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LTR-NRC-18-55

August 2, 2018

Subject: Presentation: CE16NGF Fuel Licensing to Increase Burnup Limit to 62 GWd/MTU (Non-Proprietary)

References:
1. Westinghouse Letter LTR-NRC-06-21, "Licensing Burnup Limits," dated April 19, 2006 (Accession No. ML061140289)
2. NRC Letter, Peralta (NRC) to Maurer (Westinghouse), "Approval for Increase in Licensing Burnup Limit to 62,000 MWD/MTU (TAC No. MD1486) (Accession No. ML061420458)

As requested by the NRC at the Westinghouse Fuel Performance Update Meeting held July 18-19, 2018 at the Westinghouse offices in Rockville, Westinghouse is providing the presentation: CE16NGF Fuel Licensing to Increase Burnup Limit to 62 GWd/MTU. In addition to the presentation material, additional background information can be found in References 1 and 2 to this letter.

The attached response does not contain information proprietary to Westinghouse and is considered to be Non-Proprietary in its entirety.

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Enclosures

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Presentation: CE16NGF Fuel Licensing to Increase Burnup Limit to 62 GWd/MTU

(Non-Proprietary)

August 2018

Westinghouse Electric Company
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CE16NGF Fuel Licensing to Increase Burnup limit to 62 GWd/MTU

Ed Mercier

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Outline

- Introduction
- Review of Related Topical Reports
  - CENPD-404-P-A
  - WCAP-12610-P-A & CENPD-404-P-A, Addendum 1
  - WCAP-16500-P-A
  - WCAP-17642-P-A
- Summary of Burnup Limits for CE Designs
- Proposed Generic Licensing Approach
- Possible Plant-Specific Licensing Approach

Introduction

- CE16NGF™ Fuel Assembly Licensed to 62 MWd/kgU Peak Rod Average Burnup
- PAD5 is licensed to 62 MWd/kgU for both Westinghouse and CE
- Rod diameter and pellet size for CE16NGF fuel and Westinghouse 17RFA design are the same
- Extensive operating experience for Westinghouse fuel shows acceptability of 62 MWd/kgU burnup limit
  - Framatome also has a limit of 62 MWd/kgU
- ZIRLO® and **Optimized ZIRLO™** cladding have different burnup limits between Westinghouse and CE fuel
  - 62 MWd/kgU for Westinghouse, 60 MWd/kgU for CE

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CENPD-404-P-A

- Topical report to use ZIRLO cladding for CE fuel designs
- Safety Evaluation (SE) Section 3: “burnup limit for this approval is 60 GWD/MTU”
- Section 3.6.1 (pg 47/401): 1-pin peak burnup for CENP 14x14 and 16x16 fuel designs is 60 MWd/kgU. The use of ZIRLO will be limited to 60 MWd/kgU
- Response to RAI 3 confirms limit of 60 MWd/kgU based on burnup limitations of fuel assembly designs
  - Notes that sufficient data is available to support limit of 62 MWd/kgU based on approval to 62 MWd/kgU for Westinghouse designs
  - Requested extension of the limit to 62 MWd/kgU coincident with approval of CENPD-388-P which includes justification for all non-cladding fuel assembly components to 62 MWd/kgU
  - CENPD-388-P was withdrawn on Feb 17, 2000 with no record that it was resubmitted for review

Standard CE 14x14 and 16x16 fuel designs remain limited to 60 GWd/MTU as does the use of ZIRLO cladding for CE designs

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WCAP-12610-P-A & CENPD-404-P-A, Addendum 1-A

- Topical report to use **Optimized ZIRLO** cladding for Westinghouse and CE designs
- SE Condition and Limitation (L&C) #2 limits the fuel rod burnup to “currently established limits” - 60 GWd/MTU for CE fuel designs and 62 GWd/MTU for Westinghouse designs
- Topical report section 1.3 notes that standard ZIRLO cladding models from CENPD-404-P-A are applicable to **Optimized ZIRLO** cladding models
  - Recall from CENPD-404-P-A ZIRLO cladding is limited to 60 MWd/kgU, but data demonstrates performance to 62 MWd/kgU
  - Limitation to 60 GWd/MTU is based on fuel design constraints

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WCAP-16500-P-A

- Topical report for CE16NGF fuel design
- SE L&C #3: CE16NGF design is approved to a peak rod average burnup of 62 GWd/MTU
  - A LAR is required to address plant-specific limitations on burnup, including radiological consequences
  - WCAP-12610-P-A & CENPD-404-P-A, Addendum 1-A specified a limit of 60 GWd/MTU, which must be revised prior to extending burnup for CE16NGF fuel
- SE Section 3.4 notes the approval applies to both the fuel assembly mechanical design and the analytical methods

The CE16NGF fuel design and CE analytical methods are approved to 62 GWd/MTU, but cladding materials remain limited to 60 GWd/MTU

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WCAP-17642-P-A

- Topical report for the PAD5 Fuel Performance Code
- SE Section 1.1: PAD5 is validated between proprietary rod average powers up to a rod-average burnup of 62 GWd/MTU
- SE L&C 4.1 a): Limits of applicability for the PAD5 code include “rod average burnups up to 62 GWd/MTU for all approved types of cladding”
- SE Section 5.0: “…PAD5 TR is acceptable for referencing in licensing applications for Westinghouse and CE PWRs…”

PAD5 will replace CE fuel performance methods and is approved for burnups to 62 GWd/MTU

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Summary of Burnup Limits for CE Designs

- Standard CE 14x14 and 16x16 fuel designs are limited to rod average burnup of 60 GWd/MTU
- Both ZIRLO and **Optimized ZIRLO** cladding materials are limited to a burnup of 60 GWd/MTU for CE fuel designs
- The CE16NGF fuel design and CE analytical methods are limited to a peak rod average burnup of 62 GWd/MTU
- PAD5 fuel performance code is approved for use with CE plants, all currently approved cladding materials, and is limited to a burnup of 62 GWd/MTU

Westinghouse desires a simple approach to increase the approved burnup for *Optimized ZIRLO* cladding to 62 GWd/MTU for the CE16NGF fuel design

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Proposed Generic Licensing Approach

- Request a limited-scope review of WCAP-12610-P-A & CENPD-404-P-A, Addendum 1-A
  - Based on approved burnup limits for Westinghouse fuel designs, issue a new SE supplement documenting approval to use **Optimized ZIRLO** cladding based on applicable fuel assembly limits
    - Standard 14x14 and 16x16 will remain at 60 GWd/MTU
    - CE16NGF fuel will be extended to 62 GWd/MTU
- Separate plant-specific licensing actions will be required to incorporate the burnup increase into the licensing basis

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Possible Plant-Specific Licensing Approach

- Plant license amendment request (LAR) submitted to request burnup extension to 62 GWd/MTU
  - Plant-specific application of the WCAP-12610-P-A & CENPD-404-P-A Addendum 1-A to use the CE16NGF fuel design with **Optimized ZIRLO** cladding for burnups up to 62 GWd/MTU based on the approved burnup limits for **Optimized ZIRLO** cladding with Westinghouse fuel designs
  - Request approval, as appropriate, for other licensing basis changes required to accommodate the burnup extension to 62 GWd/MTU such as radiological dose consequences and spent fuel pool criticality

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