

May 20, 2004

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

SUBJECT: DRAFT 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. Enclosed for Westinghouse's review and comment is a copy of the staff's draft safety evaluation (SE) for Revision 1 to Addendum 1-A.

Pursuant to 10 CFR 2.390, we have determined that the enclosed draft SE does not contain proprietary information. However, we will delay placing the draft SE in the public document room for a period of ten working days from the date of this letter to provide you with the opportunity to comment on the proprietary aspects. If you believe that any information in the enclosure is proprietary, please identify such information line-by-line and define the basis pursuant to the criteria of 10 CFR 2.390. After ten working days, the draft SE will be made publicly available, and an additional ten working days are provided to you to comment on any factual errors or clarity concerns contained in the SE. The final SE will be issued after making any necessary changes and will be made publicly available. The staff's disposition of your comments on the draft SE will be discussed in the final SE.

To facilitate the staff's review of your comments, please provide a marked-up copy of the draft SE showing proposed changes and provide a summary table of the proposed changes.

If you have any questions, please contact Bill Macon at (301) 415-3965.

Sincerely,

**/RA/**

Stephen Dembek, Chief, Section 2  
Project Directorate IV  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

Project No. 700

Enclosure: Draft Safety Evaluation

cc w/encl: See next page

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Pursuant to 10 CFR 2.390, we have determined that the enclosed draft SE does not contain proprietary information. However, we will delay placing the draft SE in the public document room for a period of ten working days from the date of this letter to provide you with the opportunity to comment on the proprietary aspects. If you believe that any information in the enclosure is proprietary, please identify such information line-by-line and define the basis pursuant to the criteria of 10 CFR 2.390. After ten working days, the draft SE will be made publicly available, and an additional ten working days are provided to you to comment on any factual errors or clarity concerns contained in the SE. The final SE will be issued after making any necessary changes and will be made publicly available. The staff's disposition of your comments on the draft SE will be discussed in the final SE.

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Westinghouse Electric Company

Project No. 700

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

DRAFT 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     1.0     INTRODUCTION

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

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

15    2.0     REGULATORY EVALUATION

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

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

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

### 4 3.0 TECHNICAL EVALUATION

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

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

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

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

### 29 4.0 CONCLUSION

30 The staff has reviewed the Westinghouse submittal to replace the transient stress limit of fuel  
31 rod analysis with a revised cladding stress limit based on the ASME Code Section III criteria.  
32 Because it is consistent with SRP Section 4.2 and the ASME Code, the staff concludes that the  
33 revised fuel rod cladding stress limit of Revision 1 to WCAP-10125-P-A, Addendum1-A, is  
34 acceptable.

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

7 Principal Contributor: S. Wu

8 Date: May 20, 2004