PROTECTION - SCIENCE AND TECHNOLOGY ADVANCES FOR CHEMICAL AND BIOLOGICAL PROTECTION

Shifting To Protective Clothing For The Penetration Of Aerosolized Chemical Warfare Agents In A Liquid Phase For The Enhanced Protection Performance Capabilities

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Chemical warfare agents (CWAs) such as sarin, soman, mustard gas, and VX can be encountered not only in their typical gas phase, but also in a liquid aerosol phase. Aerosolized CWAs are of particular concern as they can be transported in a long distance by wind and body movements. However, the current individual protective clothing equipment consists of the tightly woven outer layer of fabrics, which does not provide the protective performance capability against the air flow resistance and particulate filtration. To enhance the protection performance capabilities against such harmful aerosols, there are two requirements: One is the development of an effective aerosol barrier materials for protective clothing and the other is the standardized testing methodology. We will introduce a new technology shifting to protective clothing for aerosolized CWAs and testing methodology.

Currently, a standardized methodology that examines the barrier effectiveness of the protective clothing to CWAs in a liquid aerosol phase does not exist. The objectives of this study are, thus, to develop a system where the protection performance of woven garments worn by soldiers are measured against aerosolized liquid particles using a simulant, diethyl-hexyl-sebacate (DEHS) driven by wind conditions and motions mimicking body movements. The dynamic test cell was designed to show some body movement in a geometrical shape and installed inside the closed-type, recirculating wind tunnel with a uniform averaged velocity distribution and low turbulent characteristics. The particles DEHS with a uniform size of 1~2μm were supplied into the test section of the wind tunnel using the rake with multi-perforated holes to simulate chemical aerosols. The velocity fields around the test cell and the protective clothing material were measured at uniform wind tunnel velocities of up to 5 m/s. The flow characteristics around the test cell and the velocity distribution of approaching the protective clothing materials varied with the free stream velocity in the wind tunnel. DEHS aerosols in a liquid phase that pass the protective clothing material or rebound after the collision to it were also visualized in detail.