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Development of samplers for aerosol fractions deposited in two regions of the respiratory tract – gas-exchange region and posterior head airways

Abstract *

The ICRP model for deposition of airborne particles in human respiratory tract – sub-divided into the Extra-Thoracic1, Extra-Thoracic2 (ET2), Tracheo-bronchial, Bronchiolar and Alveolar regions (Alv) – is a mathematical model based on two mechanisms, diffusion and aerodynamics.

The development of two samplers for airborne particles depositing in the Alveolar region and the posterior part of the nose will be presented. The sampling conventions for these regions are described by EN-ISO13138:2012, which in turn are based on the ICRP model. These two regions were selected because the content of particles deposited there may (after dissolution in the case of the Alveolar region) end up in the brain. The samplers will be used in a project on the exposure for manganese in welding fume.

The fractions depositing by aerodynamics and diffusion are collected on two different cascaded substrates. A protective impactor separates the two substrates. The collection efficiencies of the impaction and diffusive stages have been tested with an APS for particles exceeding 1 μm aerodynamic diameter and with a DMA run either as an SMPS or a DMPS for smaller particles.

The design, testing and validation of the samplers for the two fractions will be presented. The configurations of the two collection stages have been optimized but the obtained sampling efficiencies are not a perfect match to the intended sampling conventions.

The samplers are intended for static sampling at 1.2 LPM. They can be redesigned in order to fit personal sampling, but they will not fit inside a welder's modern visor.

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