20, 2023

NL-23-0012

Docket Nos.: 50-424
50-425

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

Vogtle Electric Generating Plant – Units 1 and 2
Post-Audit Supplement to
License Amendment Request and Exemptions to Allow
Use of Lead Test Assemblies for Accident-Tolerant Fuel

By letter dated June 30, 2022, Southern Nuclear Operating Company (SNC) submitted a license amendment request (LAR) to allow for the use of lead test assemblies (LTAs) to demonstrate operating characteristics for accident-tolerant fuel (ATF). On August 1, 2022, the U.S. Nuclear Regulatory Commission (NRC) staff notified SNC that requests for additional information (RAIs) were necessary early in their review. By letter dated September 13, 2022, SNC responded to the RAIs. In December 2022, NRC staff conducted an audit and requested additional information. In response, SNC provides the following information.

Enclosure 1 provides additional (non-proprietary) information to demonstrate that the LTA program does not significantly impact radiation source terms.
Enclosure 2 provides additional (both proprietary in Attachment 1 and non-proprietary in Attachment 2) information pertaining to coated cladding emissivity.
Enclosure 3 provides the Westinghouse Affidavit, CAW-23-001, 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 in accordance with 10 CFR Section 2.390 of the Commission's regulations.

Correspondence with respect to the copyright or proprietary aspects of the items listed above or the supporting Westinghouse affidavit should reference CAW-23-001 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.

The conclusions of the No Significant Hazards Consideration Determination Analysis and Environmental Consideration contained in the LAR have been reviewed and are unaffected by these responses.

This letter contains no NRC commitments.

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

If you have any questions, please contact Ryan Joyce at 205.992.6468.

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

Executed on January 20, 2023.

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

CAG/efb/cbg

Enclosure 1: Response to NRC Audit Questions Related to HBHE LTA – Core Sources Comparison (Non-Proprietary)
Enclosure 2: Response to NRC Audit Questions Related to HBHE LTA - Chromium Coated Cladding Emissivity
    Attachment 1 – Proprietary
    Attachment 2 – Non-Proprietary
Enclosure 3: Affidavit

cc: Regional Administrator, Region ll
    NRR Project Manager – Vogtle 1&2
    Senior Resident Inspector – Vogtle 1&2
    State of Georgia Environmental Protection Division
    RType: CVC7000

**Vogtle Electric Generating Plant – Units 1 and 2**
**Post-Audit Supplement to**
**License Amendment Request and Exemptions to Allow**
**Use of Lead Test Assemblies for Accident-Tolerant Fuel**

**ENCLOSURE 1**

**Response to NRC Audit Questions Related to HBHE LTA – Core Sources Comparison**
**(Non-Proprietary)**

Subject: Vogtle Unit 2 High Burnup High Enrichment (HBHE) Lead Test Assemblies (LTA) – Core Sources Comparison

During the virtual audit of the Vogtle ATP LTA LAR (ML22181B156) on December 8, 2022, NRC staff observed that parallel work on the Alternate Source Term (AST) (ML22181B066) transition and the transition to a fuel cycle featuring High Burnup High Enrichment (HBHE) Lead Test Assemblies (LTAs) was potentially confusing. Specifically, which analysis of record (AOR) core inventory is used as the basis to show that the LTA program does not significantly impact radiation source terms.

Table 1 shows the comparison using the AST core inventory. Table 2 shows the same comparison using the current AOR, consistent with Table 15A-3 of the Vogtle UFSAR.

From the comparisons contained in Tables 1 and 2, it is shown that the core inventory used in the current AOR and the core inventory used for the AST submittal are bounding with respect to the nuclides that contribute significantly to dose consequence evaluations.

