

June 10, 2004

Mr. James A. Gresham, Manager  
Regulatory and Licensing Engineering  
Westinghouse Electric Company  
P.O. Box 355  
Pittsburgh, PA 15230-0355

SUBJECT: FINAL SAFETY EVALUATION FOR REVISION 1 TO WCAP-10125-P-A,  
ADDENDUM 1-A, "EXTENDED BURNUP EVALUATION OF WESTINGHOUSE  
FUEL, REVISION TO DESIGN CRITERIA" (TAC NO. MC1646)

Dear Mr. Gresham:

On December 8, 2003, Westinghouse Electric Company (Westinghouse) submitted Revision 1 to Topical Report (TR) WCAP-10125-P-A, Addendum 1-A, "Extended Burnup Evaluation of Westinghouse Fuel, Revision to Design Criteria," to the staff for review. On May 20, 2004, an NRC draft safety evaluation (SE) regarding our approval of Revision 1 to TR WCAP-10125-P-A, Addendum 1-A, was provided for your review and comments. By telephone conference on June 2, 2004, Mr. Rob Sisk of your staff provided Westinghouse's acceptance of the draft SE without comments.

The staff has found that Revision 1 to TR WCAP-10125-P-A, Addendum 1-A, is acceptable for referencing in licensing applications for Westinghouse-designed pressurized water reactors to the extent specified and under the limitations delineated in the TR and in the enclosed SE. The SE defines the basis for acceptance of the TR.

Our acceptance applies only to material provided in the subject TR. We do not intend to repeat our review of the acceptable material described in the TR. When the TR appears as a reference in license applications, our review will ensure that the material presented applies to the specific plant involved. License amendment requests that deviate from this TR will be subject to a plant-specific review in accordance with applicable review standards.

In accordance with the guidance provided on the NRC website, we request that Westinghouse publish an accepted version of this TR, including a non-proprietary version, within three months of receipt of this letter. The accepted version shall incorporate this letter and the enclosed SE between the title page and the abstract. It must be well indexed such that information is readily located. Also, it must contain in appendices historical review information, such as questions and accepted responses, draft SE comments, and original report pages that were replaced. The accepted version shall include a "-A" (designating accepted) following the report identification symbol.

J. Gresham

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If the NRC's criteria or regulations change so that its conclusions in this letter, that the TR is acceptable, are invalidated, Westinghouse and/or the licensees referencing the TR will be expected to revise and resubmit its respective documentation, or submit justification for the continued applicability of the TR without revision of the respective documentation.

Sincerely,

**/RA/**

Herbert N. Berkow, Director  
Project Directorate IV  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

Project No. 700

Enclosure: Safety Evaluation

cc w/encl:  
Mr. Gordon Bischoff, Manager  
Owners Group Program Management Office  
Westinghouse Electric Company  
P.O. Box 355  
Pittsburgh, PA 15230-0355

J. Gresham

- 2 -  
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Sincerely,  
**/RA/**

Herbert N. Berkow, Director  
Project Directorate IV  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

Project No. 700

Enclosure: Safety Evaluation

cc w/encl:  
Mr. Gordon Bischoff, Manager  
Owners Group Program Management Office  
Westinghouse Electric Company  
P.O. Box 355  
Pittsburgh, PA 15230-0355

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**\*SE dated 5/4/04**

**ADAMS Accession No.: ML041660309**

**NRR-106**

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REVISION 1 TO TOPICAL REPORT WCAP-10125-P-A, ADDENDUM 1-A,

"EXTENDED BURNUP EVALUATION OF WESTINGHOUSE FUEL,

REVISION TO DESIGN CRITERIA"

WESTINGHOUSE ELECTRIC COMPANY

PROJECT NO. 700

1.0 INTRODUCTION

On December 8, 2003, Westinghouse Electric Company (Westinghouse) submitted to the NRC Revision 1 to Topical Report (TR) WCAP-10125-P-A, Addendum 1-A, "Extended Burnup Evaluation of Westinghouse Fuel, Revision to Design Criteria," for review and approval. WCAP-10125-P-A is an approved TR that describes analytical methodologies that include the design bases, limits, and criteria for Westinghouse fuel in high burnup licensing applications. WCAP-10125-P-A, Addendum 1-A, is an approved addendum that revises the fuel cladding stress criterion to be consistent with industry practice.

