

March 11, 2004

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

SUBJECT: FINAL SAFETY EVALUATION FOR WESTINGHOUSE TOPICAL REPORT,  
"ADDENDUM 1 TO WCAP-12945-P-A AND WCAP-14449-P-A, METHOD FOR  
SATISFYING 10 CFR 50.46 REANALYSIS REQUIREMENTS FOR BEST-  
ESTIMATE LOCA EVALUATION MODELS" (TAC NO. MB6803)

Dear Mr. Gresham:

By letter dated October 9, 2002, the Westinghouse Electric Company (Westinghouse) submitted Topical Report (TR) "Addendum 1 to WCAP-12945-P-A and WCAP-14449-P-A, Method for Satisfying 10 CFR 50.46 Reanalysis Requirements for Best-Estimate LOCA Evaluation Models," to the staff for review. Westinghouse supplemented the information in the above TR in a letter dated December 16, 2003, which provided clarifying details regarding process controls that would be implemented in performing reanalyses using the proposed addendum methodology. On January 23, 2004, an NRC draft safety evaluation (SE) regarding our approval of the TR was provided for your review and comments. By e-mail dated February 11, 2004, Westinghouse agreed with the content of the SE.

The staff has found that the TR is acceptable for referencing as an approved methodology in plant licensing applications. The enclosed SE documents the staff's evaluation of Westinghouse's justification for the improved methodology.

Our acceptance applies only to the 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's TR website, we request that Westinghouse publish an accepted version of this TR 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, is 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, Project Manager  
Westinghouse Owners Group  
Westinghouse Electric Company  
Mail Stop ECE 5-16  
P.O. Box 355  
Pittsburgh, PA 15230-0355

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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

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Enclosure: Safety Evaluation

cc w/encl:  
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**ADAMS Accession No.: ML040770029**

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION  
"ADDENDUM 1 TO WCAP-12945-P-A AND WCAP-14449-P-A, METHOD FOR  
SATISFYING 10 CFR 50.46 REANALYSIS REQUIREMENTS FOR  
BEST-ESTIMATE LOCA EVALUATION MODELS"  
WESTINGHOUSE ELECTRIC COMPANY  
PROJECT NO. 700

## **1.0 INTRODUCTION**

By letter dated October 9, 2002, the Westinghouse Electric Company (Westinghouse) submitted Topical Report (TR) "Addendum 1 to WCAP-12945-P-A and WCAP-14449-P-A, Method for Satisfying 10 CFR 50.46 Reanalysis Requirements for Best-Estimate LOCA Evaluation Models," to the NRC for review and approval. The TR describes a proposed methodology to perform best-estimate large break (LB) loss-of-coolant accident (LOCA) reanalyses for plants already licensed with LBLOCA analyses performed using the methodology described in either of the Westinghouse LBLOCA TRs identified in the Addendum title. The proposed reanalysis methodology would implement an abbreviated calculational approach which would preserve the characteristic plant-specific LBLOCA transient while implementing changes or correcting errors in accordance with 10 CFR 50.46(a)(3). Westinghouse proposed this abbreviated methodology to reduce unnecessary regulatory burden. The staff reviewed the proposal and found it acceptable, as discussed below.

Westinghouse supplemented the information in the above TR in a letter dated December 16, 2003, which provided clarifying details regarding process controls that would be implemented in performing reanalyses using the proposed addendum methodology.

## **2.0 BACKGROUND AND REGULATORY EVALUATION**

The regulations specified in 10 CFR 50.46(a)(1) identify calculational methodology requirements for nuclear power plant LOCA methodologies. Section 10 CFR 50.46(c) identifies the types of processes which are required to assure that LOCA analyses performed for a given plant actually represent that plant. Section 50.46(a)(3)(i and ii) specifies criteria to be applied and actions to be taken when significant changes or errors in parts of the plant-specific LOCA methodology, defined in accordance with 10 CFR 50.46(a)(1) and (c), are found to have accumulated. When the licensee makes changes to its plant input model, or finds errors in parts of the plant-specific LOCA methodology covered by 10 CFR 50.46(a)(1) and (c) that are significant, the licensee must reanalyze the plant's LOCA response. This is usually done by repeating the plant's LOCA analyses (reanalyzing) using a LOCA methodology approved for the plant, with changes and errors updated if the base LOCA methodology remains the same. With

