November 21, 2008

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

SUBJECT: FINAL SAFETY EVALUATION FOR WESTINGHOUSE ELECTRIC COMPANY (WESTINGHOUSE) TOPICAL REPORT (TR) WCAP-16081-P, ADDENDUM 2, REVISION 0, "SVEA-96 OPTIMA2 CPR [CRITICAL POWER RATIO] CORRELATION (D4): MODIFIED R-FACTORS FOR PART-LENGTH RODS" (TAC NO. MD6383)

Dear Mr. Gresham:

By letter dated July 31, 2007, Westinghouse submitted TR WCAP-16081-P, Addendum 2, Revision 0, "SVEA-96 Optima2 CPR Correlation (D4): Modified R-factors for Part-Length Rods" to the U.S. Nuclear Regulatory Commission (NRC) staff for review and approval. By letter dated August 28, 2008, an NRC draft safety evaluation (SE) regarding our approval of TR WCAP-16081-P, Addendum 2, Revision 0, was provided for your review and comments. By letter dated October 14, 2008, Westinghouse commented on the draft SE. The NRC staff's disposition of Westinghouse's comments on the draft SE are discussed in the attachment to the final SE enclosed with this letter.

The NRC staff has found that WCAP-16081-P, Addendum 2, Revision 0, is acceptable for referencing in licensing applications for boiling water reactors to the extent specified and under the limitations delineated in the TR and in the enclosed final SE. The final SE defines the basis for our 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 accepted proprietary and non-proprietary versions of this TR within three months of receipt of this letter. The accepted versions shall incorporate this letter and the enclosed final SE after the title page. Also, they must contain historical review information, including NRC requests for additional information and your responses. The accepted versions shall include an "-A" (designating accepted) following the TR identification symbol.

NOTICE: Enclosure 2 transmitted herewith contains proprietary information. When separated form Enclosure 2, this document is decontrolled.

If future changes to the NRC's regulatory requirements affect the acceptability of this TR, Westinghouse and/or licensees referencing it will be expected to revise the TR appropriately, or justify its continued applicability for subsequent referencing.

Sincerely,

/RA/

Thomas B. Blount, Deputy Director
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Project No. 700

Enclosures: 1. Final SE (non-proprietary version)
2. Final SE (proprietary version)

cc w/encl 1 only:
Mr. Gordon Bischoff, Manager
Owners Group Program Management Office
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gordon.c.bischoff@us.westinghouse.com

If future changes to the NRC's regulatory requirements affect the acceptability of this TR, Westinghouse and/or licensees referencing it will be expected to revise the TR appropriately, or justify its continued applicability for subsequent referencing.

Sincerely,

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Thomas B. Blount, Deputy Director
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FINAL SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

TOPICAL REPORT (TR) WCAP-16081-P, ADDENDUM 2, REVISION 0

"SVEA-96 OPTIMA2 CPR [CRITICAL POWER RATIO] CORRELATION (D4):

MODIFIED R-FACTORS FOR PART-LENGTH RODS"

WESTINGHOUSE ELECTRIC COMPANY (WESTINGHOUSE)

PROJECT NO. 700

1.0 BACKGROUND

By letter dated July 31, 2007 (Reference 1), Westinghouse submitted TR WCAP-16081-P, Addendum 2, Revision 0, "SVEA-96 Optima2 CPR Correlation (D4): Modified R-factors for Part-Length Rods," to the U.S. Nuclear Regulatory Commission (NRC) for review and approval. By letter dated April 17, 2008 (Reference 2), Westinghouse responded to the NRC staff's request for additional information (RAI). The purpose of this report is to identify and justify a necessary revision to the R-factor model described in TR WCAP-16081-P-A, Revision 0, "10x10 SVEA Fuel Critical Power Experiments and CPR Correlation: SVEA-96 Optima2" (Reference 3), as it applies to the two-thirds length rods in the SVEA-96 Optima2 assembly. The SVEA-96 Optima2 CPR correlation with the changes described in Reference 1, as well as those separately described in TR WCAP-16081-P, Addendum 1, Revision 0, "SVEA-96 Optima2 CPR Correlation (D4): High and Low Flow Applications," as submitted by letter dated November 28, 2006 (Reference 4), is referred to as the "D4 CPR correlation with modified R-factors for part-length rods."

