July 24, 2003

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

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION REGARDING CE NPSD-1199-P, "MODEL FOR FAILURE OF RCP SEALS GIVEN LOSS OF SEAL COOLING" (TAC NO. MB5803)

Dear Mr. Bischoff:

By letter dated October 18, 2000, the Combustion Engineering Owners Group, currently known as the Westinghouse Owners Group, submitted for NRC staff review Topical Report (TR) CE NPSD-1199-P, "Model for Failure of RCP Seals Given Loss of Seal Cooling." The staff has completed its review of your responses to the staff's previous request for additional information (RAI) and has identified a number of items for which additional information is needed to continue its review. The staff recently discussed this RAI with Mr. Ken Vavrek of your staff, and it was agreed that a response would be provided within 60 days of receipt of this letter. In addition, the staff requests that the revised version of the TR be provided that integrates prior responses, as well as the responses to these RAIs.

Pursuant to 10 CFR 2.790, we have determined that the enclosed RAI does not contain proprietary information. However, we will delay placing the RAI in the public document room for a period of ten (10) 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.

If you have any questions, please call me at (301) 415-1436.

Sincerely,

/RA/

Drew Holland, Project Manager, Section 2
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Project No. 694

Enclosure: Request for Additional Information

cc w/encl: See next page

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REQUEST FOR ADDITIONAL INFORMATION

CE NPSD-1199-P, "RCP SEAL FAILURE MODEL"

WESTINGHOUSE OWNERS GROUP
(Issues Discussed during Teleconference with Westinghouse Owners Group on May 1, 2003)

PROJECT NO. 694

1. In the response to the staff's request for additional information (RAI) 16 (page 36 of the responses to the RAIs), it is mentioned that when the controlled bleed-off (CBO) is not isolated, the inlet fluid to the vapor seal is not subcooled, but the pressures are not high enough to challenge the vapor seal. However, according to Table 5.3-2a of CE NPSD-1199-P, the outlet pressure to the vapor seal is less than one-half the inlet pressure to the vapor seal. Thus, neither of the conditions which would ensure the stability of the vapor seal are present and the seal may pop open. Data was discussed in the response to RAI 2 (page 4 of the responses to the RAIs) which indicated that in tests the vapor seal did not pop open. However, there is no subcooling in the case where the CBO is not isolated (fluid is at saturation conditions), so the test results may not be applicable. How then is the probability of failure for the vapor seal (used, for example, in Table 9.2-15A of the revised Section 9 given in the responses to the RAI) justified?

2. On page 117 of the response to the RAIs, it is stated that when CBO is not isolated and the reactor coolant system (RCS) is saturated that stage 4 is relatively subcooled. This is at variance with the statement made in the response to RAI 16, referred to in question 1 above. According to Table 5.3-2a of CE NPSD-1199-P, the inlet conditions to the vapor seal are saturated conditions. There is no subcooling. Please explain this apparent contradiction.

3. Table 5.3-2a of CE NPSD-1199-P, for post-accident conditions following a station blackout (SBO) event, gives the pressures and temperatures at the inlets to the various seal stages. Consider the case where the CBO is not isolated. Here, the pressure is assumed to drop uniformly across the first three seal stages. The pressures given in Table 5.3-2a of CE NPSD-1199-P are based on the assumption of a uniform pressure drop across the first 3 stages. This is a reasonable assumption for normal operation. However, as several stages will experience two phase conditions, the pressure drops in the pressure breakdown devices will be influenced by flashing. This is particularly significant for those seal stages that appear to indicate the presence of a superheated condition. Under these conditions the pressure drop across the various seal stages will not be uniform. Likely, the flow resistance will be greater where saturated and supersaturated conditions occur. The flow model has to take into account the flashing of the water in the pressure breakdown devices and controlled bleed-off line. Once the pressures are recalculated, the probability of seal failure may change, and the applicability of loss of seal cooling events may be affected. Please analyze.

4. The response to RAI 12 gives estimates of the common cause failure (CCF) Gamma factor. As the staff understands, this factor is used to address the potential that all RCPs experience a seal failure, given that one RCP experiences a seal failure. In this sense, the Gamma factor used by the Combustion Engineering Owners Group (now known as the Westinghouse Owners Group [WOG]) represents a conditional probability of failure.

   The WOG has identified only a few historical events that have involved multiple RCPs, of which none resulted in seal failure and only two events involved stage failures on multiple RCPs. The derivation of the Gamma factor is based on this limited data and engineering judgment with the judgment that the potential for CCF is relatively low early in the event, but will increase as the exposure time increases. The staff agrees with the basic rationale for the engineering judgment, but does not believe the resulting distribution generated by the WOG properly reflects the limited information and large uncertainties with these events. The staff believes the information presented can be used as indicators of the potential for CCF of seals by considering the information on CCF potential at the stage level (i.e., use the stage-related information as an indicator of the RCP seal CCF potential).

   The staff notes that of the events involving multiple RCPs, a number of events did not experience any stage failures and reported no increased leakage. These events cannot be considered in deriving the conditional probability of multiple RCPs experiencing failures since the conditional event (failure of one RCP stage) did not occur. Of the remaining events, one event lasted only 0.1 minutes and should not be considered since its exposure time is so brief as to not expose the RCP seal stages to any significant conditions. Of the remaining events, there was either increased seal leakage or a reported stage failure. From these remaining events are the two events that involved stage failures on multiple RCPs and appear to have affected the same stage on these RCPs by the same failure mode, which is indicative of a CCF condition at the stage level. In both events, the staff understands that the affected RCPs were the only RCPs that were exposed throughout the entire event (i.e., other RCPs may have initially lost seal cooling, but cooling was restored to the other RCPs early in the event). One of these two events lasted only one-half hour and the other event lasted about 4.5 hours. The latter event is also the only event involving multiple RCPs that lasted longer than 1.5 hours. The precise timing of when increased leakage was detected, which would be indicative of when the stage failure actually occurred, is not presented. The other remaining events indicate very small leakage and/or state that only one RCP had a stage failure. Based on this limited information (i.e., a few events that exposed multiple RCPs that also involved some change in seal performance by either increased leakage or stage failure to at least one RCP, of which there are only two events that impacted the seal performance on multiple RCPs) and making a number of assumptions of when the failures occurred, the staff believes a distribution could be developed that would be technically defensible.

   Please provide additional justification for the Gamma factors proposed to be used by the WOG in the RCP seal loss-of-coolant accident (LOCA) model.

5. The response to RAI 2 indicates that while a minimum subcooling of 20°F is required by emergency operating procedures, plant operators routinely maintain subcooling margins in excess of 50°F. Please describe the modified plant-specific operating procedures and the operator training program that will assure the operator actions to maintain subcooling margins in excess of 50°F following a loss-of-component cooling water (CCW) event. Also, is the failure probability of maintaining this required operation factored into the RCP seal failure model?

6. The response to RAI 2 indicates that the WOG analysis indicates that, without operator action, the SBO event will maintain the RCS with more than 50°F subcooling for a period of time. Please provide more discussion on the temperature transient during this event. Is a temperature transient curve available for the staff to review?

7. In Figures 6.2-1, 6.2-2, 6.2-3, and 6.2-4 (of the fault trees presented in the RAI response dated April 29, 2002), there appears to be some erroneous logic, especially for cases where the vapor stage leaks enough to cause a restaging of the lower stages. Also, there is no difference in specific stage failures regardless of the CBO being isolated or not. Please confirm that the fault trees are correct or modify them to appropriately reflect the specific conditions being evaluated.

cc:
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