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WORKPLACE ATMOSPHERES - GUIDANCE FOR SAMPLING OF INHALABLE, THORACIC AND RESPIRABLE AEROSOL FRACTIONS

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Atmosphères de lieux de travail - Guide pour l'échantillonnage des fractions d'aérosols inhalables, thoraciques et alvéolaires

Arbeitsplatzatmosphäre - Leitfaden zur Probenahme der einatembaren, thorakalen und alveolengängigen Aerosolfraktion

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Foreword

This Technical Report (CEN/TR 15230:2005) has been prepared by Technical Committee CEN/TC 137 “Assessment of workplace exposure to chemical and biological agents”, the secretariat of which is held by DIN.

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0 Introduction

0.1 Background

A number of materials hazardous to health occur in the workplace in the form of aerosols, i.e. suspensions of solid or liquid particles in air. Dust is generally understood to be an aerosol of solid particles, mechanically produced, with individual particle diameters of 0,1 µm upwards. Dust particles can be compact in shape, or can have extreme shapes, as for example in the case of airborne fibres. Fume is an aerosol of solid particles generated by condensation from the vapour state usually following the evaporation of molten metals. Smoke is an aerosol of solid and or liquid particles generated by condensation or nucleation of vapours after burning of carbonaceous material. In both fumes and smokes the primary particle diameters are typically less than 0,1 µm which form larger aggregated particles. Mists are aerosols formed from liquid droplets. In this document the term ‘‘aerosol’ is used to describe any suspension of particles in air, whether the airborne particles constitute a solid dust, airborne fibres or droplets, a fume, a smoke or a mist.

Aerosol sampling at workplaces can be performed for many reasons using different sampling strategies: These include comparison of the measured concentration with the occupational exposure Limit Value (LV), exposure assessment for epidemiological studies and evaluation of control measures. Occupational Exposure Limits have been defined for many types of aerosol. In order to demonstrate that personal exposure is adequately controlled it is usually necessary to determine the concentration of the aerosol by means of personal sampling. In some cases a direct determination of the aerosol concentration is all that is needed. In other cases a subsequent analytical technique is applied for the determination of a particular harmful element or compound present in the aerosol.

0.2 Sampling instruments

Many instruments have been developed over the years for sampling airborne particles for the purpose of assessing exposure or for determining the efficacy of dust control measures (see [6]). In the past, sampling instruments were often inadequately standardised in terms of their collection characteristics. Modern standards for monitoring exposure to airborne particles are performance based, i.e. they require that the instruments used meet agreed performance criteria with respect to target specifications. This document is intended to help those responsible for making measurements to select and use instruments that meet these modern performance standards.

0.3 Inhalable, thoracic and respirable fractions of airborne particles

Most industrial aerosols contain particles of a wide range of sizes. The behaviour, deposition and fate of any particle after entry into the human respiratory system, and the response that it elicits, depends on the nature and size of the particle. For the purposes of occupational hygiene it is important to consider the concentrations of particles present in different size fractions.

Inhalable dust corresponds to the fraction of airborne material that enters the nose and mouth during breathing, and is therefore available for deposition anywhere in the respiratory tract. The target specification for sampling the inhalable fraction is given in EN 481. In reality the inhalable fraction depends on the prevailing air movement around the exposed person (wind speed and direction), and on whether breathing is by nose or mouth. It has, however, been possible to define a target specification for sampling instruments that approximates to the inhalable fraction, for representative values of breathing rate, and for a person exposed equally to all wind directions.

Thoracic dust corresponds to the fraction of airborne material that passes through the nose or mouth of the exposed person, and enters the branching airways of the lungs. The target specification for sampling the thoracic fraction is given in EN 481. In reality the thoracic fraction depends on breathing rate and varies for different individuals, however it has been possible to define a target specification for sampling instruments which approximates to the thoracic fraction for an average person.