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Arbetsplatsluft – Mätning av metaller och metalloider i luftburna partiklar – Krav och provningsmetoder

Workplace exposure – Procedures for measuring metals and metalloids in airborne particles – Requirements and test methods



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Denna standard ersätter SS-EN 13890, utgåva 1.

The European Standard EN 13890:2009 has the status of a Swedish Standard. This document contains the official English version of EN 13890:2009.

This standard supersedes the Swedish Standard SS-EN 13890, edition 1.

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 13890

September 2009

ICS 13.040.30

Supersedes EN 13890:2002

English Version

Workplace exposure - Procedures for measuring metals and metalloids in airborne particles - Requirements and test methods

Exposition sur les lieux de travail - Procédures pour le mesurage des métaux et métalloïdes dans les particules en suspension dans l'air - Exigences et méthodes d'essai

Exposition am Arbeitsplatz - Messung von Metallen und Metalloiden in luftgetragenen Partikeln - Anforderungen und Prüfverfahren

This European Standard was approved by CEN on 8 August 2009.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN Management Centre has the same status as the official versions.

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Foreword

This document (EN 13890:2009) 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.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 2010, and conflicting national standards shall be withdrawn at the latest by March 2010.

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 supersedes EN 13890:2002.

The major technical changes between this European Standard and the previous edition are as follows:

- a) Adaptation of the framework for assessing the performance of procedures for measuring metals and metalloids against the general requirements for the performance of procedures for measuring chemical agents in workplace atmospheres as specified in EN 482;
- b) Revision of the calculation model for the uncertainty of measurement to comply with EN 482 and ENV 13005.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

This European Standard provides a framework for assessing the performance of procedures for measuring metals and metalloids against the general requirements for the performance of procedures for measuring chemical agents in workplace atmospheres as specified in EN 482. It enables producers and users of procedures for measuring metals and metalloids in airborne particles to adopt a consistent approach to method validation.

Although this European Standard has been written for assessing the performance of procedures for measuring metals and metalloids, it can be used as the basis for assessing the performance of procedures for measuring other chemical agents that are present as or in airborne particles, e.g. sulphuric acid mist.

1 Scope

This European Standard specifies performance requirements and test methods for the evaluation of procedures for measuring metals and metalloids in airborne particles sampled onto a suitable collection substrate, e.g. a filter.

This European Standard specifies a method for estimating the uncertainties associated with random and systematic errors and combining them to calculate the expanded uncertainty of the measuring procedure as a whole, as prescribed in EN 482.

This European Standard is applicable to measuring procedures in which sampling and analysis is carried out in separate stages, but it does not specify performance requirements for collection, transport and storage of samples, since these are dealt with in EN 13205 and ISO 15767.

This European Standard is not applicable to procedures for measuring metals or metalloids present as inorganic gases or vapours, e.g. mercury, arsenic (see EN 838 and EN 1076), or to procedures for measuring metals and metalloids in compounds that could be present as a particle/vapour mixture, e.g. arsenic trioxide.

2 Normative references

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

EN 481, *Workplace atmospheres — Size fraction definitions for measurement of airborne particles*

EN 482:2006, *Workplace atmospheres — General requirements for the performance of procedures for the measurement of chemical agents*

EN 1232:1997, *Workplace atmospheres — Pumps for personal sampling of chemical agents — Requirements and test methods*

EN 1540:1998, *Workplace atmospheres — Terminology*

EN 12919, *Workplace atmospheres — Pumps for the sampling of chemical agents with a volume flow rate of over 5 l/min — Requirements and test methods*

EN 13205¹⁾, *Workplace atmospheres — Assessment of performance of instruments for measurement of airborne particle concentrations*

EN ISO 3696, *Water for analytical laboratory use — Specification and test methods (ISO 3696:1987)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 482:2006 and EN 1540:1998²⁾ apply.

1) All references to EN 13205 in this European Standard refer to the ongoing revision of EN 13205:2001.

2) EN 1540:1998 is currently subject to revision. Until the revised EN is published the definitions given in EN 482:2006 take precedence.

4 Principle

For measuring procedures that involve sample dissolution, instrumental detection limits are determined by repeat analysis of the calibration blank solution. For all measuring procedures, method detection limits and quantification limits are determined by analysis of laboratory blanks. The determined quantification limits are then assessed against the performance requirements specified in 5.2.1.

