MEMORANDUM April 22, 2009

To: Mr. Bill Kennedy
Program Manager NIST/NBSR

From: Dr. Wade J. Richards
Chief, Reactor Operations and Engineering

Subject: Response to ACRS Question (April 2, 2009 Meeting)

During our analysis of an accident postulated by the ACRS (accidental closing of the valve in the reactor outlet line, DWV-19), we became aware of a possible problem in our original analysis of the transient related to a loss of off-site power. In that analysis, a coast-down curve was derived within RELAP, based upon pump characteristics and the flow geometry. This curve was compared to a coast-down curve measured before initial reactor criticality, and shown to be conservative. However, the original curve was not measured under conditions appropriate to the accident being analyzed. In the figure below, the flow for the initial few seconds of the new curve is compared to that used in the prior analysis. It should be noted that the minimum Critical Heat Flux Ratio (CHFR) occurs during this time period. In order to address this issue, the primary coast-down curves were recently measured under various conditions, including the limiting case of no shut-down pump starting. The measured curve for the limiting case was ten used to derive a model as input to RELAP for complete re-analysis of the accident scenarios explored in the original analysis.

From the figure, it is clear that the two curves are almost identical for the first 3 seconds, and this fact is reflected in the analysis using RELAP. The minimum CHFR occurs in the outer plenum approximately 1.5 s after the primary pumps trip, and is 2.17 as compared to 2.19 previously. This result is a direct consequence of the comparison shown in Fig. 1, which is in turn a measure of the conservatism in the coast-down curve used in the prior analysis. It should be noted that the present curve is a *conservative* representation of the measured curve, and that there is substantial conservatism in the new result (arising from non-local deposition of fission power, neglect of clad and meat thermal conductivity, changes in the distribution of heat deposition for fission product decay, and other terms).

The result of the Loss of Offsite Power accident analysis (and by extension, the Loss of Both Shutdown Pumps) is nearly identical to the initial analysis. The reactor scram was initiated by low flow to the outer plenum 1.4 seconds after the loss of power. The maximum fuel centerline temperature is 410 K, which occurs at the hot spot at the top of the hottest element in the outer core at the time of the scram. Long term cooling in the case of failed shutdown pumps is bounded by the case of the closure of DWV-19, in which the flow drops to zero just 4 seconds after the scram.

In summary, the new analysis, which is conservative, confirms the earlier analysis and the results presented in the Safety Evaluation Report. It will be included in the revised FSAR, as will all the responses to the previous RAI.

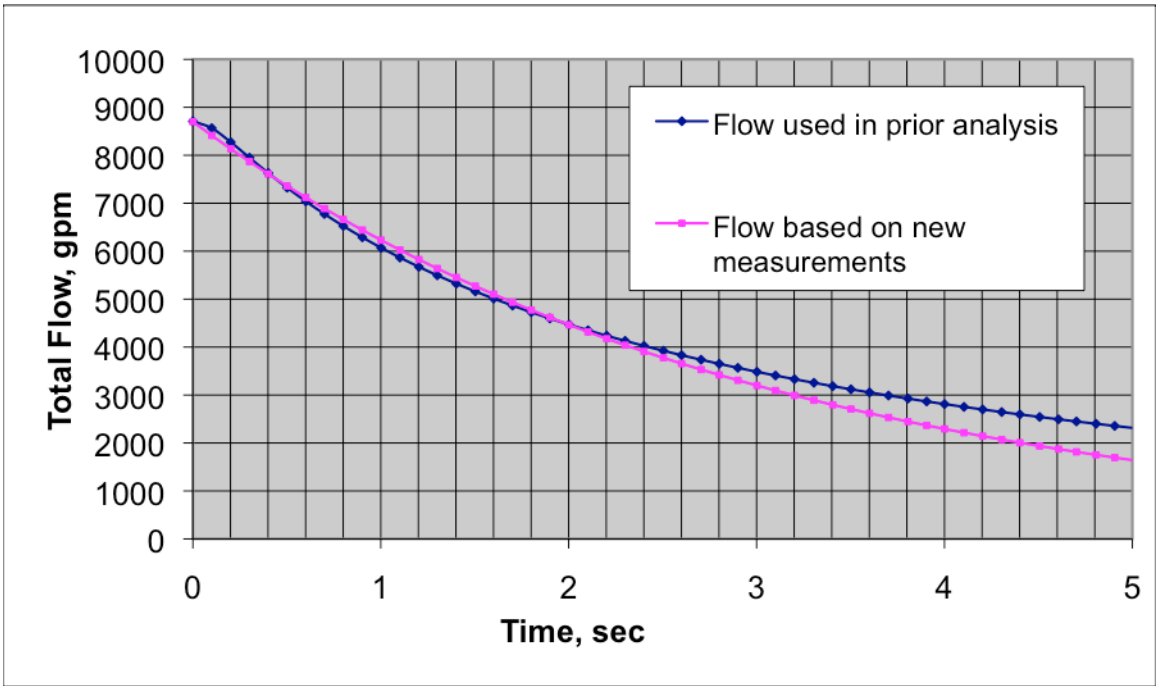

Figure 1. Comparison of the coast-down curve used in the prior analysis to that determined from new measurements.