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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*



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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 15202-2 was prepared by Technical Committee ISO/TC 146, *Air quality*, Subcommittee SC 2, *Workplace atmospheres*.

This second edition cancels and replaces the first edition (ISO 15202-2:2001), which has been technically revised. The major changes in the second edition are as follows.

- Definitions have been updated.
- In Annex B, use of ammonium citrate leach solution has been eliminated.
- A new Annex H has been added to provide a method for sample dissolution using a 95 °C hot block dissolution system. The original Annex H is now Annex I.
- A new Annex J has been added to provide guidance regarding sampler wall deposits.

Annexes B through I form a normative part of this document. Annex A and Annex J are for information only.

ISO 15202 consists of the following parts, under the general title *Workplace air — Determination of metals and metalloids in airborne particulate matter by inductively coupled plasma atomic emission spectrometry*:

- *Part 1: Sampling*
- *Part 2: Sample preparation*
- *Part 3: Analysis*

## 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 part of ISO 15202 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 (i.e. this part) 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 part of ISO 15202 that the execution of its provisions and the interpretation of the results obtained are entrusted to appropriately qualified and experienced people.



# 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 part of ISO 15202 may involve hazardous materials, operations and equipment. This part of ISO 15202 does not purport to address any safety problems associated with its use. It is the responsibility of the user of this part of ISO 15202 to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

### 1 Scope

**1.1** This part of ISO 15202 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 part of ISO 15202 are generally suitable for use with analytical techniques other than ICP-AES, e.g. atomic absorption spectrometry (AAS) by ISO 8518<sup>[5]</sup> and ISO 11174<sup>[10]</sup> and inductively coupled plasma mass spectrometry (ICP-MS) by ISO 30011<sup>[11]</sup>.

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

**1.3** 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.

**1.4** The following is a non-exclusive list of metals and metalloids for which limit values have been set (see References [15] and [16]) and for which one or more of the sample dissolution methods specified in this part of ISO 15202 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	<i>Uranium</i>
Arsenic	Cobalt	Mercury	Sodium	Vanadium
Barium	Copper	Molybdenum	Strontium	Yttrium
Beryllium	<i>Hafnium</i>	Nickel	<i>Tantalum</i>	Zinc
Bismuth	<i>Indium</i>	Phosphorus	Tellurium	Zirconium
Boron	Iron	<i>Platinum</i>	Thallium	
Caesium	Lead	Potassium	Tin	
Cadmium	Lithium	<i>Rhodium</i>	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 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.

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*

EN 13890, *Workplace exposure — Procedures for measuring metals and metalloids in airborne particles — Requirements and test methods*

## 3 Terms and definitions

For the purposes of this part of ISO 15202, the following terms and definitions apply.

**3.1 analysis**  
all operations carried out after sample preparation to determine the amount or concentration of the analyte(s) of interest present in the sample

NOTE Adapted from EN 14902:2005<sup>[14]</sup>, 3.1.1.

**3.2 analytical recovery**  
ratio of the mass of analyte measured in a sample to the known mass of analyte in that sample

NOTE The analytical recovery is usually given as a percentage.

[EN 1540:2011<sup>[13]</sup>]