**Table 1 Comparison between AST Core Source Term (Including 10% Fuel Design Margin (FDM) added to the nominal activity) and Core Source Term for Fuel Cycle Implementing LTAs**

| Group | Group Name | Nuclide | AST+10% Source (Ci) | LTA Fuel Cycle Source (Ci) | Ratio |
|---|---|---|---|---|---|
| 1 | Noble Gases | Kr-83m | 1.29E+07 | 1.16E+07 | 0.90 |
| | | Kr-85 | 1.12E+06 | 1.01E+06 | 0.90 |
| | | Kr-85m | 2.74E+07 | 2.45E+07 | 0.89 |
| | | Kr-87 | 5.40E+07 | 4.81E+07 | 0.89 |
| | | Kr-88 | 7.23E+07 | 6.43E+07 | 0.89 |
| | | Xe-131m | 1.42E+06 | 1.29E+06 | 0.91 |
| | | Xe-133 | 2.15E+08 | 1.95E+08 | 0.91 |
| | | Xe-133m | 6.83E+06 | 6.23E+06 | 0.91 |
| | | Xe-135 | 5.10E+07 | 4.59E+07 | 0.90 |
| | | Xe-135m | 4.59E+07 | 4.20E+07 | 0.92 |
| | | Xe-138 | 1.87E+08 | 1.70E+08 | 0.91 |
| 2 | Iodine | Br-82 | 3.41E+05 | 3.20E+05 | 0.94 |
| | | Br-83 | 1.28E+07 | 1.15E+07 | 0.90 |
| | | Br-84 | 2.32E+07 | 2.07E+07 | 0.89 |
| | | I-130 | 2.04E+06 | 1.90E+06 | 0.94 |
| | | I-131 | 1.07E+08 | 9.79E+07 | 0.91 |
| | | I-132 | 1.57E+08 | 1.43E+08 | 0.91 |
| | | I-133 | 2.20E+08 | 2.00E+08 | 0.91 |
| | | I-134 | 2.47E+08 | 2.24E+08 | 0.91 |
| | | I-135 | 2.10E+08 | 1.91E+08 | 0.91 |
| 3 | Cesium | Cs-134 | 1.67E+07 | 1.56E+07 | 0.93 |
| | | Cs-134m | 4.50E+06 | 4.26E+06 | 0.95 |
| | | Cs-135 | 4.51E+01 | 4.06E+01 | 0.90 |
| | | Cs-136 | 5.37E+06 | 5.01E+06 | 0.93 |
| | | Cs-137 | 1.18E+07 | 1.06E+07 | 0.90 |
| | | Cs-138 | 2.04E+08 | 1.85E+08 | 0.91 |
| | | Rb-86 | 2.07E+05 | 1.94E+05 | 0.93 |
| | | Rb-88 | 7.36E+07 | 6.55E+07 | 0.89 |
| | | Rb-89 | 9.64E+07 | 8.57E+07 | 0.89 |

**Table 1 Comparison between AST Core Source Term (Including 10% Fuel Design Margin (FDM) added to the nominal activity) and Core Source Term for Fuel Cycle Implementing LTAs**