Reference 1 describes the Westinghouse methodology for implementing two improvements to the existing SVEA-96 and SVEA-96+ CPR correlations. As the NRC staff has previously reviewed and approved these correlations, the NRC staff review of Reference 1 will focus on the two improvements to the approved correlations. Specifically, the NRC staff review will focus on the two improvements in the application of the CPR correlations to the SVEA Boiling Water Reactor (BWR) fuel.

2.0 REGULATORY EVALUATION

Section 50.36 of Title 10 of the *Code of Federal Regulations* (10 CFR), "Technical specifications [(TSs)]", requires that safety limits be included in plant-specific TS. The regulation at 10 CFR Part 50, Appendix A, "General Design Criteria for Nuclear Power Plants," General Design Criterion (GDC) 10, "Reactor design," requires, and safety limits ensure, that the reactor core and associated coolant, control, and protective system be designed with an appropriate margin to assure that specified acceptable fuel design limits are not exceeded during steady state operation, normal operational transients, and anticipated operational occurrences (AOOs).

The fuel cladding integrity safety limit is set such that no significant fuel damage is calculated to occur if the limit is maintained. Because fuel damage is not directly observable, a stepback

approach is used to establish a safety limit, such that the CPR is not less than the limit specified in the TSs. CPR greater than the specified limit represents a conservative margin relative to the conditions required to maintain fuel cladding integrity.

To ensure compliance with 10 CFR 50, Appendix A, GDC 10, the NRC staff will review this TR methodology to ensure that the CPR safety limit and, therefore, the specified acceptable fuel design limits are maintained, as prescribed in NUREG-0800, Standard Review Plan (SRP) Section 4, "Reactor."

3.0 TECHNICAL EVALUATION

3.1 Technical Background

The R-factor term accounts for the effects on the dryout sensitivity of local (i.e., fuel rod) power distribution as well as sub-assembly cross section geometry and spacer grid configuration. The traditional R-factor concept, as applied in the D4 CPR correlation, is two-dimensional assuming that the power distributions within the assembly are separable into axial and radial components.

Modern BWR fuel designs, incorporating increasingly sophisticated geometries, have provided vendors such as Westinghouse the impetus to develop more advanced phenomenological tools for the prediction of critical power. These models are developed to improve, among other things, the ability to model the local contributions to dryout of full- and part-length rods. **[**

]

This supplement to Reference 3 provides a detailed discussion of the **[**

] changes to the R-factor treatment as described in Reference 1, this addendum to Reference 3 is submitted to provide the necessary supporting information for NRC staff review and approval.

The NRC staff finds the corrective actions described in Reference 1 to be acceptable.

3.2 R-Factor Model Revised Additive Constant

The evaluation of the D4 data using a more phenomenological correlation form with an alternative R-factor treatment indicated that **[**

] The new value, **[ ]**, is in the D4 CPR correlation **[**

] the additive constants for all other rods remain as specified in Reference 3. This value is a direct outcome of the improved modeling process in the phenomenological (Mechanistic) correlation.

Because it addresses a potential non-conservatism, the NRC staff finds the use of the revised additive constant for part-length rods acceptable.

3.3 Axial Integration and Weighting of Nodal R-Factors

[

]

Therefore, the NRC staff finds this explanation acceptable.

In addition, Westinghouse determined that, **[**

]

Therefore, the NRC staff finds this determination acceptable.

