CONCURRENT SESSION 6 – RADIOLOGICAL RESEARCH STUDIES SESSION

Re-aerosolization of Dense Metal Oxide Simulating Radiological Contamination from Military Clothing

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Background: Contamination of patients and their clothing following a radiological or sub-critical nuclear incident is a concern for the patients as well as attending medical personnel. A radiological event would disperse dense aerosol material contaminating many people. Clothing removal is expected to remove more than 80-90% of contamination, however the removal of this clothing presents a risk of resuspending hazardous aerosols and cross-contaminating people and equipment. While this re-aerosolization from clothing has been studied for biological agents such as anthrax spores, less is known about re-aerosolization of dense aerosols from clothing contaminated with radiological materials or other dry toxic industrial chemical aerosols.

Purpose: The purpose of this study was to characterize inhalable dense aerosols generated during clothing removal, a first step in decontamination of a contaminated manikin.

Methodology: A flow-through aerosol test chamber was setup with HEPA filtered supply air and exhaust. A clothed manikin was placed in the chamber and contaminated with copper oxide particles (density=6.315g/cc) as a surrogate for Strontium-90 (density=5.11g/cc), via a rotating brush generator. After contamination, the clothing was vigorously shaken multiple times to simulate expedient decontamination and rapid clothing removal. Aerosol measurements were collected using an Institute of Medicine (IOM) inhalable aerosol sampler with filter. IOM samplers were analyzed using energy dispersive x-ray microscopy that allowed for elemental analysis and identification of inhalable sized copper oxide aerosol particles produced from clothing removal. This allowed for inhalable cooper oxide to be differentiated from other aerosols generated during clothing removal such as lint and other fibers. A total of 11 copper-oxide contamination trials were conducted. These were compared to the airborne IOM measurements of particles in 7 trials without contamination. The trial order was randomized to investigate chamber cleaning efficiency in limiting cross-contamination between trials.

Results: Inhalable copper oxide aerosol was detected in all contamination trials and at levels significantly higher than in background trials. A statistically significant difference (p=.01) in the number of particles on the IOM filter was found between the contamination trials and background trails. The IOM on average collected 31,600 particles/cc during the contaminated clothing removal trials. The Energy Dispersive X-Ray Spectroscopy showed that 80% of the particles on the IOM filter were copper oxide.

Discussion/Recommendations: This study demonstrated that significant quantities of inhalable dense aerosol are generated during simulated patient decontamination (i.e., clothing removal). This has important implications for both decontamination of personnel exiting a “hot zone” and for patient decontamination following a radiological incident. While personnel actively performing decontamination are provided particulate respiratory protection, personnel in more distant areas may not be. Patient decontamination must either include measures to contain generated aerosols."