APPLICABILITY OF THE TRU STANDARD STATISTICAL MAR APPROACH IN EMERGENCY PLANNING HAZARDS ASSESSMENTS (EPHAs)

QUESTION: The DOE Standard, DOE-STD-5506-2007, *Preparation of Safety Basis Documents for Transuranic (TRU) Waste Facilities*, recommends a statistical approach for estimating the bounding limits on the Material-At-Risk (MAR) for various Documented Safety Analysis (DSA) accident scenarios associated with TRU waste operations. Can this statistical approach for determining the MAR also be applied to the analyses of scenarios in the Emergency Planning Hazards Assessment (EPHA)?

ANSWER: Material-at-Risk (MAR) is the amount of material available to be acted on by a given physical stress. For a given scenario, the MAR will be based on factors such as the type and magnitude of the initiating event, the spatial distribution of the inventory, and administrative controls. Section 2.6.1 of DOE Emergency Management Guide (EMG), DOE G 151.1-2 provides an example of how the MAR can vary depending on the scenario. Although the analysis of multiple containers involved in an accident scenario is not directly addressed in the guidance, the discussion implies that the MAR should be based on a maximum quantity for *each* container (e.g., the maximum quantity allowed by administrative controls, the physical capacity of the container, or the licensed maximum container contents). While that approach may be quite reasonable for chemicals in standard commercial packages (e.g., 150 pound chlorine cylinders) or well-characterized uniform radiological packages (e.g., in accordance with limits established in the WIPP waste acceptance criteria), the safety (DSA) community has recognized that it tends to be extremely conservative for events involving a random subset of TRU waste containers for which the container contents vary widely around a mean value, are incompletely characterized, and are unconstrained by either physical capacity or administrative limits.

The overall analysis approach that is encouraged throughout the EMG, DOE G 151.1-2 and explicitly emphasized in a recent Frequently Asked Question (FAQ) is intended to produce **"**more realistic than bounding**"** estimates of consequences of hazardous material release scenarios. Subject to the exception detailed below, the basic statistical MAR approach specified in the Standard is an acceptable means for limiting conservatism in accident consequence estimates for TRU waste facility Emergency Planning Hazards Assessments (EPHAs) and achieving results that are consistent with the "more realistic than bounding" principle. [*It is important to emphasize that the application of the approach in EPHAs must acknowledge the specific conditions specified in the Standard that ensure that the statistical assumptions of the analysis are maintained*.]

Exception

In general, DOE emergency management guidance suggests that DSA methodology for accident scenario and source term formulation is generally acceptable for use in EPHAs. ***However***, the analyses in these sources should be used with caution because the assumptions and methodology applicable to their intended purposes may not be fully compatible with emergency management planning needs. A specific example of such an incompatibility is related to the multi-container MAR estimates for an inventory of containers *not* fully characterized. The use of the MAR values given in the Standard in accident consequence calculations involving these inventories can produce counter-intuitive results and pose obvious problems for emergency planning and response. It would be very difficult for the planner to rationalize having a lower classification and smaller protective action distance for a multiple-container scenario than for a comparable release event (e.g., spill, fire) involving a single container.

The DOE standard, DOE-STD-5506-2007 methodology achieves a "reasonably bounding approach" by following the general algorithm that scenarios involving small numbers of containers will be conservatively estimated, while scenarios involving larger numbers of containers will not be unnecessarily conservative. For accidents involving a fully-characterized population of waste containers, Table 4.3.2-1 of the Standard specifies a single-container MAR equal to the contents of the single maximum loaded container. For multiple-container accident scenarios, Table 4.3.2-1 specifies a MAR equal to the contents of the maximum container plus some combination of containers with the 99th percentile value, the 95th percentile value, and the mean value quantities of TRU material from the total array of containers being evaluated.

For events involving containers that are *not* fully characterized, Table 4.3.2-1 specifies a single-container MAR equal to the contents of the maximum container plus an additional 20%. The MARs for multiple-container accident scenarios are equal to the contents of the maximum container plus the contents of other containers selected using the statistical distribution of container contents for the particular site. For the SRS, ORNL, and LLNL site-specific data provided in Appendix A, the MAR consistently increases as the number of containers involved in the scenario increases. However, for the RL, INL, and LANL data, the single container MAR (i.e., the maximum container plus 20%) is *larger* than the MAR for the 2-container and other multiple-container events. For example, for two of the sites it takes up to 16 containers to exceed the single-container MAR.

With a slight modification to the algorithm, MARs can be developed that provide a sound basis for planning and response to accidents involving multiple containers. *For example*, the MAR approach for containers that are not fully characterized might be modified by adding an additional 20% to the maximum container contents each time the maximum container is specified as part of a multiple-container MAR. Thus, the single-container MAR will be equal to the maximum container plus 20%; the two-container MAR would

be equal to the maximum container plus 20% plus one container at the 95% upper tolerance limit for the 99th percentile, and so forth (cf. Table 4.3.2-1). This modification results in a consistent increase in the MAR as the number of containers involved in the scenario increases.