Analytical recovery is determined by one of a number of different methods, depending upon the nature of the measuring procedure under evaluation. For measuring procedures for soluble compounds of metals and metalloids, analytical recovery is determined by analysis of spiked laboratory blanks (except for procedures that incorporate a design-based sample dissolution method (see A.1.1), for which it is taken to be 100 %). For measuring procedures for total metals and metalloids that involve sample dissolution, analytical recovery is determined by analysis of pure compounds, reference materials or reference air samples. For measuring procedures for total metals and metalloids that involve analysis of the sample on the collection substrate, analytical recovery is determined by analysis of reference air samples, by the analysis of workplace air samples that are characterised by subsequent analysis using a reference procedure or it is estimated from theory. The determined analytical recovery is then assessed against the performance requirements specified in 5.2.2.

Measurement uncertainty is estimated using a structured approach. Firstly, a cause and effect diagram is constructed to identify individual random and non-random uncertainty components of a measuring procedure. After simplification to resolve any duplication, the resulting diagram is used to identify components for which uncertainty estimates are required. Each of these uncertainty components is then estimated or calculated from experimental data, combined to obtain an estimate of the uncertainty of the measurement method as a whole and multiplied by an appropriate coverage factor to calculate the expanded uncertainty of the method, following the guidance in Annex B. In accordance with 5.2.3, the determined expanded uncertainty is then assessed against the general performance requirements specified in EN 482.

5 Requirements

5.1 Method description

5.1.1 Scope

The scope of the measuring procedure shall give at least information about the following:

- the metals and metalloids covered by the measuring procedure;
- the analytical technique(s) used in the measuring procedure;
- the range of concentrations of metals and metalloids in air for which the measuring procedure has been shown to meet the acceptance criteria for expanded uncertainty prescribed in EN 482, together with the associated range of sampled air volumes (e.g. 0,01 mg · m⁻³ to 0,5 mg · m⁻³ for sampled air volumes in the range 240 l to 960 l);
- any form of the metals and metalloids for which the sample preparation method described has been shown to be or is known to be ineffective; and
- any known interferences.

NOTE If there is no procedure for measuring a particular metal or metalloid that meets the requirements of this European Standard, a measuring procedure whose performance is nearest to the specified requirements should be used.

5.1.2 Method performance

For all metals and metalloids included in the scope of the method, the measuring procedure shall give comprehensive information about method performance, including the following:

- the detection and quantification limits of the measuring procedure;
- the analytical recovery for all test materials for which the sample preparation method has been shown to be effective;
- all random and non-random uncertainty components of the measuring procedure, together with their estimated or experimentally determined values, and the resulting expanded uncertainty; and
- full details of any known interferences, including suitable and sufficient information on how to minimise their effects, if applicable.

5.1.3 Safety information

The measuring procedure shall provide suitable and sufficient information on the safety hazards associated with the reagents and equipment used in the procedure.

5.1.4 Samplers

The measuring procedure shall:

- require the user to select samplers that are designed to collect an appropriate fraction of airborne particles, as defined in EN 481, according to the particle size fraction(s) that is applicable to the limit value for the metals and metalloids of interest (e.g. an inhalable sampler, a thoracic sampler or a respirable sampler);
- specify that the samplers shall comply with the provisions of EN 13205; and
- require, if appropriate, for procedures that do not involve sample dissolution, calibration of the analytical instrument used to be sampler specific, e.g. for X-ray fluorescence spectrometry (XRF).

5.1.5 Sampling pumps

The measuring procedure shall require the user to use sampling pumps that comply with the provisions of EN 1232 or EN 12919.

5.1.6 Other requirements

Where necessary, the measuring procedure shall give other requirements, e.g. for the collection substrate.

5.2 Performance requirements

5.2.1 Quantification limit

For each metal and metalloid included in the scope of the measuring procedure, determine the lower limit of the working range of the method that will be satisfactory for the intended measurement task. For example, if the measurement task is testing compliance with long-term limit values, use Equation (1) to calculate the least amount of the metal or metalloid that needs to be quantified when it is to be determined at a concentration of 0,1 times its limit value:

$$m_L = 0,1 \cdot C_{LV} \cdot q_{v,a} \cdot t_{s,min} \tag{1}$$