| Group | Group Name | Nuclide | AST+10% Source (Ci) | LTA Fuel Cycle Source (Ci) | Ratio |
|---|---|---|---|---|---|
| 4 | Tellurium | Sb-124 | 7.92E+04 | 7.63E+04 | 0.96 |
| | | Sb-125 | 8.59E+05 | 7.89E+05 | 0.92 |
| | | Sb-126 | 5.11E+04 | 4.70E+04 | 0.92 |
| | | Sb-127 | 9.75E+06 | 9.03E+06 | 0.93 |
| | | Sb-129 | 3.03E+07 | 2.80E+07 | 0.92 |
| | | Te-125m | 1.82E+05 | 1.67E+05 | 0.92 |
| | | Te-127 | 9.55E+06 | 8.82E+06 | 0.92 |
| | | Te-127m | 1.58E+06 | 1.44E+06 | 0.91 |
| | | Te-129 | 2.84E+07 | 2.62E+07 | 0.92 |
| | | Te-129m | 5.44E+06 | 5.01E+06 | 0.92 |
| | | Te-131 | 9.10E+07 | 8.31E+07 | 0.91 |
| | | Te-131m | 2.07E+07 | 1.90E+07 | 0.92 |
| | | Te-132 | 1.53E+08 | 1.40E+08 | 0.91 |
| | | Te-133 | 1.17E+08 | 1.07E+08 | 0.91 |
| | | Te-133m | 1.03E+08 | 9.39E+07 | 0.91 |
| | | Te-134 | 1.96E+08 | 1.77E+08 | 0.90 |
| 5 | Strontium | Sr-89 | 1.02E+08 | 9.11E+07 | 0.89 |
| | | Sr-90 | 8.70E+06 | 7.77E+06 | 0.89 |
| | | Sr-91 | 1.27E+08 | 1.14E+08 | 0.89 |
| | | Sr-92 | 1.37E+08 | 1.23E+08 | 0.90 |
| 6 | Barium | Ba-137m | 1.12E+07 | 1.01E+07 | 0.90 |
| | | Ba-139 | 1.95E+08 | 1.77E+08 | 0.91 |
| | | Ba-140 | 1.89E+08 | 1.71E+08 | 0.91 |
| | | Ba-141 | 1.75E+08 | 1.59E+08 | 0.91 |
| 7 | Ruthenium | Mo-99 | 2.00E+08 | 1.82E+08 | 0.91 |
| | | Pd-109 | 3.49E+07 | 3.33E+07 | 0.95 |
| | | Rh-103m | 1.69E+08 | 1.56E+08 | 0.92 |
| | | Rh-105 | 1.07E+08 | 9.96E+07 | 0.93 |
| | | Rh-106 | 6.16E+07 | 5.76E+07 | 0.94 |
| | | Ru-103 | 1.69E+08 | 1.56E+08 | 0.92 |
| | | Ru-105 | 1.18E+08 | 1.10E+08 | 0.94 |
| | | Ru-106 | 5.39E+07 | 5.03E+07 | 0.93 |
| | | Tc-99 | 1.48E+03 | 1.33E+03 | 0.90 |
| | | Tc-99m | 1.77E+08 | 1.61E+08 | 0.91 |

**Table 1 Comparison between AST Core Source Term (Including 10% Fuel Design Margin (FDM) added to the nominal activity) and Core Source Term for Fuel Cycle Implementing LTAs**

| Group | Group Name | Nuclide | AST+10% Source (Ci) | LTA Fuel Cycle Source (Ci) | Ratio |
|---|---|---|---|---|---|
| 8 | Cerium | Ce-141 | 1.79E+08 | 1.62E+08 | 0.91 |
| | | Ce-143 | 1.65E+08 | 1.49E+08 | 0.90 |
| | | Ce-144 | 1.34E+08 | 1.21E+08 | 0.90 |
| | | Np-237 | 3.44E+01 | 3.13E+01 | 0.91 |
| | | Np-238 | 4.27E+07 | 4.04E+07 | 0.94 |
| | | Np-239 | 2.07E+09 | 1.94E+09 | 0.93 |
| | | Pu-238 | 3.02E+05 | 2.81E+05 | 0.93 |
| | | Pu-239 | 3.09E+04 | 2.84E+04 | 0.92 |
| | | Pu-240 | 4.50E+04 | 4.02E+04 | 0.89 |
| | | Pu-241 | 1.30E+07 | 1.23E+07 | 0.94 |
| | | Pu-242 | 2.06E+02 | 1.91E+02 | 0.93 |
| | | Pu-243 | 4.22E+07 | 4.17E+07 | 0.99 |

**Table 1 Comparison between AST Core Source Term (Including 10% Fuel Design Margin (FDM) added to the nominal activity) and Core Source Term for Fuel Cycle Implementing LTAs**

