Advanced Topics in Hazard Prediction

Laboratory to Field: Characterizing Decontamination Effectiveness Through Exposure Assessments

Brent Mantooth, Combat Capabilities Development Command Chemical Biological Center
Mark Varady, Combat Capabilities Development Command Chemical Biological Center
Shawn Stevenson, Combat Capabilities Development Command Chemical Biological Center
Nirmala Pinto, Combat Capabilities Development Command Chemical Biological Center

The overarching goal of decontamination technologies is to provide hazard mitigation and prevent negative health effects in personnel that must interact with contaminated assets (e.g., vehicles, buildings). To determine if personnel will experience negative health effects, one must determine the dose of contaminant personnel would receive while interfacing with the decontaminated assets. Limits on field testing against real chemical agent on full-scale assets inhibits directly obtaining this data. Consequently, testing must rely on materials-level, lab-scale tests to determine doses of contaminant that personnel may receive while interacting with full-scale decontaminated equipment. Typically lab-scale testing has focused on characterizing efficacy in terms of how much agent remains on a material after a decontamination process by extraction techniques. However, these data do not enable direct calculation of exposure dose to unprotected personnel. To determine if a decontamination process will prevent negative health effects requires an exposure assessment which requires data in the form of vapor emission source terms. These source term data are used to calculate potential exposure doses using modeling and simulation (M&S) tools. This talk will demonstrate how to compute potential exposure doses from laboratory measured vapor source terms to determine if materials have been sufficiently decontaminated to make them safe for acute exposures (i.e., short time duration). From this work we show that the capability to predict source terms requires an understanding of the underlying mass transport processes occurring during both the contamination and decontamination processes. Further, the efficacy of a decontaminant depends on its ability to access and remove contaminant absorbed in the bulk of materials. The ability to bridge the gap from laboratory to field for assessing decontamination effectiveness depends on the ability to convert laboratory-measured source terms to field-scale personnel dose using computational-based exposure assessments.