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LTR-NRC-22-24
June 21, 2022

Subject: Submittal of Presentation Slides for the Westinghouse-NRC Pre-Submittal Meeting on Topical Report CENPD-289-P/NP, Supplement 1, "Use of Inert Replacement Rods in CE 16x16 Next Generation Fuel (NGF)" (EPID L-2022-TOP-0030) (Proprietary/Non-Proprietary)

Enclosed are the proprietary and non-proprietary versions of the slide package to support a pre-submittal meeting between the NRC and Westinghouse on Topical Report CENPD-289-P/NP, Supplement 1, "Use of Inert Replacement Rods in CE 16x16 Next Generation Fuel (NGF)" (EPID L-2022-TOP-0030), on June 23rd, 2022.

This submittal contains proprietary information of Westinghouse Electric Company LLC ("Westinghouse"). In conformance with the requirements of 10 CFR Section 2.390, as amended, of the Nuclear Regulatory Commission's ("Commission's") regulations, we are enclosing with this submittal an Affidavit. The Affidavit sets forth the basis on which the information identified as proprietary may be withheld from public disclosure by the Commission.

Correspondence with respect to the proprietary aspects of this submittal or the Westinghouse Affidavit should reference AW-22-028 and should be addressed to Zachary S. Harper, Manager, Licensing Engineering, Westinghouse Electric Company, 1000 Westinghouse Drive, Building 1, Cranberry Township, PA 16066.

Zachary S. Harper, Manager
Licensing Engineering

cc: Ekaterina Lenning
Richard Chang

Enclosures:

(1) Affidavit, AW-22-028
(2) Presentation Slides for the Westinghouse-NRC Pre-Submittal Meeting on Topical Report CENPD-289-P/NP, Supplement 1, "Use of Inert Replacement Rods in CE 16x16 Next Generation Fuel (NGF)" (Proprietary)
(3) Presentation Slides for the Westinghouse-NRC Pre-Submittal Meeting on Topical Report CENPD-289-P/NP, Supplement 1, "Use of Inert Replacement Rods in CE 16x16 Next Generation Fuel (NGF)" (Non-Proprietary)

Commonwealth of Pennsylvania:
County of Butler:

(1) I, Zachary Harper, Manager, Licensing Engineering, 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 LTR-NRC-22-24 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: 6/21/2022

Signed electronically by
Zachary Harper

Enclosure 3

Presentation Slides for the Westinghouse-NRC Pre-Submittal Meeting on Topical Report CENPD-289-P/NP, Supplement 1, "Use of Inert Replacement Rods in CE 16x16 Next Generation Fuel (NGF)"

(Non-Proprietary)

June 2022

(31 pages including this cover page)

Westinghouse Electric Company
1000 Westinghouse Drive
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Combustion Engineering (CE)
Fuel Assembly Reconstitution Topical Report Supplement

CENPD-289-P/NP, Supplement 1, "*Use of Inert Replacement Rods in CE 16x16 Next Generation Fuel (NGF)*" (EPID L-2022-TOP-0030)

NRC Pre-Submittal Meeting

June 23, 2022

Westinghouse

Safety Message

Employee behaviors

Leader behaviors

Westinghouse

Agenda

- CE Reconstitution Topical Report (CENPD-289-P-A)
- Purpose for Submittal of Supplement 1 to CENPD-289-P-A
- Leveraging Improvements in Fuel Design
- CENPD-289-P/NP, Supplement 1
  - Neutronic Performance
  - Mechanical Performance
  - Plant Safety Analysis
  - Thermal-Hydraulic (DNB) Performance
  - Evaluation of DNB Test Data
- Licensing Approach
- Summary, Schedule & Utility Requirements
- Questions & Discussion

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CE Reconstitution Topical Report (CENPD-289-P-A)

- NRC approved the methodology in CENPD-289-P-A, "*Use of Inert Replacement Rods in ABB CENF Fuel Assemblies*," which describes the methodology for analysis of reconstituted Westinghouse fuel containing inert replacement rods in Combustion Engineering (CE) plants
  - Intended as a methodology and not as an assessment of plant-specific Analyses of Record
- Submitted in response to NRC generic letter GL 90-02, Supplement 1, which required NRC approval for methods used to analyze core configurations containing "inert" rods
  - Conservatism of DNB methodology was a primary concern
- Similar submittals were made by other fuel vendors including Westinghouse

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CE Reconstitution Topical Report (contd.)