3.4 Fast Transient Applications

The D4.1.1 CPR correlation described in Reference 3 was developed to provide best estimate CPR values for well-established equilibrium thermal and hydraulic conditions. Reference 3 also demonstrated that the D4.1.1 CPR correlation yielded conservative predictions of critical power

[

] As a result, the D4.1.1 correlation and the revised D4 CPR correlation **[** **]** still provide conservative predictions of critical power.

This conclusion is further supported by **[**

]

Westinghouse has agreed to use the revised additive constant value for **[**

] The NRC staff finds the use of the revised additive constant acceptable for fast transient analyses because it results in conservative predictions of critical power.

4.0 CONCLUSION

TR WCAP-16081-P, Addendum 2, "SVEA-96 Optima2 CPR Correlation (D4): Modified R-factors for Part-Length Rods" (Reference 1), identifies and justifies a necessary revision to the R-Factor model described in TR WCAP-16081-P-A, Revision 0, "10x10 SVEA Fuel Critical Power Experiments and CPR Correlation: SVEA-96 Optima2" (Reference 3), **[** **]** The NRC staff has reviewed Reference 1 and obtained additional information through discussions with Westinghouse. Based on the considerations provided above, the NRC staff has concluded that the proposed revision **[** **]** is acceptable for both steady-state and fast transient applications.

5.0 REFERENCES

1. J.A. Gresham, Westinghouse Electric Company, letter to the U.S. Nuclear Regulatory Commission, "Transmittal of TR WCAP-16081-P-A, Addendum 2, Rev 0, 'SVEA-96 Optima2 CPR Correlation (D4): Modified R-factors for Part-Length Rods' (Proprietary/Non-proprietary)," July 31, 2007, LTR-NRC-07-37 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML072200239 and ML072200243).

2. J.A. Gresham, Westinghouse Electric Company, letter to the U.S. Nuclear Regulatory Commission, "Response to NRC's Request for Additional Information by the Office of Nuclear Reactor Regulation for TR WCAP-16081-P-A, Addendum 2, 'SVEA-96 Optima2 CPR Correlation (D4): Modified R-Factors for Part-Length Rods,'" April 17, 2008,

LTR-NRC-08-20 (ADAMS Accession No. ML081260157).

3. J.A. Gresham, Westinghouse Electric Company, letter to the U.S. Nuclear Regulatory Commission, "Issuance of Approved Version of TR WCAP-16081-P-A and TR WCAP-16081-NP-A, '10x10 SVEA Fuel Critical Power Experiments and CPR Correlation: SVEA-96-Optima2,'" March 31, 2005, LTR-NRC-05-21 (ADAMS Accession No. ML051260171).

4. J.A. Gresham, Westinghouse Electric Company, letter to the U.S. Nuclear Regulatory Commission, "Submittal of TR WCAP-16081-P-A, Addendum 1/WCAP-16081-NP-A, Addendum I, 'SVEA-96 Optima2 CPR Correlation (D4): High and Low Flow Applications,' (Proprietary/Non-Proprietary)," November 28, 2006, LTR-NRC-06-63, (ADAMS Accession No. ML063520424).

Attachment: Resolution of Comments

Principle Contributors: A. Attard
A. Hoffman

Date: November 21, 2008

RESOLUTION OF WESTINGHOUSE ELECTRIC COMPANY (WESTINGHOUSE)

COMMENTS ON DRAFT SAFETY EVALUATION FOR TOPICAL REPORT (TR)

WCAP-16081-P, ADDENDUM 2, REVISION 0, "SVEA-96 OPTIMA2 CPR

CORRELATION (D4): MODIFIED R-FACTORS FOR PART-LENGTH RODS"

(TAC NO. MD6383)

By letter dated October 14, 2008, Westinghouse provided no additional comments on the draft safety evaluation (SE) for TR WCAP-16081-P-A, Addendum 2, Revision 0, "SVEA-96 Optima2 CPR Correlation (D4): Modified R-factors for Part-Length Rods." Some information in the draft SE for this TR was identified as proprietary; therefore, the draft of this SE will not be made publicly available.

ATTACHMENT