September 15, 2004

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

SUBJECT: DRAFT SAFETY EVALUATION FOR TOPICAL REPORT WCAP-15996P, "TECHNICAL DESCRIPTION MANUAL FOR CENTS CODE" (TAC NO. MB6982)

Dear Mr. Bischoff:

On December 13, 2002, the Westinghouse Owners Group (WOG) submitted Topical Report (TR) WCAP-15996P, "Technical Description Manual for CENTS Code" to the staff for review. Enclosed for the WOG's review and comment is a copy of the staff's draft safety evaluation (SE) for the TR.

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 Girija Shukla at 301-415-8439.

Sincerely,
/RA/

Robert A. Gramm, Chief, Section 2
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Project No. 694

Enclosure: Draft Safety Evaluation

cc w/encl: See next page

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DRAFT SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

WCAP-15996P, "TECHNICAL DESCRIPTION MANUAL FOR CENTS CODE"

WESTINGHOUSE OWNERS GROUP

PROJECT NO. 694

1.0 INTRODUCTION

By letter dated December 13, 2002, the Westinghouse Owners Group (WOG) submitted WCAP-15996P to the NRC for review and approval of the transient analysis methodology described therein for licensing applications with regard to both Combustion Engineering (CE) and Westinghouse-designed pressurized water reactors. The WOG, as part of its request for review and approval by the NRC of WCAP-15996P, requested a clarification with regard to the restriction on the use of the CENTS code for application to control element assembly (CEA) ejection licensing analyses. At issue is the statement in the safety evaluation for CENPD-282-P-A, "... CENTS is not approved for performing CEA ejection licensing analyses." The rationale for this restriction is stated as, "Benchmarking for the CEA ejection transient has not been provided...." The basis for these statements is that the validated neutronic core modeling capability of CENTS as described in CENPD-282-P-A, is limited to the point kinetics approximation. The NRC-approved methodology for CEA ejection analysis is specified in CENPD-190-A. The current review has revisited the CENPD-190-A methodology and has verified that there are two distinct end-points of the methodology: the evaluation of the fuel failure aspects of the CEA ejection, and the evaluation of the nuclear steam supply system (NSSS) thermal-hydraulic response aspects. The former requires that space-time kinetics effects be explicitly taken into account in the CEA ejection; the latter is bounded by a point-kinetics evaluation of the energy deposition in the reactor coolant.

2.0 REGULATORY EVALUATION

The methodology presented in WCAP-15996P, as applied to the issue addressed in this addendum, concerns the computational issues associated with demonstrating compliance with the requirements for a reactor coolant pressure boundary set forth in General Design Criterion (GDC) 14. In particular, the numerical values computed with this methodology may be used to support the demonstration that the reactor coolant boundary is designed to have an extremely low probability of abnormal leakage, of rapidly propagation failure, and of gross rupture. The approval of the computational methodology in WCAP-15996P is consistent with the requirements set forth in Appendix B to Part 50 of Title 10 of the *Code of Federal Regulations* (10 CFR Part 50), "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants." WCAP-15996P describes a pressurization calculation necessary to provide adequate confidence that the reactor coolant pressure boundary will perform satisfactorily under a postulated CEA ejection event.

3.0 TECHNICAL EVALUATION

The NRC approved CEA ejection analysis methodology, as described in CENPD-190-A, consists of a synthesis method that utilizes zero, one and two dimensional calculations. These calculations are used to determine the maximum total fuel energy content and the fuel and clad temperatures during a CEA ejection accident. The former is an integral quantity and governs the total energy deposition in the coolant; the latter are local values and are governed by the peak local deposition of energy in the fuel and cladding. Key to the distribution of the energy deposition during a CEA ejection transient and the termination of the transient is the Doppler reactivity feedback effect. The synthesis methodology quantifies the space-time effects, that determine local energy deposition, via a core and transient specific Doppler weight. Since the magnitude of the Doppler feedback is directly proportional to the Doppler weighting factor, the normalized net energy rise decreases as the weighting factor increases (i.e., space-time effects become more important). Parametric analyses, in CENPD-190-A, show that the normalized energy rise increases monotonically as the Doppler weighting factor goes to one (i.e., point kinetics). Thus, for the computation of an integral value such as the energy deposition in the coolant, the point-kinetics calculation is bounding. Therefore, the system pressure computed on the basis of the energy deposition in the coolant is also bounding.

4.0 CONCLUSION

The staff has considered the request for a clarification with regard to the application of the CENTS code to the analysis of the NSSS thermal-hydraulic response aspects of a CEA ejection transient. In view of the fact that the NSSS thermal-hydraulic response to a CEA ejection transient is completely dependent on the total energy deposition in the coolant, and that this total energy deposition is bounded when the deposited energy is computed in the point kinetics approximation, the computed NSSS pressure is also bounding. The NRC staff concurs that the approved CENTS code is applicable to the computation of the NSSS pressure response due to a CEA ejection transient. This conclusion, however, only holds provided all parameters necessary for a point-kinetics calculation of the energy deposited in the coolant, during the transient of the reactor system at hand, are computed based on the approved methodology specified in CENPD-190-A.

Principal Contributor: Yuri Orechwa

Date: September 15, 2004

cc:
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