Revision 1 to Addendum 1-A intends to apply the same revised fuel cladding stress criterion to another approved TR, WCAP-12488-A, "Westinghouse Fuel Criteria Evaluation Process." This TR describes a process and criteria intended to apply to changes or improvements in existing fuel designs that will not require NRC review and prior approval when these criteria are satisfied. Revision 1 to Addendum 1-A will clarify the fuel cladding stress criterion in WCAP-12488-A to maintain a set of fuel rod design criteria consistent with industry practice.

2.0 REGULATORY EVALUATION

The fuel system consists of arrays of fuel rods including fuel pellets and tubular cladding, spacer grids, end plates, and reactivity control rods. The objectives of the fuel system safety review are to provide assurance that: (1) the fuel system is not damaged as a result of normal operation and anticipated operational occurrences; (2) fuel system damage is never so severe as to prevent control rod insertion when it is required; (3) the number of fuel rod failures is not underestimated for postulated accidents; and (4) coolability is always maintained.

The staff acceptance criteria are based on NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants" (SRP), Section 4.2, "Fuel System Design." These criteria include three parts: (1) design bases that describe specified acceptable fuel design limits (SAFDLs) that implement Criterion 10, "Reactor design," as specified in Title 10 of the *Code of Federal Regulations*, Part 50 (10 CFR Part 50), Appendix A, "General Design Criteria for Nuclear Power Plants;" (2) design evaluations that demonstrate that the design bases are met; and (3) testing, inspection, and surveillance plans that show

there is adequate monitoring and surveillance of irradiated fuel. The design bases include: (1) fuel system damage; (2) fuel rod failure; and, (3) fuel coolability. The fuel rod cladding stress and strain limits are part of the SAFDLs.

### 3.0 TECHNICAL EVALUATION

Fuel rods are constantly under thermal and mechanical loads during steady-state and transient operating conditions in reactors. The cladding strain produced from these loads can be divided into two components: steady-state and transient strains. The total strain is the sum of steady-state and transient strains. However, cladding stress is either steady-state stress or transient stress depending on the cladding loading conditions. To protect fuel rods against pellet-cladding interaction (PCI), which is a severe transient condition that could lead to multiple fuel failures, SRP Section 4.2 establishes two limiting criteria: (1) the transient-induced strain should not exceed 1 percent, and (2) fuel melting should be avoided.

Westinghouse has established four design criteria in WCAP-10125-P-A to protect against PCI. These four criteria are: (1) steady-state strain must be less than 1 percent; (2) transient strain must be less than 1 percent; (3) fuel centerline melting must not occur; and (4) transient stress must be less than a proprietary value. Westinghouse stated that the first three criteria met the intent of the SRP requirements, but the fourth criterion was redundant and did not represent current industry practice. Westinghouse therefore proposed to replace the fourth criterion of transient stress with a stress limit based on the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code).

SRP Section 4.2 states that stress limits obtained by methods similar to those given in Section III of the ASME Code are acceptable. ASME Code Section III describes various stress state criteria and limits, and is widely accepted in the nuclear industry. The Westinghouse proposal for a fuel rod cladding stress limit based on the ASME Code Section III criteria is consistent with SRP Section 4.2.

Since WCAP-12488-A references WCAP-10125-P-A and shares the same cladding stress limit, the staff concludes that the revised fuel rod cladding stress limit of WCAP-10125-P-A is also applicable to WCAP-12488-A.

### 4.0 CONCLUSION

The staff has reviewed the Westinghouse submittal to replace the transient stress limit of fuel rod analysis with a revised cladding stress limit based on the ASME Code Section III criteria. Because it is consistent with SRP Section 4.2 and the ASME Code, the staff concludes that the revised fuel rod cladding stress limit of Revision 1 to WCAP-10125-P-A, Addendum 1-A, is acceptable.

The staff further concludes that the revised fuel rod cladding stress limit of Revision 1 to WCAP-10125-P-A, Addendum 1-A, is also applicable to WCAP-12488-A. The staff requires that Westinghouse administratively update the section on clad stress in WCAP-12488-A to reflect the revision that will supersede the current limit. There is no requirement for Westinghouse to submit an updated WCAP-12488-A to the staff; however, Westinghouse should submit a letter informing the staff of the update.

Principal Contributor: S. Wu

Date: June 10, 2004