| Group | Group Name | Nuclide | AST+10% Source (Ci) | LTA Fuel Cycle Source (Ci) | Ratio |
|---|---|---|---|---|---|
| 9 | Lanthanum | Am-241 | 1.28E+04 | 1.17E+04 | 0.91 |
| | | Am-242 | 7.06E+06 | 6.83E+06 | 0.97 |
| | | Am-243 | 2.53E+03 | 2.40E+03 | 0.95 |
| | | Cm-242 | 3.69E+06 | 3.56E+06 | 0.97 |
| | | Cm-244 | 3.71E+05 | 3.70E+05 | 1.00 |
| | | Eu-154 | 6.80E+05 | 6.26E+05 | 0.92 |
| | | Eu-155 | 2.87E+05 | 2.65E+05 | 0.92 |
| | | Eu-156 | 2.46E+07 | 2.32E+07 | 0.94 |
| | | La-140 | 1.96E+08 | 1.79E+08 | 0.91 |
| | | La-141 | 1.76E+08 | 1.60E+08 | 0.91 |
| | | La-142 | 1.70E+08 | 1.54E+08 | 0.91 |
| | | La-143 | 1.63E+08 | 1.48E+08 | 0.90 |
| | | Nb-95 | 1.84E+08 | 1.66E+08 | 0.90 |
| | | Nb-95m | 2.09E+06 | 1.89E+06 | 0.90 |
| | | Nb-97 | 1.83E+08 | 1.66E+08 | 0.91 |
| | | Nb-97m | 1.73E+08 | 1.57E+08 | 0.91 |
| | | Nd-147 | 7.08E+07 | 6.43E+07 | 0.91 |
| | | Pm-147 | 1.77E+07 | 1.59E+07 | 0.90 |
| | | Pm-148 | 1.93E+07 | 1.77E+07 | 0.92 |
| | | Pm-148m | 4.01E+06 | 3.64E+06 | 0.91 |
| | | Pm-149 | 6.53E+07 | 6.00E+07 | 0.92 |
| | | Pm-151 | 2.06E+07 | 1.90E+07 | 0.92 |
| | | Pr-143 | 1.61E+08 | 1.45E+08 | 0.90 |
| | | Pr-144 | 1.35E+08 | 1.22E+08 | 0.90 |
| | | Pr-144m | 1.88E+06 | 1.70E+06 | 0.90 |
| | | Sm-151 | 4.47E+04 | 4.04E+04 | 0.90 |
| | | Sm-153 | 4.93E+07 | 4.59E+07 | 0.93 |
| | | Y-90 | 9.08E+06 | 8.13E+06 | 0.89 |
| | | Y-91 | 1.34E+08 | 1.20E+08 | 0.89 |
| | | Y-91m | 7.39E+07 | 6.60E+07 | 0.89 |
| | | Y-92 | 1.38E+08 | 1.24E+08 | 0.90 |
| | | Y-93 | 1.57E+08 | 1.41E+08 | 0.90 |
| | | Y-95 | 1.72E+08 | 1.56E+08 | 0.90 |
| | | Zr-95 | 1.82E+08 | 1.64E+08 | 0.90 |
| | | Zr-97 | 1.82E+08 | 1.65E+08 | 0.91 |

**Table 2 Comparison between Measurement Uncertainty Recapture (MUR) Core Source Term and Core Source Term for Fuel Cycle Implementing LTAs**

| Nuclide | MUR Program Source (Ci/Core) | LTA Fuel Cycle Source (Ci/Core) | Ratio |
|---|---|---|---|
| I-131 | 1.03E+08 | 9.79E+07 | 0.95 |
| I-132 | 1.50E+08 | 1.43E+08 | 0.95 |
| I-133 | 2.10E+08 | 2.00E+08 | 0.95 |
| I-134 | 2.26E+08 | 2.24E+08 | 0.99 |
| I-135 | 1.95E+08 | 1.91E+08 | 0.98 |
| Kr-85m | 2.68E+07 | 2.45E+07 | 0.91 |
| Kr-85 | 1.04E+06 | 1.01E+06 | 0.97 |
| Kr-87 | 4.93E+07 | 4.81E+07 | 0.98 |
| Kr-88 | 7.02E+07 | 6.43E+07 | 0.92 |
| Xe-131m | 7.13E+05 | 1.29E+06 | 1.82 |
| Xe-133m | 3.01E+07 | 6.23E+06 | 0.21 |
| Xe-133 | 2.12E+08 | 1.95E+08 | 0.92 |
| Xe-135m | 4.18E+07 | 4.20E+07 | 1.01 |
| Xe-135 | 4.65E+07 | 4.59E+07 | 0.99 |
| Xe-138 | 1.69E+08 | 1.70E+08 | 1.00 |

