THREAT AGENT DEFEAT MODELING AND TESTING

Aerosol Deposition Model For Simulating The Distribution Of Deposited Aerosolized Particles On A Mannequin

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In this study we present the development, validation, and application of an aerosol deposition model for simulating the distribution of deposited aerosolized particles on the surface of a mannequin, either unprotected or protected to various degrees, exposed to a turbulent air stream with a specified aerosol concentration and particle size distribution, using as few turbulence flow parameters as possible. Validation of the model is performed predominately using data obtained from wind tunnel experiments carried out at Defence Research and Development Canada, Suffield Research Centre. Scenarios involving dermal exposure to the chemical nerve agent VX in the form of a liquid aerosol are presented. The aerosol deposition model allows for the calculation of deposition velocity, total deposited mass, and other quantities, over the entire surface of a mannequin given the aerosol concentration, exposure time, particle size distribution, and air flow conditions are specified. Furthermore, characteristics of the clothing ensemble must be specified if the mannequin is protected by a clothing ensemble. The model uses shear velocity distributions over a mannequin, obtained from computational fluid dynamic (CFD) simulations, and accounts for three particle transport mechanisms: Brownian (molecular) diffusion, turbulence (eddy) diffusion, and gravitational sedimentation. Additionally, the model considers surface roughness and orientation of the mannequin surface relative to gravity. The model is integrated into a broader computer program, written in the Fortran programming language, that handles all input and output.

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