

## **Derivation and Use of an Empirical, Time-Resolved Model for Predicting Residual Skin Contamination as a Decision-Aiding Tool for First Responders (“ASPIRE”)**

Joanne Larner | *University of Hertfordshire*

The use of water is a well-established means of performing mass casualty decontamination and, after emergency dry decontamination, form the second and third components of the “Triple Protocol” recommended in current U.S. federal guidance [1]. However, the use of water may result in hypothermia and may raise compliance issues with patients. Therefore, the clinical benefit of proceeding from dry to wet decontamination needs to demonstrably outweigh any attendant risks and disadvantages. The “Algorithm Suggesting Proportional Incident Response Engagement” (ASPIRE) decision-aiding tool was developed to assist first responders ascertain the need to perform wet decontamination.

Derivation of the algorithm: A study was performed to measure the rate of evaporation of a wide range of liquid chemicals (n=58) from clothed or unclothed synthetic skin surfaces using different droplet sizes. The evaporation rates of each chemical were subject to a correlation analysis with commonly available physicochemical properties. The best fit ( $p < 0.0001$ ) was related to  $\Delta H_{\text{evap}}$  (heat of evaporation) and was used in a four parameter logistic regression analysis to predict an evaporative half-life ( $T_{1/2}$ ) from which a simple exponential decay function was used to predict the fraction of an applied dose of chemical remaining on the skin at any given time post exposure.

ASPIRE has been fully integrated into the National Library of Medicine’s CHEMM and WISER digital systems for emergency responders [2] and requires two end-user inputs: the time elapsed since exposure and the identity of the chemical (selected from a pull-down menu) from which the algorithm is populated with the appropriate  $\Delta H_{\text{evap}}$  value. Where the identity of the contaminant is not known, an estimate of volatility can be input using a slider bar. The ASPIRE system then indicates if wet decontamination is required.