
**Workplace air — Determination of
mercury vapour — Method using gold-
amalgam collection and analysis by
atomic absorption spectrometry or atomic
fluorescence spectrometry**

*Air des lieux de travail — Détermination de la vapeur de mercure —
Méthode combinant un prélèvement par amalgamation à l'or et une
détection par spectrométrie d'absorption atomique ou par spectrométrie
de fluorescence atomique*



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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 20552 was prepared by Technical Committee ISO/TC 146, *Air quality*, Subcommittee SC 2, *Workplace atmospheres*.

Introduction

The health of workers in many industries is at risk through exposure by inhalation of mercury and inorganic mercury compounds. 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 International Standard has been published in order to make available a method for making measurements of mercury vapour in the workplace environment, i.e. by static sampling. It is also of use for making short-term personal exposure measurements. The standard 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 mercury and inorganic mercury compounds and their workers, etc.

The procedure described in this International Standard is based upon several published papers ^{[1][2][3][4][5][6]} that describe methodology for the determination of mercury vapour in air. This procedure has been fully validated and the resulting back-up data are presented in this standard.

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

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Workplace air — Determination of mercury vapour — Method using gold-amalgam collection and analysis by atomic absorption spectrometry or atomic fluorescence spectrometry

1 Scope

This International Standard specifies a procedure for determination of the mass concentration of mercury vapour in workplace air using a method of gold-amalgam collection with analysis by either cold vapour atomic absorption spectrometry (CVAAS) or cold vapour atomic fluorescence spectrometry (CVAFS).

The procedure specifies a number of sampling methods for different applications.

- When it is known that no particulate inorganic mercury compounds are used in the workplace and that none are produced in the processes carried out, samples of mercury vapour are collected using a pumped sorbent tube containing porous gold-coated diatomaceous earth. Suitable sorbent tubes are commercially available or they can be made from sorbent prepared by pyro-decomposition of chloroauric acid [hydrogen tetrachloroaurate(III)] sintered on diatomaceous earth.
- When both mercury vapour and particulate inorganic mercury compounds could be present in the test atmosphere, samples of mercury vapour are collected using a pumped sorbent tube fitted with a quartz fibre prefilter to remove particulate inorganic mercury compounds. If desired, the procedure described in ISO 17733 can be used to collect and analyse separate samples for measurement of particulate inorganic mercury compounds.
- When it is known that no elemental mercury is used in the workplace and that no mercury vapour is produced in the processes carried out, the procedure described in ISO 17733 can be used, if desired, to collect and analyse samples for measurement of particulate inorganic mercury compounds.

The procedure is highly sensitive and suitable for static sampling or for determination of short-term personal exposure to mercury vapour in workplace air. The lower limit of the working range of the procedure is governed by the lower limit of the analytical range of the CVAAS or CVAFS instrument, which is approximately 0,01 ng of mercury for a sorbent tube containing 80 mg of sorbent (see 13.1). The upper limit of the working range of the procedure is governed by the upper limit of the analytical range of the CVAAS or CVAFS instrument, e.g. about 1 µg of mercury (see 13.2). The sampling capacity of one commercially available sorbent tube has been shown to be greater than 2 µg. The concentration ranges of mercury in air for which the procedure is applicable are determined in part by the sampling method selected by the user.

The procedure is suitable for making short-term measurements (e.g. 15 min) when sampling at a flow rate of between 100 ml min⁻¹ and 1 000 ml min⁻¹ using a commercially available sorbent tube. For assessment of long-term exposure, such as 8 h, this procedure can be used with sampling flow rate of 100 ml min⁻¹ in workplaces where the concentration of mercury vapour is expected to be lower than 20 µg m⁻³. If the expected concentration of mercury vapour is higher than 20 µg m⁻³, it is necessary to use the procedure prescribed in ISO 17733.

The method is unsuitable for making measurements of mercury vapour in air when chlorine is present in the atmosphere, e.g. in chloralkali works (see 13.8.1). Gaseous organo-mercury compounds can cause a positive interference (see 13.8.2).

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 17733, *Workplace air — Determination of mercury and inorganic mercury compounds — Method by cold-vapour atomic absorption spectrometry or atomic fluorescence spectrometry*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 General definitions

3.1.1

chemical agent

any chemical element or compound, on its own or admixed as it occurs in the natural state or as produced by any work activity, whether or not produced intentionally and whether or not placed on the market

[EN 1540:1998] ^[7]

3.1.2

breathing zone

(general definition) space around the worker's face from where he or she takes his or her breath

3.1.3

breathing zone

(technical definition) hemisphere (generally accepted to be 0.3 m in radius) extending in front of the human face, centred on the mid-point of a line joining the ears; the base of the hemisphere is a plane through this line, the top of the head and the larynx

NOTE 1 The definition is not applicable when respiratory protective equipment is used.

NOTE 2 Adapted from EN 1540 ^[7].

3.1.4

exposure (by inhalation)

situation in which a chemical agent is present in air, which is inhaled by a person

3.1.5

measuring procedure

procedure for sampling and analysing one or more chemical agents in the air, and including storage and transportation of the sample

3.1.6

operating time

period during which a sampling pump can be operated at specified flow rate and back pressure without recharging or replacing the battery

[EN 1232:1997] ^[8]

3.1.7

limit value

reference figure for concentration of a chemical agent in air

NOTE An example is the Threshold Limit Value[®] (TLV) for a given substance in workplace air, as established by the ACGIH ^[9]. (Threshold Limit Value[®] is an example of a suitable product available commercially. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by ISO of this product.)