**Vogtle Electric Generating Plant – Units 1 and 2**
**Post-Audit Supplement to**
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# ENCLOSURE 2

## Response to NRC Audit Questions Related to HBHE LTA - Chromium Coated Cladding Emissivity

**Attachment 1 – Proprietary**

**Attachment 2 – Non-Proprietary**

Subject: Vogtle Unit 2 High Burnup High Enrichment (HBHE) Lead Test Assemblies (LTA) – Chromium Coated Cladding Emissivity

Information pertaining to coated cladding emissivity under LOCA conditions was discussed with NRC staff during the regulatory audit identified in Reference 1 and is provided herein. Figure 1 illustrates chromium coated cladding oxidation generated during simulated large break loss-of-coolant accident (LBLOCA) conditions for the Vogtle Accident Tolerant Fuel (ATF) lead test assemblies (LTAs). Figure 2 shows the emissivity of the resulting chromium oxide at the peak cladding temperature (PCT) time is [ ]$^{a,c}$ to the emissivity of zirconium oxide for uncoated cladding. Details of Figures 1 and 2 are described further in the following discussion.

The orange line on Figure 1 shows the limiting LBLOCA cladding temperature in °C at the peak cladding temperature (PCT) elevation for the Vogtle LTAs; the LBLOCA PCT of [ ]$^{a,c}$ occurs at [ ]$^{a,c}$. The blue line on Figure 1 shows the chromium oxide thickness in microns corresponding to the limiting LTA temperature transient. The oxide thickness is based on chromium oxidation kinetics derived from Westinghouse high temperature steam oxidation testing performed on chromium coated cladding. At the PCT time of [ ]$^{a,c}$, the estimated chromium oxide thickness is approximately [ ]$^{a,c}$, as illustrated by the green dashed line on Figure 1.

Figure 2 compares the chromium oxide emissivity at the time of PCT to the emissivity modeled in the LTA evaluation, which reflects the emissivity of zirconium oxide for uncoated cladding. The cladding emissivity of oxidized zirconium modeled during the LBLOCA ranges from 0.6 (lower bound) to [ ]$^{a,c}$ and is represented by the black line on Figure 2. Reference 2 provides emissivity data for oxidized chromium at various oxide-film thicknesses and temperatures. Using the data for the maximum temperature available (800°C), the emissivity for a chromium oxide film thickness of [ ]$^{a,c}$ is estimated to be [ ]$^{a,c}$. This emissivity is [ ]$^{a,c}$, as shown by the green dashed line on Figure 2. Based on the Reference 2 data, chromium oxide emissivity increases with temperature; therefore, it is likely that the emissivity for [ ]$^{a,c}$ chromium oxide thickness will be higher at [ ]$^{a,c}$ compared to 800°C. The green dashed line in Figure 2, along with the red arrow indicating the emissivity would be higher at the higher temperatures, shows the estimated emissivity at the time of PCT for chromium coated cladding is [ ]$^{a,c}$ to that of uncoated cladding.

**References**

1. "VOGTLE ELECTRIC GENERATING PLANT, UNITS 1 AND 2 – REGULATORY AUDIT IN SUPPORT OF REVIEW OF THE APPLICATION TO ALLOW USE OF LEAD TEST ASSEMBLIES FOR ACCIDENT-TOLERANT FUEL (EPID L-2022-LLA-0097)," October 2022 (NRC ADAMS Accession Number ML22103A253).
2. Zhorov, G.A., Yagunov, K.A., "Effect of thickness of oxide film on the emissivity and reflectivity of heat-resistant metals and alloys," *Journal of Engineering Physics* 34, 20–23 (1978).

