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Standard Specification for Wipe Sampling Materials for Beryllium in Surface Dust[1]

This standard is issued under the fixed designation D7707; 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 This specification covers requirements for premoistened wipe materials that are used to collect settled dusts on surfaces for the subsequent determination of beryllium.

1.2 For wipe materials used for the determination of lead in surface dust, refer to Specification E1792. This is mentioned to insure that users of wipes recognize that there is some relationship between wipes and the analyte of interest.

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

1.4 This specification contains notes that are explanatory and are not part of the mandatory requirements of the specification.

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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D1356 Terminology Relating to Sampling and Analysis of Atmospheres

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)

D7202 Test Method for Determination of Beryllium in the Workplace by Extraction and Optical Fluorescence Detection

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

E105 Practice for Probability Sampling of Materials

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

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

E1792 Specification for Wipe Sampling Materials for Lead in Surface Dust

3. Terminology

3.1 For definitions of pertinent terms not listed here, see Terminology D1356.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *lot, n*—a finite quantity of a given product manufactured under production conditions that are considered uniform.

3.2.2 *standard beryllium test method, n*—as used in this specification, any of the following test methods: D7035, D7202, D7439, the graphite furnace atomic absorption technique in Test Method E1613, or a equivalent test method issued by a national or international consensus standard organization.

3.2.3 *wipe, n*—a disposable towellette that is premoistened with an acceptable agent.

3.2.3.1 *Discussion*—The towellette is used to collect a sample of settled dust on a surface for subsequent beryllium analysis.

4. Significance and Use

4.1 This specification is intended for use by manufacturers and suppliers to evaluate the performance of wipe sampling materials for beryllium in surface dust.

4.2 This specification may also be employed by users of wipes to compare the performance of candidate wipes for the sampling of beryllium in surface dust.

[1] This specification 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] 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.

5. Manufacture

5.1 The wipes shall be made from materials using methods that ensure compliance with the requirements of Sections 6 and 8, and shall be clean and free of imperfections that would affect their performance.

5.2 An expiration date shall be established based on date of manufacture, and shall be marked on each package (see 10.2). The expiration date should not be less than one year from date of manufacture.

6. General Requirements

6.1 Wipes shall conform to the requirements in 6.1.1 – 6.1.8. Test procedures for each requirement are found in Section 8.

6.1.1 *Background Beryllium*—The mean background beryllium content per wipe shall be less than 0.0005 µg.

6.1.2 *Ruggedness*—Wipes shall be sufficiently rugged so as to be capable to be used to wipe a 2000 cm^2 area (large wipes; see 6.1.4.1(*1*)) or 500 cm^2 area (small wipes; see 6.1.4.1(*2*)) of a vinyl or urethane-coated vinyl tile surface without tearing.

6.1.3 *Moisture Content*—Each wipe, when examined, must be fully wetted upon removal from the package or container. Wipes shall have a moisture content such that the coefficient of variation for a random sampling of the lot of wipes be no greater than 25 % across individually packaged wipes, and 25 % within and between multi-packaged wipes.

6.1.4 *Dimensions:*

6.1.4.1 The mean area of the wipe shall be either:

(1) No smaller than 200 cm^2 and no larger than 400 cm^2 with the mean dimension of a side or diameter no smaller than 10 cm or larger than 20 cm (referred to as the "large wipe"); or,

(2) No smaller than 16 cm^2 and no larger than 38 cm^2 with the mean dimension of a side or diameter no smaller than 4.0 cm or larger than 8.0 cm (referred to as the "small wipe").

NOTE 1—Large wipes are intended for use on larger areas (for example, 1000 cm^2). Small wipes are intended for use on smaller areas (for example, 100 cm^2).

6.1.5 *Thickness*—Dry wipes (wipes without the moistening agent) shall have a mean thickness of at least 0.005 cm, but no greater than 0.05 cm (see 8.6).

6.1.6 *Mass*—The coefficient of variation in mass of dry wipes in a lot shall not exceed 10 %.

6.1.7 *Beryllium Recoveries*—The mean beryllium recoveries from wipes spiked with Certified Reference Materials (CRMs) shall be 100 ± 20 % at the 95 % confidence level in accordance with 8.2.

NOTE 2—It is not imperative that the wipe be completely dissolved when digested/extracted in accordance with a standard beryllium test method to meet the recovery criterion. However, the digestion/extraction solution that is to be analyzed should be free of suspended particulates and gelatinous material.

6.1.8 *Collection Efficiency*—Collection efficiency of an individual wipe, using an initial wipe on a given vinyl or urethane-coated vinyl tile test surface, shall be determined using a solid beryllium-containing CRM in accordance with 8.2. The mass of beryllium-containing material (particulate or dust) loaded per surface area to be sampled shall be 0.50 ± 0.05 g for the large wipe and 0.050 ± 0.005 g for the small wipe. The minimum collection efficiency of at least 95 % of the individual wipes shall be 75 %, as measured against the known mass of beryllium loaded on the test surface prior to wiping (1000 cm^2 minimum surface area for the large wipe and 100 cm^2 for the small wipe).

