Staff Response to the Advisory Committee on Reactor Safeguards (ACRS) May 15, 2012, memorandum, SUBJECT: STATE-OF-THE-ART REACTOR CONSEQUENCE ANALYSES (SOARCA) PROJECT

1. The SOARCA work is a major step forward in developing more realistic, integral deterministic analyses for severe accident progression for selected accident sequences. It can provide a more integrated approach for analyzing important accident sequences in Level 2 and Level 3 probabilistic risk assessments (PRAs), and the insights from these analyses can be useful in the regulatory decisionmaking process.

The staff appreciates the ACRS's support of the SOARCA study and believes that feedback from the ACRS throughout the study contributed to its success. The ACRS's observations and comments have helped improve the outcomes of the study. The staff has addressed the ACRS's comments in the reports (e.g., effect of earthquake on public evacuation).

2. Priorities for future work related to SOARCA should be the performance of an uncertainty analysis for Surry and the completion of a MACCS2 [MELCOR Accident Consequence Code System] *best practices document.*

The staff has submitted a Notation Vote Commission paper and recommended an uncertainty analysis for a Surry station blackout scenario for Commission consideration. In addition, the MACCS2 and MELCOR best practice NUREGs will be submitted for publication later this year.

3. The experience with the Peach Bottom "best-estimate" analysis and the associated uncertainty analyses demonstrate that these analyses should be conducted in parallel rather than having the uncertainty analyses be an "add-on" to an already performed "best-estimate" analysis.

The staff agrees in principle with this ACRS recommendation, and will certainly attempt to do this for future projects. However, for SOARCA, the best-estimate analysis and the uncertainty analysis required many of the same subject matter experts. Sensitivity analyses and uncertainty analysis parameter selections were completed as the best-estimate analysis was being performed and prior to being published In addition, sufficient preliminary uncertainty analysis is complete and allows the staff to conclude that the uncertainty analysis demonstrated similar timing as indicated in the best-estimate analysis. Publication of the best-estimate analysis prior to the uncertainty analysis was viewed to be in the best interest of the agency given the amount of stakeholder interest in the SOARCA study, length of undertaking, and close proximity in time that both final reports will be published.

4. The SOARCA project has provided estimates of the public health consequences of selected scenarios at two plant sites. Although the scenarios considered by SOARCA are generally important contributors to risk, it is not clear what fraction of the risk has been captured without more complete external events PRAs. Comparisons with earlier studies such as NUREG/CR-2239, which were intended to represent the risk from all accident scenarios, should not be made without acknowledging these differences.

The staff recognizes that the SOARCA methodology may not have captured the total risk from the operating reactors studied. However, the staff analyzed a range of station blackout and containment bypass scenarios using the state-of-the-art models embodied in MELCOR and MACCS2 and believes SOARCA considered accident scenarios that account for the majority of

risk at both the Peach Bottom and Surry plants. The staff selected external events to be representative of those that might arise due to seismic, fire, or internal flooding initiators. In the future, the Site Level 3 PRA project plans to analyze a wider range of external event scenarios than was analyzed in SOARCA.

With respect to the comparison of SOARCA against NUREG/CR-2239, the staff has included text in NUREG-1935 explaining the limitations of the comparison. Because the 1982 Siting Study does not provide latent cancer results at distances that are comparable to those provided in the SOARCA study or to the NRC safety goal, an effort was made to reproduce the 1982 Siting Study results for Peach Bottom using the SST1 source term to produce results that are directly comparable to the SOARCA results. Despite the limitations, the staff believes the comparisons were useful in providing perspective of the SOARCA results.

5. The selection of parameters, their uncertainty distributions, and their correlations—as well as sensitivity studies to assess the impact of uncertainties that are difficult to quantify—are critical to the Peach Bottom and Surry uncertainty analyses. The uncertainty reports should describe the approaches used to identify the parameters, distributions, and sensitivity studies and justify the bases for omission of parameters or effects of interest not addressed in the uncertainty analyses.

The staff will enhance the documentation in the Uncertainty Analysis (UA) NUREG/CR report to better describe the approaches for identifying parameters and distributions and parameters and effects not treated in the integrated UA.

6. Analyses of severe accident progression in a plant with an ice condenser containment would be an important follow-on study. However, such a study should have a lower priority than completion of the ongoing NRC Level 3 PRA study.

In the Notation Vote paper submitted to the Commission, the staff recommended analyzing a plant with an ice condenser containment for Commission consideration. Contingent on Commission approval, the staff plans to coordinate the ice condenser analysis and the Surry uncertainty analysis with the Site Level 3 PRA project as well as other activities (such as those supporting the Fukushima lessons learned) so that schedules for all activities are properly managed.