LOCA methodologies covered by 10 CFR Part 50, Appendix K, this reanalysis entails performing one LOCA calculation for each case analyzed. Using the best-estimate LOCA methodologies described in WCAP-12945-P-A and WCAP-14449-P-A, several LOCA calculations are required. The proposed methodology would significantly reduce the number of LOCA calculations needed to perform the reanalysis, and therefore significantly reduce unnecessary regulatory burden, while assuring plant safety.

WCAP-12945-P-A describes the approved Westinghouse best-estimate LBLOCA analysis methodology that applies to Westinghouse three- and four-loop reactor designs with conventional cold leg emergency core cooling system (ECCS) injection. WCAP-14449-P-A describes the approved Westinghouse best-estimate LBLOCA analysis methodology that applies to Westinghouse two-loop reactor designs with upper plenum ECCS injection. The proposed abbreviated best-estimate LBLOCA analysis methodology uses the same computer code, WCOBRA/TRAC, as the staff approved for use in the methodologies described in the TRs.

The Westinghouse best-estimate LBLOCA analysis methodology uses a combination of response surfaces and Monte Carlo techniques to develop a peak cladding temperature (PCT) uncertainty distribution for a plant. Westinghouse demonstrates this using the following equation:

$$PCT_i = PCT_{REF} + \Delta PCT_{PD,i} + \Delta PCT_{IC,i} + \Delta PCT_{MOD,i} + \Delta PCT_{SUP,i}$$

where:

$PCT_{REF}$  = PCT for a fixed set of reference conditions by the approved methodology,

$\Delta PCT_{PD,i}$  = change in PCT due to the power distribution parameters sampled for iteration i,

$\Delta PCT_{IC,i}$  = change in PCT due to sampling of the initial and boundary condition uncertainty distribution for iteration i,

$\Delta PCT_{MOD,i}$  = change in PCT due to the thermal-hydraulic models sampled for iteration i,

$\Delta PCT_{SUP,i}$  = change in PCT due to application of the superposition correction factor, and sampling of the superposition correction uncertainty for iteration i,

In the proposed abbreviated reanalysis methodology, only the  $PCT_{REF}$  and  $\Delta PCT_{SUP,i}$  are completely recalculated, unless the analyst determines that input changes for the reanalysis will significantly alter the characteristic profile of any of the other factors (i.e.,  $\Delta PCT_{PD,i}$ ,  $\Delta PCT_{IC,i}$ , and  $\Delta PCT_{MOD,i}$ ). If the analyst does determine that one or more of the other factors, or the characteristic plant-specific LBLOCA transient profile is so altered, a decision must be made whether a full reanalysis must be performed in lieu of implementing the abbreviated reanalysis methodology.

The staff reviewed the proposed methodology using as criteria: (1) preservation of the characteristic plant-specific LBLOCA transient profile, and (2) substantial retention of the statistical process profile for the plant. Fulfilling these two objectives provides assurance that the proposed abbreviated reanalysis methodology for the Westinghouse best-estimate LBLOCA analysis methodology will be able to satisfy 10 CFR 50.46(a)(1) and applicable parts of 10 CFR 50.46(c).