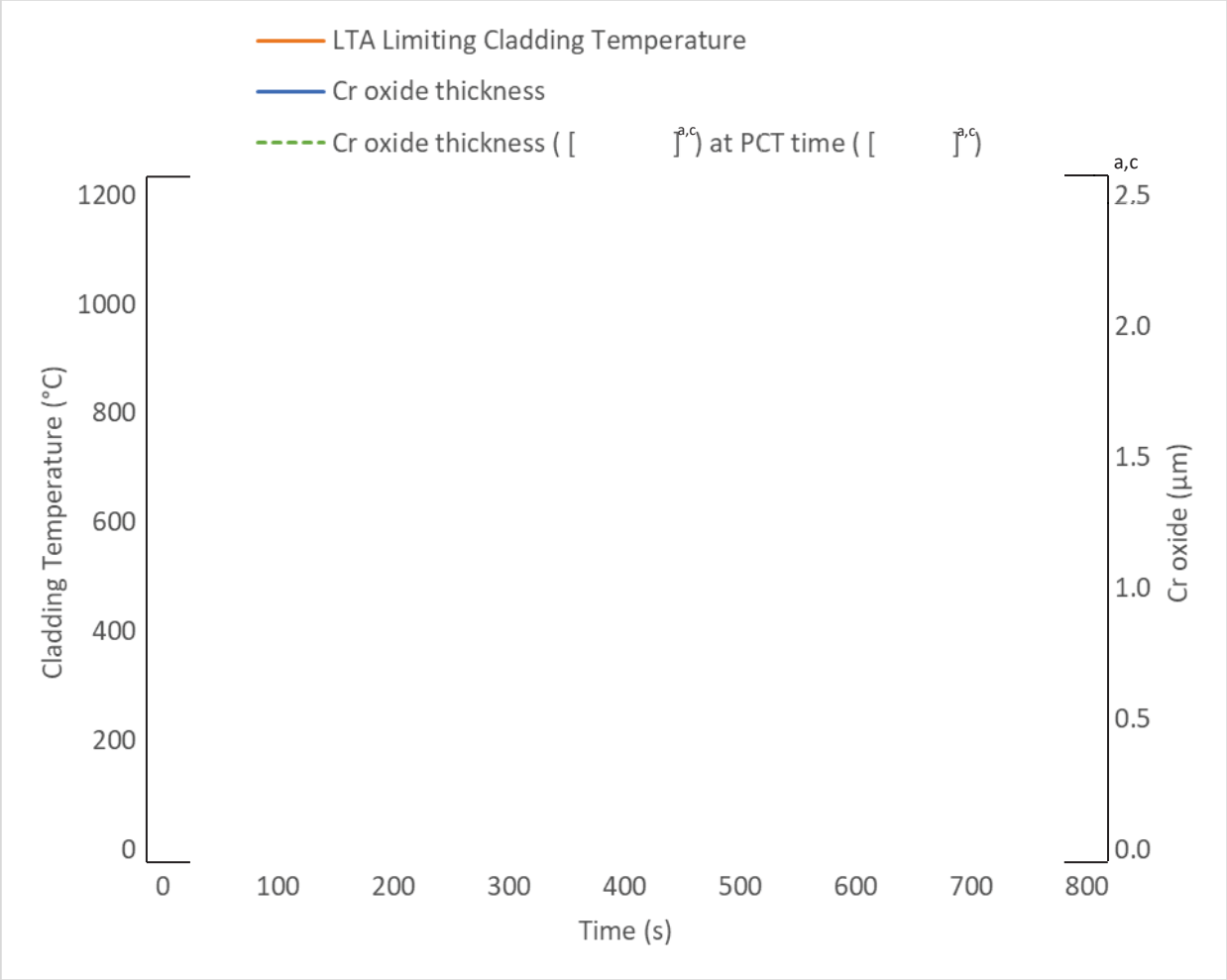


**Figure 1: Cladding Temperature at PCT Elevation and Cr Oxide Thickness**

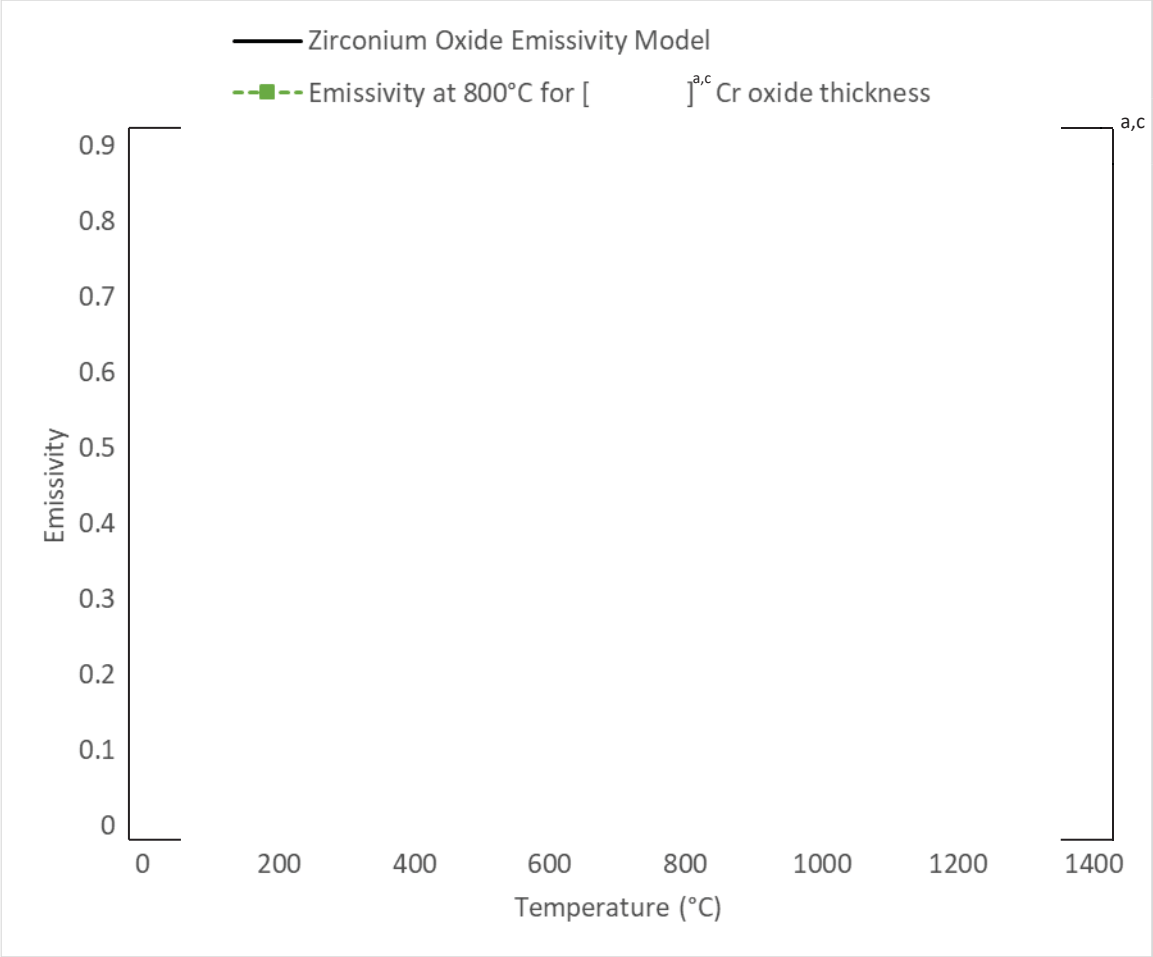


**Figure 2: Zirconium Oxide Emissivity Model and Cr Oxide Emissivity at PCT Time**

**Vogtle Electric Generating Plant – Units 1 and 2**
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**ENCLOSURE 3**

**Affidavit**

Commonwealth of Pennsylvania:
County of Butler:

(1) I, Anthony Schoedel, Manager, eVinci Licensing & Configuration Management, 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 Enclosure 2 to NL-23-0012 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) The information sought to be withheld is being transmitted to the Commission in confidence and, to Westinghouse's knowledge, is not available in public sources.

(iii) Westinghouse notes that a showing of substantial harm is no longer an applicable criterion for analyzing whether a document should be withheld from public disclosure. Nevertheless, 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.

(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 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: 1/18/2023

Anthony J. Schoedel

Signed electronically by
Anthony Schoedel