

January 23, 2004

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

SUBJECT: DRAFT 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. Galembush:

Enclosed for Westinghouse's review and comment is a copy of the staff's draft safety evaluation (SE) for 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."

Pursuant to 10 CFR 2.790, we have determined that the enclosed SE does not contain proprietary information. However, we will delay placing the SE in the public document room for ten working days from the date of this letter to provide you with the opportunity to comment on the proprietary aspects only. 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 2.790. Following your agreement that the draft SE is non-proprietary, we will place it in the public document room while you continue your review for factual errors or clarity concerns. Please identify any such errors or concerns within 20 working days of this letter.

In the event of any comments or questions, please contact Brian Benney at (301) 415-3764.

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:
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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DRAFT 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} = peak cladding temperature 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,

Elements of the above equation are iterated 10,000 times, producing the plant PCT distribution. The methodology then fine tunes the calculated PCT to account for other uncertainties including those due to superposition and propagation of uncertainty.

In the proposed abbreviated methodology, only the PCT_{REF} and $\Delta PCT_{SUP,i}$ are recalculated, unless the analyst determines that input changes for the reanalysis will significantly alter the characteristic profile of any of the other factors. 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 regarding whether reanalysis implementing a correction is the preferred course of action. In certain cases such a corrective modification may be appropriate.

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 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 that is also somewhat subjective. 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 analyzed. This record could be audited and, if necessary, corrected.

4.0 LIMITATIONS

"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.

5.0 CONCLUSION

Although the implementation of the proposed methodology involves somewhat subjective decisions, the controls provided by Westinghouse address this concern and, along with other methodology usage programs shared with and/or implemented by the plant licensee, assure that the programmatic requirements for a vendor of 10 CFR 50.46(c) will be satisfied.

The staff also finds that "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.

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.

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: January 23, 2004