Improved Safety Margin Characterization of Risk from Loss of Offsite Power

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ABSTRACT

Hess *et al*. (ICONE18, 2009) suggest research is needed in support of the Risk-Informed Safety Margin Characteristic (RISMC) methodology in order "to address completeness of analysis, treatment of uncertainty, and efficiency of computation so that more accurate and cost-effective techniques can be used to address safety margin characterizations." The proposed project directly supports all three elements of this call, in the following manner. More specifically:

Task 1 builds upon previous work of the investigators (Shawn Rodgers *et al.*, "Toward Quantification of the Uncertainty in Estimating Frequency of critical station Blackout," *Procs. of the International Conference on Mathematics and Computational Methods Applied to Nuclear Science and Engineering (M&C 2011),* Rio de Janeiro, May 8-12, 2011, in press) to improve the efficiency of computational estimates of the frequency of potential initiating events arising from the very important issue of Loss of Offsite Power (LOOP) events. The efficiency issue arises because this previous work obtains these estimates in the form of computational evaluation of a multidimensional "nonrecovery integral" having dimensionality equal to the number of backup power trains. Evaluation of multiple integrals can be a computationally very intensive process. (In the prior work cited it is shown that all previously developed approaches known to the investigators are based upon approximations that in one manner or another approximate the recovery integral in terms of single integrals; results in that work also suggest frequency estimates from numerical evaluation of the multidimensional reentry integral are capable of significantly reducing excess overconservatism inherent in even the most realistic of those prior approaches.)

Task 2 is directed toward analysis of completeness of the RISMC approach. Initially (Subtask 2.a) the focus will be upon exploration of issues, especially precision in the associated definitions of "capacity" and "loading," arising in the mapping of specific safety-related issue into the abstract RISMC framework (S. Hess, "Framework for Risk-Informed Safety Margin Characterization," EPRI Report Number 1019206, December 2009.). The subsequent Subtask 2.b will explore the utility of an expanded taxonomy for safety-related analyses that classifies different approaches not only by the deterministic or stochastic nature of the related safety margins, but also by the corresponding properties of the associated estimates of capacity and loading.

Task 3 will further treat improved computational methodologies, but rather then efficiency (as in Task 1) the focus will be upon expanding the domain of application, especially beyond LOOP events.

Task 4 will address the important (and difficult) issue of quantifying uncertainty, again with LOOP events taken as a primary example.