



Designation: D8502 – 25

Standard Guide for Field Collection of Airborne Particulate Samples for Subsequent Determination of Lead Content¹

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1. Scope

1.1 This guide covers the collection of airborne particulates using personal air samplers during activities potentially resulting in the exposure of workers to lead. It may also be used for collection of airborne particulate samples in areas of workplaces.

1.2 This guide is used to collect samples for determination of lead on a mass per unit volume basis (milligrams of lead per cubic meter of air sampled).

1.3 There are various processes that can be used for the collection of samples and this guide describes two. All processes require adherence to specific procedures in order to produce valid results.

NOTE 1—The processes described will provide equivalent results in some, but not all situations, and it is incumbent on the user of this guide to ascertain which process is the most appropriate for a given situation; guidance is provided to assist in the selection.

1.4 This guide does not address sampling design criteria such as included in a sampling plan where the number of samples collected and location of sampling is stated in support of exposure assessment for management of health risks.

1.5 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.7 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

¹ This guide is under the jurisdiction of ASTM Committee D22 on Air Quality and is the direct responsibility of Subcommittee D22.12 on Sampling and Analysis of Lead for Exposure and Risk Assessment.

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2. Referenced Documents

2.1 ASTM Standards:²

- D1356 Terminology Relating to Sampling and Analysis of Atmospheres
- D1357 Practice for Planning the Sampling of the Ambient Atmosphere
- D4185 Test Method for Measurement of Metals in Workplace Atmospheres by Flame Atomic Absorption Spectrophotometry
- D5337 Practice for Setting and Verifying the Flow Rate of Personal Sampling Pumps
- D6785 Test Method for Determination of Lead in Workplace Air Using Flame or Graphite Furnace Atomic Absorption Spectrometry
- D7035 Test Method for Determination of Metals and Metalloids in Airborne Particulate Matter by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES)
- D8358 Guide for Assessment and Inclusion of Wall Deposits in the Analysis of Single-Stage Samplers for Airborne Particulate Matter
- E1583 Practice for Evaluating Laboratories Engaged in Determination of Lead in Paint, Dust, Airborne Particulates, and Soil Taken From and Around Buildings and Related Structures
- E1605 Terminology Relating to Lead in Buildings
- E1741 Practice for Preparation of Airborne Particulate Lead Samples Collected During Abatement and Construction Activities for Subsequent Analysis by Atomic Spectrometry (Withdrawn 2009)³
- E1979 Practice for Ultrasonic Extraction of Paint, Dust, Soil, and Air Samples for Subsequent Determination of Lead
- E2239 Practice for Record Keeping and Record Preservation for Lead Hazard Activities

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at www.astm.org/contact. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ The last approved version of this historical standard is referenced on www.astm.org.

2.2 Governmental Agency Guidance:⁴

NIOSH 0501 PARTICULATES NOT OTHERWISE REGULATED, TOTAL

NIOSH 7082 LEAD by Flame AAS

NIOSH 7105 LEAD by GFAAS

NIOSH 7300 ELEMENTS by ICP (Nitric/Perchloric Acid Ashing)

NIOSH 7301 ELEMENTS by ICP (Aqua Regia Ashing)

NIOSH 7303 ELEMENTS by ICP (Hot Block/HCl/HNO₃ Digestion)

NIOSH 7306 ELEMENTS by Cellulosic Internal Capsule Sampler

NIOSH 7701 LEAD by PORTABLE ULTRASONIC EXTRACTION/ASV

2.3 ISO Standards:⁵

ISO 7708 Air Quality – Particle size fraction definitions for health-related sampling

ISO 8518 Workplace air — Determination of particulate lead and lead compounds — Flame and electrothermal atomic absorption spectrometric methods

ISO 15202 Determination of metals and metalloids in airborne particulate matter by inductively coupled plasma atomic emission spectrometry: Part 1 Sampling, Part 2 Sample preparation, and Part 3 Analysis

ISO/IEC 17025 General requirements for the competence of testing and calibration laboratories

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

ISO 30011 Workplace air — Determination of metals and metalloids in airborne particulate matter by inductively coupled plasma mass spectrometry

3. Terminology

3.1 For definitions of terms used in this guide, refer to Terminologies **D1356** and **E1605**.

3.2 Definitions:

3.2.1 *capsule, n*—a filter including a cowl or similar product manufactured as a single item, for single-use only and placed in other assemblies as part of a sampler.

