UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

May 8, 2019

Mr. Korey Hosack, Manager Regulatory
Compliance and Plant Licensing
Westinghouse Electric Company
1000 Westinghouse Drive
Cranberry Township, PA 16066

SUBJECT: MODIFICATION OF THE CONDITION AND LIMITATION 2 OF THE U.S. NUCLEAR REGULATORY COMMISSION SAFETY EVALUATION FOR WESTINGHOUSE ELECTRIC COMPANY TOPICAL REPORT WCAP-12610-P-A & CENPD-404-P-A, ADDENDUM 1-A, "OPTIMIZED ZIRLO™" (EPID L-2019-TOP-0004)

Dear Mr. Hosack:

By letter dated June 10, 2005, U.S. Nuclear Regulatory Commission (NRC) issued a final safety evaluation (SE) for Addendum 1 to Westinghouse Electric Company (Westinghouse) Topical Report (TR) WCAP-12610-P-A & CENPD-404-P-A, "Optimized ZIRLO™" (Agencywide Documents Access and Management System (ADAMS) Accession No. ML051670403). By letter dated July 10, 2016, Westinghouse submitted an approved version of TR WCAP-12610-P-A and CENPD-404-P-A, Addendum 1-A (Proprietary)/WCAP-14342-A and CENPD-404-NP-A, Addendum 1-A (Non-Proprietary), "Optimized ZIRLO™" (ADAMS Accession No. ML062080563). The NRC SE contained 10 Conditions and Limitations. By letter dated February 7, 2019, Westinghouse submitted to the NRC a request to modify a Condition and Limitation 2 in the NRC SE for WCAP-12610-P-A & CENPD-404-P-A, Addendum 1-A, "Optimized ZIRLO™" (ADAMS Accession No. ML19039A010).

The NRC staff has performed the review and documented our evaluation in the enclosure. The NRC staff modified Condition and Limitation 2 in Section 3 of the enclosed NRC staff's evaluation. Modified Condition and Limitation 2 can be used as stated in this NRC SE in future license amendment requests when referencing WCAP-12610-P-A and CENPD-404-P-A, Addendum 1-A, "Optimized ZIRLO™," dated July 2006.

If you have any questions, please contact Ekaterina Lenning at 301-415-3151.

Sincerely,

/RA/

Dennis C. Morey, Chief
Licensing Processes Branch
Division of Licensing Projects
Office of Nuclear Reactor Regulation

Docket No. 99902038

Enclosure:
As stated

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U.S. NUCLEAR REGULATORY COMMISSION

MODIFICATION TO CONDITION AND LIMITATION 2

OF THE U.S. NUCLEAR REGULATORY COMMISSION SAFETY EVALUATION FOR

WESTINGHOUSE ELECTRIC COMPANY TOPICAL REPORT WCAP-12610-P-A

AND CENPD-404-P-A, ADDENDUM 1-A, "OPTIMIZED ZIRLO™"

1.0 INTRODUCTION

By letter dated February 7, 2019 (Ref. 1), Westinghouse Electric Company (Westinghouse) submitted to the U.S. Nuclear Regulatory Commission (NRC) a request to amend a condition and limitation on the NRC staff's approval of WCAP-12610-P-A and CENPD-404-P-A, Addendum 1-A, "Optimized ZIRLO™" (Ref. 2). Specifically, Condition and Limitation (C/L) #2 in the Section 5.0, "Conditions and Limitations," in the NRC staff's safety evaluation (SE) restricts fuel rod burnup to the existing (i.e., at the time of approval), established limits for Westinghouse and Combustion Engineering (CE) fuel designs. Westinghouse has requested that C/L #2 be modified to extend allowable burnup for the CE 16x16 Next Generation Fuel (CE16NGF) assembly design. The NRC staff approved the use of the CE16NGF assembly design in the NRC SE for TR WCAP-16500-P-A, "CE 16x16 Next Generation Fuel Core Reference Report" (Ref. 3).

2.0 REGULATORY EVALUATION

Regulatory guidance for the review of fuel system materials and designs and adherence to General Design Criteria (GDC)-10, GDC-27, and GDC-35 is provided in NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants" (SRP), Section 4.2, "Fuel System Design" (Ref. 4). In accordance with SRP Section 4.2, the objectives of the fuel system safety review are to provide reasonable assurance that:

1) the fuel system is not damaged as a result of normal operation and anticipated operation occurrences,
2) fuel system damage is never so severe as to prevent control rod insertion when it is required,
3) the number of fuel rods failures is not underestimated for postulated accidents, and
4) coolability is always maintained.

This regulatory guidance was followed by the NRC staff when reviewing the two Westinghouse TRs identified above, Optimized ZIRLO™ and CE16NGF.

Based upon the degree of characterization of irradiated properties and performance, operating experience, and/or validation of analytical models and methods, the NRC staff often restricts the use of approved materials, fuel designs, or models via C/Ls defined in the SE. Licensees employing the approved TRs must comply with the C/Ls. Westinghouse has requested that a prior, C/L #2 (Ref. 2) be modified to allow a higher fuel rod average burnup for plants using the CE16NGF assembly design with Optimized ZILRO cladding.

3.0 TECHNICAL EVALUATION

In 2007, the NRC staff reviewed and approved the CE16NGF assembly designs and the methods and models used for evaluating its acceptability. This approval included an extension in allowable burnup from 60 to 62 GWd/MTU for the CE16NGF assembly design. As identified in the NRC staff's SE (C/L #3 of Ref. 3), burnup restrictions may exist, either explicitly or implicitly, in other portions of a plant's licensing basis, and this may require further action prior to implementing the higher allowable burnup with the CE16NGF assembly design.

