Lilliput or Brobdingnag: Does Scale Influence Decontamination Studies?

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There are a multitude of scaling aspects that need to be considered when extrapolating the results of laboratory decontamination studies to real life incidents. Two such factors relate to the contamination density (dose) and geometry (droplet number) of test contaminants. In other words, will a particular decontamination method be equally effective against single droplets of varying size (dose) or multiple droplets of the same dose? This is a critical consideration, as many decontamination test methods employ a standard contamination density and there is an assumption that the test results will be applicable to a wide range of exposure scenarios. In this study, we utilised a previously validated test model [1] to assess the effectiveness of gross (Ladder Pipe System; LPS) decontamination (against chemical warfare agents, simulants and toxic industrial chemicals) applied to porcine skin either as a single droplet over a range of doses (equivalent to 0.1 – 10 mg cm^{-2}) or when applied as 1 – 10 separate droplets at constant overall dose (10 mg cm^{-2}).

The results of both studies were identical in that the effectiveness of gross decontamination was constant and so independent of contamination density and/or application geometry. However, differences were observed in the extent to which each contaminant spread over the skin surface in relation to the number of applied droplets: large numbers of small droplets undergo more rapid dermal absorption and so confirms the need to perform decontamination as soon as practically possible. Additional studies have subsequently confirmed that the effectiveness of dry decontamination is also independent of contamination density and application geometry [2].

[1] M. Matar H, J. Larner J, S. Kansagra et al., 2014. Toxicol In Vitro 28(4):492-501. doi: 10.1016/ j.tiv.2014.01.001

[2] R.P. Chilcott, J. Larner and H. Matar, eww.medicalcountermeasures.gov/barda/ cbrn/prism/