4. Summary

4.1 An airborne particulate sample is collected using a sampler connected to a pump via tubing that is flexible, but not easily compressed. The collected sample is submitted for lead determination to a laboratory accredited to Practice **E1583** or ISO/IEC 17025, or both, by a recognized accrediting body for analysis to determine lead mass or concentration.

5. Significance and Use

5.1 The procedures in this guide are based on NIOSH 7082, 7105, 7701, 7300, 7301, 7303, and 7306, and use an internal

sampling cartridge (sampler insert) for determination of lead in airborne particulate samples. Use of this guide assures that sample analysis results meet Guide **D8358**, NIOSH recommendations, and OSHA requirements for consideration of sampler wall deposits in airborne particulate samples.

5.2 This guide may be used for personal and area collection of airborne particulate samples for determination of lead content.

6. Selection of the Sampling Method

6.1 *Sampling*—For general information on sampling, refer to Practice **D1357**. For more specific information, refer to ISO 21832. Samples of airborne particulate (aerosol) are collected by samplers, arranged in the breathing zone of a worker. Samplers consist of a filter housed in a body, through which air is drawn by means of a small vacuum pump. Area samples of airborne particulates may be collected using the same sampling arrangement except that the sampler is placed within the work area of interest at the approximate height of a worker's breathing zone. There are several factors which can influence aerosol sampling; for further information see Baron (2016) **(1)**.⁶

6.2 *Sampling Convention*—In order to compare sample results between workers, or to a standard concentration, samplers should meet a performance standard. In earlier times, it was thought that samplers collected Total Particulate Matter (TPM) but it was later found that not all samplers have the same sampling efficiency. A more recent convention known as Inhalable Particulate Mass (IPM) has been designed as a performance standard for samplers to meet when attempting to mimic the inhalation of particles by a worker. TPM samplers do not necessarily meet the criteria for an IPM sampler. More information on this subject is given in **Appendix X1**. In many jurisdictions around the world, use of IPM samplers is required to compare airborne concentrations of lead to occupational exposure limit values couched as IPM concentrations. While American Conference of Governmental Industrial Hygienists (ACGIH®) Threshold Limit Values (TLV®s)⁷ are couched in terms of IPM for many other metals (for example, metallic Ni, Cr, Co, Mn, Sn, Be, Mo, Tl, and many compounds of these metals), lead is not included in this list at the present time. The U.S. Occupational Safety and Health Administration (OSHA) and National Institute for Occupational Safety and Health (NIOSH) do not require sampling of lead with an IPM sampler.

7. Process

7.1 Area samples can be collected with suitable air sampling equipment (see for example, Test Method **D7035**).

7.2 *Personal Sampling with a 37 mm Closed-face Cassette (CFC) and Internal Capsule (see Appendix X1)*—Details on sampling can be found in Test Method **D7035**.

7.2.1 *Sampler Assembly*—Air samples should be collected in a capsule, which consists of a 0.8 µm cellulose ester

⁴ Available from U.S. Dept. of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health (NIOSH), 400 7th Street S.W., Suite 5W, Washington, D.C. 20024 <https://www.cdc.gov/niosh/nmam/default.html>.

⁵ Available from American National Standards Institute (ANSI), 1180 Avenue of the Americas, 10th Floor, New York, NY 10036, <http://www.ansi.org>.

⁶ The boldface numbers in parentheses refer to a list of references at the end of this standard.

⁷ ACGIH and TLV are trademarks of American Conference of Governmental Industrial Hygienists (ACGIH).