Establishing Air Flow Patterns inside Respiratory Protection Devices

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ABSTRACT

On various levels air flow patterns inside respiratory protection devices determine the functionality of the protective device. Aspects such as fogging of eye glasses, heat stress, the efficiency of the filter and the method to perform fit testing depend on the air flow. In this paper a digital gas mask is described, which was developed using 3D-scanning techniques and a CAD/CAM model. The model can be placed on a representative digital head of a person; Both models combined, allow the calculation and visualisation of air flow patterns inside the respirator. Air flow calculations were performed using computational fluid dynamics. This method allows the localization and analysis of dead spaces inside a respirator. In addition the outcome of the computerised respirator was validated by measurements of the air flows. For these measurements, high speed video imaging of smoke inside respirator was used, as well as Laser Doppler Anemometry. The measurements show the circular flow patterns during the breathing cycle behind the eye glasses.