April 30, 2007

MEMORANDUM TO: Farouk Eltawila, Director
Division of Risk Assessment and Special Projects
Office of Nuclear Regulatory Research

FROM: E. William Brach, Director /RA/
Division of Spent Fuel Storage and Transportation
Office of Nuclear Materials Safety
and Safeguards

SUBJECT: COMMENTS ON ORNL SENSITIVITY AND UNCERTAINTY ANALYSIS OF COMMERCIAL REACTOR CRITICALS FOR BURNUP CREDIT

Enclosed are comments from Division of Spent Fuel Storage and Transportation (SFST) staff regarding the Oak Ridge National Laboratory (ORNL) "Sensitivity and Uncertainty Analysis of Commercial Reactor Criticals for Burnup Credit," as requested by your Memorandum dated March 7, 2007.

If you have any questions regarding these comments, please contact Drew Barto of my staff at (301) 492-3336.

Enclosure: DSFST Comments

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Comments on Draft Sensitivity and Uncertainty Analysis of Commercial Reactor Criticals for Burnup Credit

1. The last paragraph of Section 5.0 addresses conclusions regarding applicability of commercial reactor criticals (CRCs) for criticality code bias determination. This is the only section in the report that addresses the fact that more work needs to be done in order to use CRCs for bias determination, and these statements seem to contradict the body of the report. It should be clarified in the introduction to this report that the sensitivity and uncertainty analysis provides an estimate of experiment similarity based on neutronic considerations, and that there are other considerations, such as material uncertainties, which may prevent an experiment from being sufficiently applicable for bias determination. The report should mention that before CRCs are included as a component of the benchmarking methodology, one must show that the data collection process for the CRCs is of benchmark quality, particularly in view of the caveat in ANSI 19.4 regarding reactor data collection methods.

   Additionally, the report should recommend what other analyses should be included if CRCs are to be used as part of the benchmarking, such as methodologies for determining isotopic uncertainties or k_{eff} penalties for conservatively bounding such uncertainties.

2. Clarify the basis for the estimated penalty for non-covered sensitivity data described in Section 2.4. It is not clear how Equation 5 was developed or if it provides a conservative estimate of the k_{eff} penalty to account for non-covered sensitivity data. Revise the report to include information regarding the derivation of this equation.

   Additionally, it is not clear how this k_{eff} penalty would be combined with an isotopic bias, or with a bias determined for actinide criticality using actual critical experiments, such as experiments involving mixed-oxide fuel. Finally, it is not clear what other margins should be included in the overall benchmarking for burnup credit.

3. The penalty process used in the report appears to rely on the nuclear data evaluator's estimates of the error in the cross section data. Are these estimates meaningful and sufficient by themselves to account for the use of CRCs in the benchmarking process or should other sources of margin be included when determining the final USL?

4. Regarding the use of the sensitivity and uncertainty methodology, is a comparison of sensitivities the only factor one should consider when determining whether a piece of data is acceptable for benchmarking purposes?

5. In the use of the index "g" such as in Figure 4.13, it is not clear what value of g indicates that a benchmark is acceptable for a particular nuclide-reaction pair. It may be helpful to have a discussion of how a plot of g values is used and what it means relative to whether or not a sensitivity is covered and the implication of this for acceptability of an experiment for benchmarking purposes. Since g values are plotted for individual nuclides, should a determination on the applicability of CRCs be made on a nuclide-by-nuclide basis rather than collectively?

6. There appear to be more state-points referenced in Table 4.4 than are plotted in Figure 4.13 for each nuclide, Why?

7. It is suggested that a meeting between members of SFST, RES and ORNL be held to have further discussions on the draft report.