January 17, 2002

MEMORANDUM TO: File

FROM: Drew Holland, Project Manager, Section 2 **/RA/**
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

SUBJECT: WESTINGHOUSE OWNERS GROUP TASK - WCAP-15666, "EXTENSION OF RCP MOTOR FLYWHEEL EXAMINATION" (TAC NO. MB2819)

The staff has developed an informal list of questions. This request for additional information (RAI) has been transmitted via facsimile to the Westinghouse Owners Group (WOG). The staff and the WOG will discuss the questions in an upcoming conference call and a formal RAI will be developed to formally transmit to the WOG.

Project No. 694

Attachment: Request for Additional Information

Proposed Request for Additional Information on the Topical Report, WCAP-15666, “Extension of Reactor Coolant Pump Flywheel Examination”.

1. The parameter on pipe size shown in Table 3-4 of the SRRA Benchmarking Study considers a range of pipe sizes (pipe OD and wall thickness) that are much smaller than the characteristic dimensions of flywheels discussed in WCAP-15666. How will the fracture mechanics model used in the SRRA code be applicable to validate the results obtained in Table 3-8 using flywheel-specific fracture mechanics model discussed in Section 2 of the submittal ? Please explain, what parts of the flywheel failure probability code calculations (e.g. the PROF object library) are validated by the SRRA results by comparing the results of the SRRA code with that of the pc-PRAISE code as shown in Tables 3-3 and 3-4?

2. Do you calculate the failure probabilities of ductile and excessive deformation failure modes stated in RG-1.14? If not, please provide your rationale.

3. Section 3.3 states that the nominal rpm for a flywheel is 1200 rpm and discusses “peak speed[s]” of 1500 rpm or 3321 rpm that are “used in the evaluation” of failure frequency. The entries in Table 3-8 identify the failure frequencies by these peak speeds. Table 3-5 includes input parameters as “Number of Transients per operating cycle” and “Speed Change per transient (RPM)”.

> a) What is the relationship between the “peak speed” and the probability of failure at 40 and 60 years? For example, does the calculation in Table 3-8 for 1500 rpm assume that the flywheel runs continuously at 1500 rpm during the life of the plant? Does the calculation for 3321rpm assume that the flywheel runs continuously at 3321 rpm during the life of the plant?
>
> b) If the flywheel is assumed to run at 1200 rpm and only increase speed to 1500 rpm or at 3321 rpm after an event, please describe the input frequency of each event and the development of the frequency. If an event frequency is included in failure frequency calculation in Table 3-8 for either of the cases 1500 rpm or the 3321 rpm, how does this comport with the multiplication of the failure frequencies with initiating event frequencies in Tables 3-12 and 3-13?

4. The submittal’s estimate of an initiating event frequency of 2E-6/yr for large break LOCAs is two orders of magnitude lower than the estimates used in the IPEs. Table 4.3 in the reference used in the submittal for the conditional LOOP probability of 2E-2 given a LOCA (NUREG/CR-6538) uses 5E-4/yr to 2E-4/yr as large LOCA PWR frequency estimates. Additionally, although the 3321 rpm speed is discussed as the bounding speed, Table 3-11 and the following paragraph indicate that the 2E-6/yr LOCA frequency only includes large cold leg breaks which would, on loss of RCP power, result in the 3321 rpm. Therefore, although the speed may be a bounding value, the frequency is not a bounding value because the lesser equivalent break area equal to 60% of double-ended break area (resulting in 2609 rpm) is not included in the risk calculation. The analysis should include consideration of the uncertainty in the LOCA frequency as part of an overall uncertainty or bounding evaluation.

5. The sensitivity study in Table 3-9 indicates that the results are quite sensitive to some input parameters when the values of the parameters are individually varied. There is no discussion on

how the results could vary when the input parameters are simultaneously varied. Furthermore, Table 3-5 includes other parameters that appear to represent highly uncertain parameters, particularly “Fatigue Crack Growth Rate,” that are not included in the sensitivity study. Another parameter with large uncertainties that is not included in the sensitivity analysis is the LOCA frequency. RG 1.174 requires that uncertainty be considered in any risk-informed analysis. If the calculated metric is sufficiently small, “a simple bounding analysis may suffice.” Please provide an analysis that bounds the final result (change in risk) based on the potential variation in all the input parameters. Alternatively, a systematic uncertainty analysis as described in Reference 1 and illustrated in Reference 2 may be performed.

1. U. S. Nuclear Regulatory Commission, *Best Estimate Calculations of Emergency Core Cooling System Performance*, Regulatory Guide 1.157, May 1989.

2. U. S. Nuclear Regulatory Commission, *Quantifying Reactor Safety Margins*, NUREG/CR-5249, December 1989.

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