7. Selection and Handling of Wipes for Testing

7.1 Tests described in Section 8 shall be conducted on wipes selected in accordance with the random sampling procedure described in Practice E105, using wipes selected after packaging, and representative of each lot.

7.2 Wipes shall not be removed from their packages until immediately prior to testing.

8. Procedure

8.1 *Background and Recovery*—Recoverability of beryllium from spiked wipes (see 6.1.7) shall be measured in accordance with a standard beryllium test method. Background beryllium in unspiked wipes (see 6.1.1) shall be measured in accordance with the same procedure. A minimum of seven samples per each concentration level (unspiked, 0.020 ± 0.002 µg, 0.10 ± 0.02 µg, 0.20 ± 0.02 µg, 1.5 ± 0.2 µg, 3.0 ± 0.2 µg, and 6.0 ± 0.2 µg) shall be tested (see 6.1.1 and 6.1.7), using wipes randomly selected from each lot in accordance with Practice E105.

8.1.1 Compute the mean and coefficient of variation for each set of samples. See Practice E691 for details regarding statistical computations. Compare with the requirements of 6.1.1 and 6.1.7.

8.2 *Collection Efficiency*—Collection efficiency of beryllium shall be measured in the following manner:

8.2.1 A delineated area of the vinyl or urethane-coated tile test surface (minimum area 1000 cm^2 for large wipes and 100 cm^2 for small wipes as in 6.1.8) is loaded with a known mass (0.50 ± 0.05 g for large wipes and 0.050 ± 0.005 g for small wipes) of CRM particulate or dust (see 6.1.7) and then wiped in accordance with Practice D6966.

8.2.2 An equivalent alternative procedure consists of manually distributing a known amount (mass) of beryllium-containing CRM uniformly onto the vinyl tile test surface of 1000 cm^2 (large wipe) or 100 cm^2 (small wipe) minimum area, and then wiping the applicable surface with the appropriately sized wipe in accordance with Practice D6966.

8.2.3 The collection efficiency is determined by comparing the amount of beryllium collected in the wipe against the total amount of beryllium loaded onto the area of interest on the test surface (in accordance with 8.2.1 or 8.2.2). A minimum of seven wipes, randomly selected from the lot in accordance with Practice E105, shall be tested for each beryllium level.

8.2.4 For the measurement of beryllium content, the wipes shall be digested/extracted and the beryllium content determined in accordance with a standard beryllium test method. Determine the collection efficiency for each wipe and compare with the requirements of 6.1.8.

8.3 *Ruggedness*—Using the procedure described in Practice D6966, wipe the vinyl or urethane-coated vinyl tile test surface (see 6.1.2). Examine the wipe for the presence of tears. Follow

this procedure for a minimum of seven wipes, randomly selected from the lot of wipe material in accordance with Practice E105. If at least 95 % of the wipes tested reveal no tears, then the ruggedness test is deemed successful.

8.4 *Moisture Content*—Moisture content (see 6.1.3) of wipes shall be determined by weighing the wipe before and after quantitative drying (to the nearest 0.01 g), and calculating the difference. A minimum of seven wipes, randomly selected from the lot in accordance with Practice E105, shall be tested. Calculate the coefficient of variation about the mean value for moisture content and compare with requirements of 6.1.3.

8.5 *Dimensions*—Determine the linear dimensions of a minimum of seven individual wipes to the nearest 1 mm and calculate the means and coefficient of variations. Compare with requirements of 6.1.4.

8.6 *Thickness*—Determine the thickness of a minimum of seven individual wipes using a micrometer or other appropriate device to the nearest 0.001 cm. Calculate the mean and coefficient of variation. Compare with requirements of 6.1.5.

8.7 *Mass*—Using the data for dry wipes from 8.4, determine the mass of a minimum of seven individual wipes to the nearest 0.1 mg. Calculate the mean and coefficient of variation. Compare with requirement of 6.1.6.

9. Retesting

9.1 If any of the requirements (6.1.2 – 6.1.8) are not met, then additional full-sets of testing (6.1.2 – 6.1.8) is allowed. All data obtained from testing conducted for conformance to this specification shall be used in determining whether the requirement has been met.

10. Packaging and Package Marking

10.1 Wipes shall be wrapped individually to dispense individual wipes one at a time. Wipes shall be wrapped and packaged according to trade custom.

10.2 Each package or container shall be marked with the supplier's name, date of manufacture, lot number, and expiration date.

10.3 The statement "Meets ASTM D7707 for Large Wipes" or "Meets ASTM D7707 for Small Wipes," as appropriate, shall be marked on individual packaging. Also, on general packaging, it shall be stated that the material "Meets ASTM D7707 for Large Wipes" or "Meets ASTM D7707 for Small Wipes," as appropriate, and that supporting performance data are available upon request.

11. Recordkeeping

11.1 All supporting data from tests conducted for each lot shall be kept by the supplier for a minimum of five (5) years. All test information shall be available for release to users of wipe materials upon request.

12. Keywords

12.1 beryllium; surface dust; wipe