### 3.0 TECHNICAL EVALUATION

The Westinghouse October 9, 2002, letter describes the proposed abbreviated reanalysis methodology and its implementation, as discussed in Section 2.0 above. In a letter dated December 16, 2003, Westinghouse further described how it will implement the methodology. In the October 9, 2002, letter, Westinghouse gave examples to demonstrate how the abbreviated methodology would be implemented. From these examples, it is apparent to the staff that the analyst will be able to make decisions that would allow the methodology to perform LBLOCA analyses using the methodology consistent with the standards set for the source methodologies, while maintaining control of uncertainties within the corrective capabilities of the methodologies. The analyst will also be able to determine when the original approach (WCAP-12945-P-A or WCAP-14449-P-A) is required. The staff's review indicates that the intent of the abbreviated approach is to implement the approved methodology previously used to perform a given plant's best estimate LBLOCA analyses utilizing elements of the previous calculation that continue to directly apply to the current reanalysis. This is done by adjusting elements as needed to suit the reanalyses while not significantly changing their qualitative contribution to the overall calculation, and by exercising the corrective capabilities of the previous approach to assure that the impact on the uncertainty analysis is not significant. Therefore, the staff finds that the proposed abbreviated methodology satisfies the requirements of 10 CFR 50.46(a)(1) regarding the acceptability of the calculational methodology.

The staff requested that Westinghouse provide information regarding controls that would ensure that the methodology would be properly implemented, since the decisions by the analyst require sound technical judgement. In the December 16, 2003, letter, Westinghouse described the process that Westinghouse would implement and the general reanalysis guidelines to provide more objective criteria for decisions to help assure the methodology is not misapplied.

As part of the process, the Westinghouse "Evaluation Model Lead Engineer" would review and concur with the analyses. As a last step, Westinghouse would maintain documentation of the reanalyses, the basis for concluding that the specific application is within the limits of applicability, and the record of concurrence in the Westinghouse plant files for the unit being reanalyzed. This record could be audited and, if necessary, emended.

The controls provided by Westinghouse, along with other programs and other information necessary for application of the calculational framework to a specific LOCA analysis, shared with and/or implemented by the plant licensee (see Section 4.0, "Limitations"), assure that the programmatic requirements for a vendor of 10 CFR 50.46(c) will be satisfied.

The staff also finds that the TR, though associated with previously approved LBLOCA analysis methodologies, is a unique LBLOCA analysis methodology in and of itself. Therefore, in its

initial licensing applications for the various plants to which it may be applied, licensees must submit plant-specific license amendment requests to adopt this methodology, including technical specifications changes, core operating limit report changes, and initial LBLOCA reanalysis results.

#### 4.0 LIMITATIONS

Licensees must include in individual plant requests a statement that the licensee and its fuel vendor (Westinghouse) have ongoing processes which assure that the ranges and values of input parameters for the plant (LOCA) analysis bound the ranges and values of the as-operated plant values for those parameters

"Addendum 1 to WCAP-12945-P-A and WCAP-14449-P-A" is a unique LBLOCA analysis methodology in and of itself. Therefore, in its initial licensing applications for the various plants to which it may be applied, licensees must submit plant-specific license amendment requests to adopt this methodology, including technical specifications changes, core operating limit report changes, and initial LBLOCA reanalysis results.

As proposed by Westinghouse, licensees may only apply "Addendum 1 to WCAP-12945-P-A and WCAP-14449-P-A" to plants whose approved LBLOCA analyses were performed using methodologies described in either WCAP-12945-P-A or WCAP-14449-P-A.

The staff also finds that the TR, though associated with previously approved LBLOCA analysis methodologies, is a unique LBLOCA analysis methodology in and of itself. Therefore, in its initial licensing applications for the various plants to which it may be applied, licensees must submit plant-specific license amendment requests to adopt this methodology, including technical specifications changes, core operating limit report changes, and initial LBLOCA reanalysis results.

#### 5.0 CONCLUSION

Based on its review as discussed above, the staff concludes that "Addendum 1 to WCAP-12945-P-A and WCAP-14449-P-A" meets applicable requirements of 10 CFR 50.46(a)(1) and (c). Therefore, the staff finds this proposed LBLOCA methodology acceptable within the limitations specified in Section 4.0.

As proposed by Westinghouse, licensees may only apply "Addendum 1 to WCAP-12945-P-A and WCAP-14449-P-A" to plants whose approved LBLOCA analyses were performed using methodologies described in either WCAP-12945-P-A or WCAP-14449-P-A.

Principle Contributor: F. Orr

Date: March 11, 2004