Designation: D8358 – 25

Standard Guide for Assessment and Inclusion of Wall Deposits in the Analysis of Single-Stage Samplers for Airborne Particulate Matter[1]

This standard is issued under the fixed designation D8358; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 Many methods for sampling airborne particulate matter entail aerosol collection on a substrate (typically a filter) housed within a container (or holder), the whole apparatus being referred to as an aerosol sampler. In operation, the sampler allows a vacuum (pressure below ambient or room air pressure) to be applied to the rear of the substrate so that sampled air will pass through the substrate, leaving collected particles on the substrate for subsequent analysis. The sampler may also protect the substrate, while the opening (orifice) of the container may further play some role in determining what size range(s) of particles approach the collection substrate (size-selective sampling).

1.2 All particles entering the container orifice are considered part of the sample, unless stated otherwise in the method, but not all particles are necessarily found on the substrate after sampling (**1**).[2] Particles may be deposited on the inner walls of the sampler during sampling or may be deposited on the inside walls of the sampler or on the orifice plug or cap following transportation (**2**). These particles are often loosely referred to as wall deposits. This guide presents background on the importance of these wall deposits and offers procedures by which these deposits can be assessed and included in the sample.

1.3 Wall deposits may also occur in multi-stage samplers (for example, cascade impactors), but this guide does not cover such samplers.

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

1.5 *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.*

1.6 *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.*

2. Referenced Documents

2.1 *ASTM Standards:*[3]

D1356 Terminology Relating to Sampling and Analysis of Atmospheres

D4185 Test Method for Measurement of Metals in Workplace Atmospheres by Flame Atomic Absorption Spectrophotometry

D4532 Test Method for Respirable Dust in Workplace Atmospheres Using Cyclone Samplers

D6061 Practice for Evaluating the Performance of Respirable Aerosol Samplers

D6062 Guide for Personal Samplers of Health-Related Aerosol Fractions

D6552 Practice for Controlling and Characterizing Errors in Weighing Collected Aerosols

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)

D7439 Test Method for Determination of Elements in Airborne Particulate Matter by Inductively Coupled Plasma–Mass Spectrometry

D7948 Test Method for Measurement of Respirable Crystalline Silica in Workplace Air by Infrared Spectrometry

NOTE 1—Other standards under the jurisdiction of ASTM 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] The boldface numbers in parentheses refer to a list of references at the end of this standard.

[3] 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.

D22 on Air Quality, including standards that are not the direct responsibility of Subcommittee D22.04 on Workplace Air Quality, may also be affected by this guide and should be considered on a case-by-case basis.

2.2 *Other Standards:*

ISO 7708 Air quality — Particle size fraction definitions for health-related sampling[4]

EN 13205 Workplace exposure — Assessment of sampler performance for measurement of airborne particle concentrations (in four parts)[5]

3. Terminology

3.1 *Definitions*—For definitions of terms used in this standard, refer to Terminology D1356.

3.1.1 *wall deposit, n*—particles which have entered the container (holder) of an air sampler but which are found elsewhere than on or in the principal particle collection medium (for example, a filter), including on any internal surfaces of the holder or container, such as O-rings and inlet plugs or covers.

4. Summary of Guide

4.1 Aerosol samplers that are used to collect "total particulate matter" (TPM), as dictated by the aspiration efficiency of the sampler, and samplers that are used to collect "inhalable particulate matter" (IPM), as dictated by the ISO 7708 inhalable particle convention, consist of filters housed in containers (holders). The design of the holder, normally referred to as a sampler, may be optimized so that aspiration follows the ISO 7708 inhalable particle convention. All particles passing through the orifice of these samplers, particularly where the orifice is designed for a specific sampling performance, typically are considered as part of the sample, unless otherwise dictated by the method.

4.2 Samplers that are used to collect the "thoracic" particulate fraction, as defined by ISO 7708, or the "respirable" particulate fraction, as defined by ISO 7708, have a preselector to provide a defined size selection. These samplers may also exhibit wall deposits that could require inclusion for subsequent analysis.

4.3 This guide details procedures that have been used to ensure that all collected particles are assessed in the report of mass collected, or airborne concentrations calculated from the collected mass.

4.4 This guide focuses mainly on samples taken for two types of analysis: gravimetric analysis for Particles Not Otherwise Regulated/Specified/Classified (PNOR/S/C), and acid extraction/digestion for metals analysis. However, the principles of the guide are applicable to samples collected for other analytical procedures, such as inorganic acid mists and organic aerosols.

4.5 Three main methods and some variants for assessing wall deposits are discussed in this guide. The selection of methods is dictated by the ability of the method to meet data quality objectives. Recovery must be validated as being sufficiently efficient and reproducible to meet the expanded uncertainty requirements of the overall sampling and analytical method. In the absence of a published standard method it is the responsibility of those collecting samples and the analytical laboratory to review the validation data and assess the fitness-for-purpose of the procedure.

5. Significance and Use

5.1 The following is a non-exclusive list of standards to which this guide applies: Guide D6062; Test Methods D4185, D4532, D6785, D7035, D7439, D7948; and Practices D6061 and D6552.

5.2 The applicability of this guide to other standards under the jurisdiction of ASTM Committee D22, but not the direct responsibility of Subcommittee D22.04, should be considered where analyte entry into the sampler is considered the sample and where analyte adherence to internal sampler surfaces ("walls") is likely to scavenge analyte from the collection substrate.

5.3 Aerosol samplers typically consist of a filter or other collection substrate, for example an impaction plate or foam, supported in a container or holder. The entire device typically is considered an aerosol sampler. The sampling efficiency of the aerosol sampler, that is, the ratio of the concentration collected by the collection substrate to the undisturbed concentration in the air, has three components: (*1*) aspiration (or entry) efficiency; (*2*) transport efficiency (depending on design, both from entry "plane" to internal separator and from any internal separator to collection substrate); and (*3*) penetration (through the internal separator). For a sampler of a specific design, the three efficiency components are functions of particle (aerodynamic) size and flow rate. The aspiration efficiency also depends on wind speed and direction, while the sampler's angle to the vertical influences both the aspiration efficiency and the transport efficiency. Ideally, when a sampler is designed and tested for its sampling performance, or both, it should first be established what is considered as the collected sample (that is, the deposit on the collection substrate, but also any deposits on any internal surfaces if these are to be analysed).

5.4 Part of the aerosol entering a sampler will deposit on the internal surfaces of the sampler prior to reaching the collection substrate. There are number of mechanisms by which this can occur, including bounce from the filter, inertial impaction, gravitational settling and electrostatic attraction after entry. In addition, after sample collection, if the collection substrate is transported while mounted in the sampler, it is possible that particles originally deposited on the collection substrate may dislodge during transportation. Such particles can thereby contribute to deposits on the walls, as well as on the base of any cover plate or plug. All particles found elsewhere than on or in the collection substrate are often loosely termed "wall deposits." If the sample of interest entails the entire aspirated air particulate into the container or holder (sampler), it is necessary to account for these wall deposits, especially if it cannot be shown that they should be disregarded.

[4] Available from International Organization for Standardization (ISO), ISO Central Secretariat, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, https://www.iso.org.

[5] Available from British Standards Institution (BSI), 389 Chiswick High Rd., London W4 4AL, U.K., http://www.bsigroup.com.