INTERNATIONAL STANDARD

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Workplace air — Determination of metals and metalloids in airborne particulate matter by inductively coupled plasma atomic emission spectrometry —

Part 2: Sample preparation

Air des lieux de travail — Détermination des métaux et métalloïdes dans les particules en suspension dans l'air par spectrométrie d'émission atomique avec plasma à couplage inductif —

Partie 2: Préparation des échantillons

Reference number
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 146, *Air quality*, Subcommittee SC 2, *Workplace atmospheres*.

This third edition cancels and replaces the second edition (ISO 15202-2:2012), which has been technically revised. The main changes compared to the previous edition are as follows:

— Definitions that appear in ISO 18158 have been removed from ISO 15202-2, with ISO 18158 being added as a reference (replacing references to EN 1540).

— References to EN 482 have been replaced with ISO 20581, and references to EN 13890 have been replaced with ISO 21832.

— Information regarding digestion of acid-soluble internal capsules has been added to Annexes C, D, E, F, G and H.

— The text has been editorially updated.

A list of all parts in the ISO 15202 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

The health of workers in many industries is at risk through exposure by inhalation of toxic metals and metalloids. Industrial hygienists and other public health professionals need to determine the effectiveness of measures taken to control workers' exposure, and this is generally achieved by making workplace air measurements. This document has been published in order to make available a method for making valid exposure measurements for a wide range of metals and metalloids in use in industry. It will be of benefit to agencies concerned with health and safety at work, industrial hygienists and other public health professionals, analytical laboratories, industrial users of metals and metalloids and their workers.

ISO 15202, published in three parts, specifies a generic method for the determination of the mass concentration of metals and metalloids in workplace air using inductively coupled plasma atomic emission spectrometry (ICP-AES).

— ISO 15202-1 gives details of relevant International, European and National Standards which specify characteristics, performance requirements and test methods relating to sampling equipment. It also augments guidance provided elsewhere on assessment strategy and measurement strategy, as well as specifying a method for collecting samples of airborne particulate matter for subsequent chemical analysis.

— ISO 15202-2 describes a number of procedures for preparing sample solutions for analysis by ICP-AES.

— ISO 15202-3 gives requirements and test methods for the analysis of sample solutions by ICP-AES.

The sample preparation methods described in this part of ISO 15202 are generally suitable for use with analytical techniques other than ICP-AES; e.g. atomic absorption spectroscopy (AAS) and inductively coupled plasma mass spectrometry (ICP-MS).

It has been assumed in the drafting of this document that the execution of its provisions and the interpretation of the results obtained are entrusted to appropriately qualified and experienced people.

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Workplace air — Determination of metals and metalloids in airborne particulate matter by inductively coupled plasma atomic emission spectrometry —

Part 2: Sample preparation

WARNING — The use of this document may involve hazardous materials, operations and equipment. This document does not purport to address any safety problems associated with its use. It is the responsibility of the user of this document to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

1 Scope

This document specifies a number of suitable methods for preparing test solutions from samples of airborne particulate matter collected using the method specified in ISO 15202-1, for subsequent determination of metals and metalloids by ICP-AES using the method specified in ISO 15202-3. It contains information about the applicability of the methods with respect to the measurement of metals and metalloids for which limit values have been set. The methods can also be used in the measurement of some metals and metalloids for which limit values have not been set but no information about its applicability is provided in this case.

NOTE The sample preparation methods described in this document are generally suitable for use with analytical techniques other than ICP-AES, e.g. atomic absorption spectrometry (AAS) by ISO 8518[5] and ISO 11174[10] and inductively coupled plasma mass spectrometry (ICP-MS) by ISO 30011[11].

The method specified in Annex B is applicable when making measurements for comparison with limit values for soluble metal or metalloid compounds.

One or more of the sample dissolution methods specified in Annexes C through H are applicable when making measurements for comparison with limit values for total metals and metalloids and their compounds. Information on the applicability of individual methods is given in the scope of the annex in which the method is specified.

The following is a non-exclusive list of metals and metalloids for which limit values have been set (see References [14] and [15]) and for which one or more of the sample dissolution methods specified in this document are applicable. However, there is no information available on the effectiveness of any of the specified sample dissolution methods for those elements in italics.

Aluminium	Calcium	Magnesium	Selenium	Tungsten
Antimony	Chromium	Manganese	Silver	*Uranium*
Arsenic	Cobalt	Mercury	Sodium	Vanadium
Barium	Copper	Molybdenum	Strontium	Yttrium
Beryllium	*Hafnium*	Nickel	*Tantalum*	Zinc
Bismuth	*Indium*	Phosphorus	Tellurium	Zirconium

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Boron	Iron	*Platinum*	Thallium
Caesium	Lead	Potassium	Tin
Cadmium	Lithium	*Rhodium*	Titanium

ISO 15202 is not applicable to the determination of elemental mercury or arsenic trioxide, since mercury vapour and arsenic trioxide vapour are not collected using the sampling method specified in ISO 15202-1.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

ISO 15202-1, *Workplace air — Determination of metals and metalloids in airborne particulate matter by inductively coupled plasma atomic emission spectrometry — Part 1: Sampling*

ISO 15202-3, *Workplace air — Determination of metals and metalloids in airborne particulate matter by inductively coupled plasma atomic emission spectrometry — Part 3: Analysis*

ISO 18158, *Workplace air — Terminology*

ISO 21832, *Workplace air — Metals and metalloids in airborne particles — Requirements for evaluation of measuring procedures*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 18158 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org

3.1
sample dissolution
process of obtaining a solution containing all analytes of interest from a sample, which might or might not involve complete dissolution of the sample

3.2
sample solution
solution prepared from a sample by the process of *sample dissolution* (3.1)

Note 1 to entry: A sample solution might need to be subjected to further operations, e.g. dilution, or addition, or both, of an internal standard(s), in order to produce a *test solution* (3.3).

SOURCE: Adapted from EN 14902:2005, 3.1.22.

3.3
test solution
blank solution or *sample solution* (3.2) that has been subjected to all operations required to bring it into a state in which it is ready for analysis

Note 1 to entry: "Ready for analysis" includes any required dilution or addition, or both, of an internal standard. If a blank solution or *sample solution* (3.2) is not subject to any further operations before analysis, it is a test solution.

SOURCE: EN 14902:2005, 3.1.30.

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