CSSG TASKING 2008-04
Date Issued: June 30, 2008

Task Title:

Definition of critical in terms of calculated reactivity for use in probabilistic risk analysis.

Task Statement:

Recently, an issue has surfaced at the Savannah River Site regarding the proper use of margin of subcriticality in conjunction with Probabilistic Risk Analysis (PRA). The purpose of a PRA is to determine the frequency that a criticality would occur for a given set of circumstances. A fault tree is developed with those events that in conjunction would lead to a critical configuration – the individual probabilities of those events are then combined mathematically to determine the overall frequency that the string required to reach criticality may be achieved. This process is used in some facilities to determine if criticality accident alarms are required. The critical configuration as well as most event sequences are determined by the criticality group and then fed to the risk analysis group for application of the PRA methodology to sequence the events and to assign probabilities. At question is the proper reactivity of the configuration to define as "critical". The two trains of thought are:

1. ANSI standards require that an arbitrary margin be provided that assure configurations calculated to be subcritical are truly subcritical (e.g., see ANSI/ANS-8.1, Paragraph 4.3.3.) Therefore the determination of when a system is critical is that point above which it can no longer be assured that it is safely subcritical (this is the same value used in typical NCSEs to set Criticality Safety Limits and is equivalent to 1 + bias – bias uncertainty – margin of subcriticality).

2. Since PRA is a mathematical tool to determine the frequency of an event (criticality), the proper reactivity to determine if an event is critical is 1+ bias – bias uncertainty without the application of a subcritical margin (you are not trying to determine if a configuration is safety subcritical, but instead if a configuration is (or could be) critical). The value of 1 + bias is the best estimate of a critical configuration as defined by the code. The application of the bias uncertainty to that value provides a small amount of margin for uncertainties in cross sections, experiments, etc.

To date, this issue has not been resolved on-site. The Department of Energy - Savannah River Operations Office (DOE-SR), Washington Savannah River Company (WSRC) and Washington Safety Management Solutions (WSMS) have agreed to seek additional external guidance. Thus, the CSSG is being requested to provide guidance on the subject. For further information on the specific use of

the methodology or further background on the issue, please contact either Glenn Christenbury (DOE-SR) at 803.208.3737 or Fitz Trumble (WSMS) at 803.221.1152.

.

Period of Performance:

The site has adopted a conservative philosophy on a forward fit basis until this issue is resolved. However, it has been decided that no explicit effort will be made to revise any existing analyses until the issue is resolved. Accordingly, while there is no immediate impact to ongoing operations, a prompt response would be appreciated.

Resources:

NCSP CSSG FY08 funding will cover this effort. However, no travel is expected to be necessary to support this request. Mr. Trumble has offered to abstain from this activity due to his involvement in this issue. It is requested that his request be honored.

Task Deliverables:

A formal written report under the signature of the CSSG Chair should be provided to the NCSP Manager electronically. The NCSP Manager will review and forward to Glenn Christenbury, DOE-SR Criticality Safety Program Manager.

Task Due:

July 31, 2008