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Standard Guide for Strategies for Surface Sampling of Metals and Metalloids for Worker Protection¹

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1. Scope

1.1 This guide provides criteria to be used in defining strategies for sampling for metals and metalloids on surfaces for workplace health and safety monitoring or evaluation.

1.2 Guidance provided by this standard is intended for sampling of metals and metalloids on surfaces for subsequent analysis using methods such as atomic spectrometry, mass spectrometry, X-ray fluorescence, or molecular fluorescence. Guidance for evaluation of data after sample analysis is included.

1.3 Sampling for volatile organometallic species (for example, trimethyl tin) is not within the scope of this guide.

1.4 Sampling to determine levels of metals or metalloids on the skin is not within the scope of this guide.

1.5 Sampling for airborne particulate matter is not within the scope of this guide. Guide E1370 provides information on air sampling strategies.

1.6 Where surface sampling is prescribed by law or regulation, this guide is not intended to take the place of any requirements that may be specified in such law or regulation.

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

1.8 *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.*

1.9 *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 D22.04 on Workplace Air Quality.

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2. Referenced Documents

2.1 ASTM Standards:²

- D1356 Terminology Relating to Sampling and Analysis of Atmospheres
- D3670 Guide for Determination of Precision and Bias of Methods of Committee D22
- D5438 Practice for Collection of Floor Dust for Chemical Analysis
- D6399 Guide for Selecting Instruments and Methods for Measuring Air Quality in Aircraft Cabins
- D6620 Practice for Asbestos Detection Limit Based on Counts
- D6966 Practice for Collection of Settled Dust Samples Using Wipe Sampling Methods for Subsequent Determination of Metals
- D7035 Test Method for Determination of Metals and Metalloids in Airborne Particulate Matter by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES)
- D7144 Practice for Collection of Surface Dust by Microvacuum Sampling for Subsequent Determination of Metals and Metalloids
- D7202 Test Method for Determination of Beryllium in the Workplace by Extraction and Optical Fluorescence Detection
- D7296 Practice for Collection of Settled Dust Samples Using Dry Wipe Sampling Methods for Subsequent Determination of Beryllium and Compounds
- D7439 Test Method for Determination of Elements in Airborne Particulate Matter by Inductively Coupled Plasma–Mass Spectrometry
- D7440 Practice for Characterizing Uncertainty in Air Quality Measurements
- D7822 Practice for Dermal Wipe Sampling for the Subsequent Determination of Metals and Metalloids
- E1216 Practice for Sampling for Particulate Contamination by Tape Lift

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

E1370 Guide for Air Sampling Strategies for Worker and Workplace Protection

E1402 Guide for Sampling Design

E1542 Terminology Relating to Occupational Health and Safety

E1613 Test Method for Determination of Lead by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES), Flame Atomic Absorption Spectrometry (FAAS), or Graphite Furnace Atomic Absorption Spectrometry (GFAAS) Techniques (Withdrawn 2021)³

E1728/E1728M Practice for Collection of Settled Dust Samples Using Wipe Sampling Methods for Subsequent Lead Determination

E1792 Specification for Wipe Sampling Materials for Lead in Surface Dust

E2271 Practice for Clearance Examinations Following Lead Hazard Reduction Activities in Multifamily Dwellings

E3193 Test Method for Measurement of Lead (Pb) in Dust by Wipe, Paint, and Soil by Flame Atomic Absorption Spectrophotometry (FAAS)

E3203 Test Method for Determination of Lead in Dried Paint, Soil, and Wipe Samples by Inductively Coupled Plasma-Optical Emission Spectroscopy (ICP-OES)

2.2 ISO and European Standards:⁴

ISO TR 14294 Workplace atmospheres — Measurement of dermal exposure — Principles and methods

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

ISO 18158 Workplace air — Terminology

2.3 Other Documents:

40 CFR 745 Lead-Based Paint Poisoning Prevention in Certain Residential Structures⁵

3. Terminology

3.1 For definitions of terms relating to occupational health and safety, see Terminology **E1542**.

3.2 For definitions of terms relating to sampling and analysis of atmospheres, see Terminology **D1356**.

3.3 Definitions:

3.3.1 *analyte*—designated chemical species to be measured by a monitor or to be identified and quantified by an analyzer. **D6399**

3.3.2 *analytical sensitivity*—ability of an analytical method to detect small amounts of, or small changes in the amount of, the analyte of interest. **(1)**⁶

3.3.3 *analytical specificity*—ability of an analytical method to respond uniquely to the analyte of interest; that is, its ability

to measure accurately an analyte, both qualitatively and quantitatively. **(1)**

3.3.3.1 *Discussion*—Important factors in determining analytical specificity include freedom from interference by other components, and good precision and accuracy.

3.3.4 *confidence interval*—range of values that has a specified probability of including the true value of the parameter(s) of an underlying distribution. **(2)**

3.3.5 *data quality objectives (DQOs)*—qualitative and quantitative statements of the overall level of uncertainty that a decision maker is willing to accept in results or decisions derived from environmental data. **D6399**

3.3.5.1 *Discussion*—Minimum DQOs include method detection limit, precision, and bias.

3.3.6 *decision value*—a numerical value used as a boundary in a statistical test to decide between the null hypothesis and the alternative hypothesis. **D6620**

3.3.7 *descriptive statistics*—simple metrics of a sample distribution's characteristics such as central tendency (for example, mean, median) and dispersion (for example, standard deviation, variance, range). **(2)**

3.3.7.1 *Discussion*—Additional examples are the number of samples and the actual fraction of samples above a decision value or an OELV.

3.3.8 *inferential statistics*—parameters used to make estimates about a distribution and underlying population. **(2)**

3.3.9 *occupational exposure limit value (OELV)*—limit of the time-weighted average of the concentration of a chemical agent in the air within the breathing zone of a worker in relation to a specified reference period. **ISO 18158**

3.3.9.1 *Discussion*—The term “limit value” is often used as a synonym for “occupational exposure limit value” but the term “occupational exposure limit value” is preferred because there is more than one limit value (for example, biological limit value and occupational exposure limit value).

3.3.9.2 *Discussion*—As used in this guide, examples of OELVs include occupational exposure limits established by regulation, or Threshold Limit Values established by the American Conference of Governmental Industrial Hygienists **(3)**. This should not be confused with analytical limits, such as method detection limit, as defined in Terminology **D1356**.

3.3.10 *non-parametric statistical inference*—evaluation of a data set using statistical procedures whose validity do not depend on assuming a specified underlying distribution.

3.3.11 *parametric statistical inference*—evaluation of a data set based on assuming a specified underlying statistical model, such as normal or lognormal distributions.

3.3.12 *professional judgment*—application and appropriate use of knowledge gained from formal education, experience, experimentation, inference, and analogy. The capacity of an experienced professional to draw correct inferences from incomplete quantitative data, frequently on the basis of observations, analogy, and intuition. **(2)**

3.3.13 *reporting limit*—value at which reported data are censored.

3.3.13.1 *Discussion*—Values below the reporting limit are

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

⁴ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

⁵ Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401, <http://www.access.gpo.gov>.

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