> The reference fuel assembly design, CE 16x16 NGF, its fuel mechanical design methodology and design criteria, are approved up to a peak rod average burnup of 62 GWd/MTU. A fuel burnup limit may exist, however, either explicitly or implicitly, in other portions of a plant's licensing basis. The NRC staff's approval of this topical report allows the CE 16x16 NGF assembly to reach a rod average burnup of 62 GWd/MTU. However, a license amendment request, specifically addressing each plant's licensing basis including radiological consequences, is required prior to extending burnup beyond current levels. Further, the NRC staff's SE for Optimized ZIRLO™ (Addendum 1 to TR WCAP-12610-P-A and TR CENPD-404-P-A) specified a 60 MWd/kgU burnup limit and this limitation must be revised prior to extending the peak rod average burnup for the NGF design (SE Section 3.4).

The purpose of this request is to address the last sentence above (C/L #3 of Ref. 3) which identified an explicit burnup restriction on the NRC staff's approval of Optimized ZIRLO. This text refers to C/L #2 of Reference 2 whereby the NRC staff restricted fuel rod average burnup to 60 GWd/MTU for CE fuel designs with Optimized ZIRLO.

> The fuel rod burn up limit for this approval remains at currently established limits: 62 GWd/MTU for Westinghouse fuel designs and 60 GWd/MTU for CE fuel designs.

Westinghouse is requesting a modification to C/L #2 that would allow a burnup limit of 62 GWd/MTU for CE16NGF assembly designs, as approved in Reference 3. Its proposed modification is shown below.

> The fuel rod burn up limit for this approval is 62 GWd/MTU for Westinghouse and CE16NGF fuel designs and 60 GWd/MTU for Standard 14x14 and 16x16 CE fuel designs.

At the time of the NRC staff's approval of CE16NGF (2007), the full extent of fuel thermal conductivity degradation (TCD) was not fully understood. The NRC staff now recognizes that legacy fuel performance codes lacking accurate degradation in fuel thermal conductivity with exposure may yield non-conservative predictions of important fuel parameters, such as fuel stored energy, fission gas release, and fuel swelling. As a result of this knowledge, the NRC staff no longer supports any extension in allowable burnup for applications which do not properly account for the effects of TCD. This includes the use of FATES3B which is part of the application methodology for CE16NGF described in Reference 3.

In its request, Westinghouse provides the following stipulation related to TCD:

> For those plants where an NRC-approved burnup-dependent fuel Thermal Conductivity Degradation (TCD) penalty has been applied, this penalty will be validated to 62 GWd/MTU and will be used to determine burnup-dependent power limits for the cycle specific confirmation of future cycles.

This stipulation does not address plants which do not have an NRC-approved burnup-dependent TCD penalty, nor does it address plants which migrate from legacy fuel performance codes (e.g., FATES3B) to modern codes which fully account for TCD (e.g., PAD5). To address this issue, the NRC staff has developed the following modification to C/L #2 which still meets the intent of the Westinghouse request.

Revised C/L #2:

> For Westinghouse fuel designs, the fuel rod average burnup limit for this approval remains at the currently established limit of 62 GWd/MTU. For the CE16NGF assembly design, the fuel rod average burnup limit for this approval is 62 GWd/MTU when analyzed with NRC approved analytical methods which properly accounts for TCD. This includes licensees that use penalties and allowances to account for TCD that have been explicitly approved by the NRC. For CE16NGF without NRC approved analytical methods which properly accounts for TCD and all remaining CE fuel designs, the fuel rod average burnup limit for this approval remains at the currently established limit of 60 GWd/MTU.

4.0 CONCLUSION

In 2007, the NRC staff reviewed and approved the CE16NGF assembly designs and the methods and models used for evaluating its acceptability. This approval included an extension in allowable burnup from 60 to 62 GWd/MTU for the CE16NGF assembly design. In the C/L #3 of the SE (Ref. 3), the NRC staff identified a conflict with the C/L #2 in the Optimized ZIRLO SE (Ref. 2) which needed to be addressed prior to extending burnup. This SE modifies C/L #2 of Reference 2 to resolve this conflict.

It has been more than 10 years since the NRC staff's approvals of Optimized ZIRLO cladding and CE16NGF assembly design. Significant operating experience has been acquired and acceptable in-reactor performance has been demonstrated. The modification to the C/L #2 of Reference 2 does not pose any additional risk to public health and safety.

5.0 REFERENCES

1. Letter from J. A. Gresham (Westinghouse) to U.S.NRC, "Request to Modify Condition and Limitation 2 to WCAP-12610-P-A & CENPD-404-P-A, Addendum 1-A, "*Optimized ZIRLO™*," LTR-NRC-19-7, Revision 7, February 7, 2019 (Agencywide Documents and Management System (ADAMS) Accession No. ML19039A010).

2. Westinghouse Electric Company, "Optimized ZIRLO™," WCAP-12610-P-A and CENPD-404-P-A, Addendum 1-A, July 10, 2006 (ADAMS Accession No. ML062080563).

3. Westinghouse Topical Report, WCAP-16500-P-A, “CE 16x16 Next Generation Fuel Core Reference Report,” August 2007 (ADAMS Accession No. ML072500331).

4. NUREG-0800, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants” (SRP), Section 4.2, “Fuel System Design,” Revision 3, March 2007 (ADAMS Accession No. ML070740002).

Principal Contributor: Paul Clifford, DSS

Date: May 8, 2019