- CENPD-289-P-A defines two “classes” of inert rod configurations
  - Class A Configurations

[ ] a, c

  - Non-Class A configurations are defined as all configurations that do not satisfy Class A definition

CE Reconstitution Topical Report – Safety Evaluation Report (SER)

- The NRC limited the application of the CE fuel reconstitution methodology only to Class A configurations
  - SER restrictions were accepted by CE customers in order to perform reconstitutions in upcoming reloads
  - SER restrictions were not a major concern at the time since **[ ]**[a,c] could be performed to meet Class A restrictions in most cases

- Although the topical report described the application of the methodology to non-Class A configurations, the SER listed additional restrictions on the use of the methodology

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Purpose for Submittal of Supplement 1 to CENPD-289-P-A

- Updating the limitations on CENPD-289-P-A to allow non-Class A configurations in the **CE16NGF**™ fuel design would alleviate challenges related to:

[a, c]

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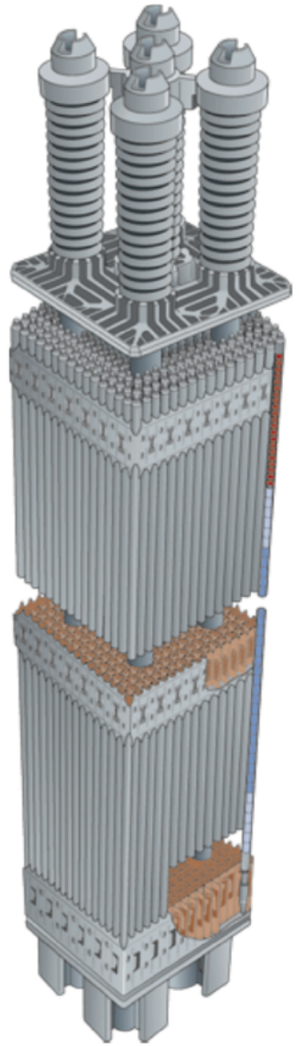
Leveraging Improvements in Fuel Design

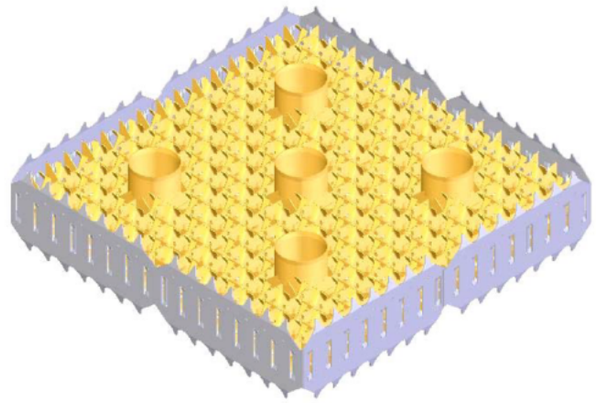
- Westinghouse fueled CE-NSSS plants currently use a new fuel product (**CE16NGF**), which was not available when CENPD-289-P-A was approved
  - Applicability of the methodology in CENPD-289-P-A to the **CE16NGF** fuel product was approved in WCAP-16500-P-A for Class A configurations



Mid Grids with "I" Spring Rod Support
SSV Mixing Vanes
***ZIRLO*® grid-strap**
2 Additional IFM grids

[ ] a, c

Side-Supported Vane (SSV)



IFM Grid

Leveraging Improvements in Fuel Design (contd.)

- The features of modern fuel designs support relaxation of the SER limits on CENPD-289-P-A for reconstitution of **CE16NGF** fuel
  - Mixing vanes and Intermediate Flow Mixers (IFM) – Westinghouse DNB tests have shown that mixing vanes and IFM grids **[ ]**^{a,c}
  - I-Springs – The I-Springs design has virtually eliminated **[ ]**^{a,c}
  - Updated Critical Heat Flux (CHF) correlations based on **CE16NGF**-specific DNB tests and additional test data that was not included in the CE-1 database

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CENPD-289-P/NP, Supplement 1

- Supplement 1 to CENPD-289-P-A justifies the use of non-Class A inert rod configurations for use with the **CE16NGF** fuel design
  - Explicit cycle-specific analyses will be performed to demonstrate that the COLSS/CPC (Core Operating Limits Supervisory System/Core Protection Calculator) setpoints and Core Operating Limits Report (COLR) limits will ensure that Technical Specification limits and AORs remain bounding

- Additional DNB test results have been included in the supplement to demonstrate conservatism of current **CE16NGF** CHF correlations (WSSV / WSSV-T, ABB-NV, WLOP) for inert rod configurations

CENPD-289-P/NP, Supplement 1 (contd.)

- Major change to the approved inert rod configurations is to allow currently approved methodology (WCAP-16500-P-A) to be used to analyze **CE16NGF** fuel assemblies with non-Class A inert rod configurations provided that:

a, c

[

]

CENPD-289-P/NP, Supplement 1 (contd.)

