Abstract

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Theme: Injury Prevention
Category: Remote Environment

Title: "Testing Technologies for Personnel Dry Decontamination of Radiological Contaminant in Extreme Cold Environments to Increase Human Survivability"

Abstract: (less than 2000 words, 3 parts, plus one image, table or figure)

Summary: An incident where radiological agents are released into the air is a serious threat and hazard for military forces and civilians in the operational environment. The events can range from an industrial accident or accidental release of radiological particulate into the environment to an intentional terrorist or adversary use of a nuclear or radiological weapon. Casualties may present with conventional traumatic injuries, burns and/or radiological contamination on skin and clothing. Decontamination should be performed immediately if there are no life-threatening injuries. Standard decontamination procedures use a water-based solution which poses logistical challenges of transportation of water tanks, equipment and a water source readily available. However, in extreme cold weather environments snow and ice create additional logistical challenges as well as risk of lowering core body temperatures causing casualties to experience cold shock or hypothermia. Various dry technologies such as a wipe, spray or vacuum have been developed to expand the operational temperatures that can be used to safely and adequately decontaminate casualties in extreme cold weather, especially when water-based systems are not a viable option for use in humans due to the high risk of hypothermia. Our objective was to test the various dry technologies for efficacy and ease of use in removing dusty radiological contaminate in extreme cold temperatures.

Methods-Results:
Our purpose was to collect independent performance data of dry decontamination technologies in a range of low temperatures as an alternative to water-based systems. We performed the experiments using dead pig skin as simulant to human flesh and an adherent non-radioactive simulant to represent radiological fallout. A key performance data point was adequate reduction of contaminate on the pig skin (1 x 1"and 3 x 7" samples) and time to complete decontamination within a set time frame. This time limit

for self-decontamination of ambulatory casualties is 3 minutes and non-ambulatory casualties is 9 minutes. The technologies were tested at 3 prescribed temperatures of (65F, 35F and 5F) using the radiological simulant at concentrations of (10g/m2, 5 g/m2, and 2 g/m2) and measuring residual contaminate by utilizing several detection sensors (laser particle, microscope, X-ray fluorescence, and high-speed camera analysis). The technologies tested included an alcohol-based wipe, carbon embedded fiber wipe, spray, and HEPA vacuum. Initial testing showed that there is no significant impact of temperature on the efficacy of the technologies. Temperature only drives the decision to use dry decontamination instead of water-based systems when the temperature is below 35 degrees F. The results utilizing 60 data points showed the most effective technology was the carbon embedded fiber wipe and the HEPA vacuum, with efficacy of 82% and 79% respectively. The less effective technologies include the spray which showed no significant change between the samples and alcohol-based wipe with efficacy of 61%.

Conclusions:
The carbon embedded fiber wipe showed no significant difference in efficacy when compared to the HEPA vacuum. The performance of the two technologies is identical in the full range of temperatures and concentrations. The technology proved robust with changing temperatures and demonstrated consistent performance and efficacy. Final phase of testing involving large scale operations in the field performed in Alaska. Points of measure included rate of processing contaminated casualties in both an ambulatory and non-ambulatory setting, ease of training and use, durability, and waste management.