71-9315

BWXT Y-12
Protecting America's Future

May 31, 2005

CCN-013703
COR-BWXT-5/31/2005-63542

Mr. Shawn Williams
U. S. Nuclear Regulatory Commission
Mail Stop: O13D13
Washington, D.C. 20555-0001

RE: KENO V.a Issue Investigation for the ES-3100 Safety Analysis Report

Dear Mr. Williams:

KENO V.a is a module of the Standardized Computer Analysis for Licensing Evaluations (SCALE) software. SCALE was developed by the Oak Ridge National Laboratory (ORNL) with funding from the Department of Energy and Nuclear Regulatory Commission. The software was first released in 1980. Since that time, distribution and use has grown worldwide. KENO V.a is a Monte Carlo computer code used by the DOE complex for complex fissile material operations to calculate a resultant reactivity (effective neutron-multiplication-factor, k_{eff}). Y-12 nuclear criticality safety engineers typically model process operations and conditions involving fissile material in the KENO V.a computer code which then computes the reactivity.

On Monday, March 21, 2005, the Safety Analysis Engineering (SAE) Department of BWXT Y-12 received notification from the Y-12 Software Quality Assurance (SQA) Manager of a potential error in the KENO V.a module of the SCALE code system (version 4 and all subsequent versions). The Y-12 SQA Manager asked the SAE Department to determine the impact on Y-12. The error in KENO V.a is associated with the modeling of cylinder and other geometries in specific conditions that could potentially result in the calculated k_{eff} value being underestimated from a few tenths of a percent to several percent.

SAE determined that the subroutine could have potentially been used in many evaluations used to perform criticality safety evaluations (CSEs) for Safety Analysis Reports and other documents, but could not specify which CSEs were affected at that time. SAE immediately recalculated five typical cases using corrective input measures and determined that there were no statistically significant differences in the outcomes.

NMSS01

CSEs utilizing KENO V.a computations were evaluated to ascertain the significance of the error. The determination found that multiple k_{eff} calculations are performed for each process modeled such that a random unfavorable event would be evident. The impact of the error was determined to be statistically insignificant for cases at Y-12 (i.e., within the current bands of calculational uncertainty), thus not affecting the overall conclusion of the CSEs.

SCALE version 4.4a was used in the performance of criticality calculations for the ES-3100 Safety Analysis Report. Since the SCALE system was used, KENO V.a was involved. It was further determined that the defective code feature of KENO V.a was used exclusively in the criticality calculations involving the metal slug contents for the ES-3100.

For the ES-3100, a set of infinite array cases for the slug content was reevaluated with the corrected input. Although some differences in $k_{eff}+2\sigma$ values were observed exceeding one standard deviation, these occurred in the cases with low k_{eff}, and not the bounding cases. Differences in $k_{eff}+2\sigma$ values for the cases used to establish the fissile loading limits for the ES-3100 were well within the statistical uncertainty. **Therefore, the CSEs for the ES-3100 shipping package were not affected by the error noted in KENO V.a.**

In order to both dispel doubt and assure conservative results in light of this code problem, criticality safety analysts are now inserting a small gap in their models between surfaces of the suspect geometries. This effectively prevents the problem from arising. A patch to fix the problem in the code is expected to be released by the SCALE development group at ORNL in the near future.

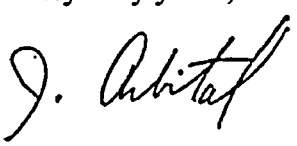
Under the Y-12 SQA Program, SQA activities for software received from another government agency include verification of installation and validation of the software product, user training, configuration management, and cyber security requirements. The Y-12 SQA requirements are consistent with recommendations from the American Society for Quality, the Software Engineering Institute, and the Institute of Electrical and Electronics Engineers (IEEE). The requirements exceed those of the American Society of Mechanical Engineers standard NQA-1-1994, Quality Assurance Requirements for Nuclear Facilities, Subpart 2.7, for acquired software. Under NQA-1, software that has been approved under a program consistent with NQA-1 does not require additional review.

Although Y-12 has the capability for detecting errors in software and administrative procedures for documenting errors and seeking corrective actions, it is the code developer who has the knowledge of the coding, responsibility for implementation of the computation logic, and maintains configuration control over the source code and data libraries. Y-12 depends on software verification provided by the code developer of design agency/government agency software such as KENO V.a.

The Y-12 SQA Program meets or exceeds minimum requirements for use of acquired software. The SCALE development group has implemented the software with the controls and processes necessary to minimize the impact of a potential code error. The statistical results of reviewing approximately 200 k_{eff} calculations performed at Y 12 using the KENO code indicates that no statistically significant impact has occurred at Y-12 as a result of this code error.

If you have any questions, please contact me at (865) 576-8254 or George Singleton at (865) 241-3854.

Very truly yours,



Jeffrey G. Arbital
Containers Program Manager

JGA:slc

cc: E. D. Ragos, NNSA YSO
J. M. Shuler, DOE EM-24
D. R. Tousley, DOE NA-26