PD CEN/TR 13205-3:2014

BSI Standards Publication

Workplace exposure — Assessment of sampler performance for measurement of airborne particle concentrations

Part 3: Analysis of sampling efficiency data

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National foreword

This Published Document is the UK implementation of CEN/TR 13205-3:2014. Together with BS EN 13205-1:2014, BS EN 13205-2:2014, BS EN 13205-4:2014, BS EN 13205-5:2014 and BS EN 13205-6:2014 it supersedes BS EN 13205:2002 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee EH/2/2, Work place atmospheres.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Exposition sur les lieux de travail - Évaluation des performances des instruments de mesurage des concentrations d'aérosols - Partie 3: Analyse des données d'efficacité de prélèvement

Exposition am Arbeitsplatz - Beurteilung der Leistungsfähigkeit von Sammlern für die Messung der Konzentration luftgetragener Partikel - Teil 3: Analyse der Daten zum Probenahmewirkungsgrad

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Foreword

This document (CEN/TR 13205-3:2014) 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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document together with EN 13205-1, EN 13205-2, EN 13205-4, EN 13205-5 and EN 13205-6 supersedes EN 13205:2001.

EN 13205, *Workplace exposure — Assessment of sampler performance for measurement of airborne particle concentrations*, consists of the following parts:

— *Part 1: General requirements;*

— *Part 2: Laboratory performance test based on determination of sampling efficiency;*

— *Part 3: Analysis of sampling efficiency data* [Technical Report] (the present document);

— *Part 4: Laboratory performance test based on comparison of concentrations;*

— *Part 5: Aerosol sampler performance test and sampler comparison carried out at workplaces;*

— *Part 6: Transport and handling tests.*

Introduction

EN 481 defines sampling conventions for the particle size fractions to be collected from workplace atmospheres in order to assess their impact on human health. Conventions are defined for the inhalable, thoracic and respirable aerosol fractions. These conventions represent target specifications for aerosol samplers, giving the ideal sampling efficiency as a function of particle aerodynamic diameter.

In general, the sampling efficiency of real aerosol samplers will deviate from the target specification, and the aerosol mass collected will therefore differ from that which an ideal sampler would collect. In addition, the behaviour of real samplers is influenced by many factors such as external wind speed. In many cases there is an interaction between the influence factors and fraction of the airborne particle size distribution of the environment in which the sampler is used.

This Technical Report presents how data obtained in a type A test (see EN 13205-2) can be analysed in order to calculate the uncertainty components specified in EN 13205-2.

The evaluation method described in this Technical Report shows how to estimate the candidate sampler's sampling efficiency as a function of particle aerodynamic diameter based on the measurement of sampling efficiency values for individual sampler specimen, whether all aspirated particles are part of the sample (as for most inhalable samplers) or if a particle size-dependent penetration occurs between the inlet and the collection substrate (as for thoracic and respirable samplers).

The document shows how various sub-components of sampling errors due to non-random and random sources of error can be calculated from measurement data, for example, for individual sampler variability, estimation of sampled concentration and experimental errors.

1 Scope

This Technical Report specifies evaluation methods for analysing the data obtained from a type A test of aerosol samplers under prescribed laboratory conditions as specified in EN 13205-2.

The methods can be applied to all samplers used for the health-related sampling of particles in workplace air.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1540, *Workplace exposure — Terminology*

EN 13205-1:2014, *Workplace exposure — Assessment of sampler performance for measurement of airborne particle concentrations — Part 1: General requirements*

EN 13205-2:2014, *Workplace exposure — Assessment of sampler performance for measurement of airborne particle concentrations — Part 2: Laboratory performance test based on determination of sampling efficiency*

3 Terms and definitions

For the purpose of this document, the term and definitions given in EN 1540, EN 13205-1 and EN 13205-2 apply.

NOTE With regard to EN 1540, in particular, the following terms are used in this document: total airborne particles, respirable fraction, sampling efficiency, static sampler, thoracic fraction, measuring procedure, non-random uncertainty, random uncertainty, expanded uncertainty, standard uncertainty, combined standard uncertainty, uncertainty (of measurement), coverage factor, precision and analysis.

4 Symbols and abbreviations

4.1 Symbols

4.1.1 Latin

$A(D_{\mathrm{A}}, \sigma_{\mathrm{A}}, D)$ relative lognormal aerosol size distribution, with mass median aerodynamic diameter D_{A} and geometric standard deviation σ_{A}, $[1/\mu\mathrm{m}]$

NOTE The word "relative" means that the total amount of particles is unity [-], *i.e.* $\int_0^\infty A(D_{\mathrm{A}}, \sigma_{\mathrm{A}}, D)\,\mathrm{d}D = 1$.

A_p integration of aerosol size distribution A between two particle sizes, [-] – (polygonal approximation method)

$A_{t,p}$ integration of aerosol size distribution A between two particle sizes, calculated using set t of the simulated test particle sizes, [-] – (polygonal approximation method)

$b_{ipr}, b_{ipr}^{\mathrm{left}}, b_{ipr}^{\mathrm{right}}, b_{ipr}^{\mathrm{top}}, b_{ipr}^{\mathrm{front}}$ coefficients in Formula (19) to estimate the test aerosol concentration at a specific sampler position e.g. in a wind tunnel based on nearby concentrations (to the left, right, above and in front of) the sampler measured by thin-walled sharp-