- If it is determined that any operating penalty, such as the [

  ]^{a,c} will be made to ensure conservative operation within the allowable licensed limits

- Supplement contains detailed discussions on the effects of rod replacement on
  - Neutronic Performance
  - Mechanical Performance
  - Plant Safety Analysis
  - Thermal-Hydraulic (DNB) Performance
  - Evaluation of DNB Test Data

Neutronic Performance

- The neutronic impact of inert rods is analyzed using currently approved nuclear design methodology (ANC for Westinghouse analyses)
- Primary effects of inert replacement rods are:
  - Increased power peaking in fuel rods adjacent to inert rod
  - [

    ]^{a,c}
- Supplement 1 proposes the explicit analysis of all non-Class A inert rod configurations (within the allowable range specified in the supplement)
  - If required, [

    ]^{a,c} to ensure plant operation within licensed limits

Mechanical Performance

- Mechanical design analyses are currently performed using NRC-approved methods for the **CE16NGF** fuel design
- Primary effects of inert replacement rods are:
  - Reduced fuel assembly weight decreases hold-down force that prevents assembly lift-off
  - Increase in fuel assembly lateral stiffness and change in natural frequency, which impacts the dynamic response of the fuel assembly during seismic LOCA type events
- Assessments have shown that the Analysis of Record remains bounding for all anticipated inert rod configurations within the allowable range specified in the supplement
  - Configurations requiring cycle-specific assessment are described in the topical report

Plant Safety Analysis

- Safety Analyses are currently performed using NRC-approved methods for the **CE16NGF** fuel design
- Primary effects of inert replacement rods are:
  - Reduced number of active fuel rods result in an increase in the core average and peak fuel rod power (kW/ft)
  - Increased power peaking in fuel rods adjacent to inert rods
- Plant-specific safety analyses currently assume a maximum number of inert rods
  - This value is verified each cycle as part of the reload safety analyses
- The reload safety analyses will continue to verify that the maximum number of inert rods are within safety analysis assumptions, and if [

]a,c

Thermal-Hydraulic (DNB) Performance

- The core thermal-hydraulic design analyses are currently performed using NRC-approved methods (WCAP-16500-P-A)
- **CE16NGF** design significantly improves fuel DNB performance and [ ]^{a,c} as compared to fuel design with vaneless grids
  - Addition of mixing vanes on mid-grids
  - Addition of two IFM grids with mixing vanes
- Evaluation of additional CHF test data has shown that the current **CE16NGF** CHF correlations remain conservative for all inert rod configurations within the allowed range specified in the supplement
- [ ]^{a,c} associated with non-Class A inert rod configurations will be explicitly included in the core thermal-hydraulic calculations of the reload safety analysis and COLSS/CPC setpoints

Evaluation of DNB Test Data

- The supplement to CENPD-289-P-A contains evaluations of additional inert rod configurations and comparison to DNB test data
  - Test bundle [ ]a,c (non-class A configuration)
  - Test bundle [ ]a,c
  - Reference tests with same array geometry and all rods heated

- Comparisons to reference DNB tests show [

]a,c

Evaluation of DNB Test Data (contd.)

- Test data evaluation concludes that all current **CE16NGF** DNB correlations, WSSV / WSSV-T, ABB-NV and WLOP, remain applicable to the inert rod configurations described in the supplement

[ ]

a, c

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Licensing Approach – Applicable Regulations and NRC Guidance

- Current regulatory requirements will be generically applicable to the methodology in CENPD-289-P/NP, Supplement 1
  - General Design Criteria (GDC) provide the minimum design requirements for Light Water Reactors, such as GDC 10 and 35
  - 10 CFR 50.46 as it relates to cooling performance
  - Standard Review Plan (SRP), NUREG-0800, will be utilized
    - SRP Section 4.2, “Fuel System Design”
    - SRP Section 4.3, “Nuclear Design”
    - SRP Section 4.4, “Thermal and Hydraulic Design”
    - SRP Chapter 15, “Transient and Accident Analysis”
  - Supplement 1 to Generic Letter GL 90-02, “Alternative Requirements for Fuel Assemblies in Design Features Section of Technical Specifications”

Licensing Approach – Impact on the Licensing Basis

- Changes to the Licensing Basis may include updates to the
  - Updated Final Safety Analysis Report
  - COLR

- Licensing Basis updates will be implemented under 10 CFR 50.59 consistent with NRC-approval of CENPD-289-P/NP, Supplement 1

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Summary

- CENPD-289-P/NP, Supplement 1 demonstrates that current NRC-approved methods are applicable for analyses of non-Class A inert rod configurations in **CE16NGF** type assemblies subject to the following limitations and conditions:

a, c

[

]

Summary (contd.)

- The currently approved methods will be applied for the cycle-specific analysis of all **CE16NGF** non-Class A inert rod configurations within the above limitations to determine if additional **[** **]**^{a,c} will be necessary.

- If it is determined that any penalty, such as **[**

]^{a,c} will be made to ensure conservative operation within the allowed licensed limits.

Schedule & Utility Requirements

- Initial discussion with the NRC at Westinghouse FPUM in September 2021
  - Subsequently in LTR-NRC-22-1, *Topical Report Submittals Forecast for CY2022*
- Targeted submittal by [ ]a,c
- Requesting Final SER by [ ]a,c
  - Anticipated to be the lead plant for this supplement, which is required to support [ ]a,c
  - Letters of support to the NRC stating that utilities intend to apply the methodology once it is approved

Approval of the methodology in CENPD-289-P/NP, Supplement 1 would have direct benefits with regard to safety, operations, and fuel utilization

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Questions & Discussion