



Designation: ~~D7144 – 05a (Reapproved 2011)~~ D7144 – 05a (Reapproved 2016)

Standard Practice for Collection of Surface Dust by Micro-vacuum Sampling for Subsequent Metals Determination¹

This standard is issued under the fixed designation D7144; 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 practice covers the micro-vacuum collection of surface dust for subsequent determination of metals. The primary intended application is for sampling from soft, rough, or porous surfaces.

1.2 Micro-vacuum sampling is carried out using a collection nozzle attached to a filter holder (sampling cassette) that is connected to an air sampling pump.

1.3 This practice allows for the subsequent determination of metals on a loading basis (mass of metal(s) per unit area sampled), or on a concentration basis (mass of metal(s) per unit mass of sample collected), or both.

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 *Limitations*—Due to a number of physical factors inherent in the micro-vacuum sampling method, analytical results for vacuum dust samples are not likely to reflect the total dust contained within the sampling area prior to sample collection. Indeed, dust collection will generally be biased towards smaller, less dense dust particles. Nevertheless, the use of this standard practice will generate data that are consistent and comparable between operators performing micro-vacuum collection at a variety of sampling locations and sites.²

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

Document Preview

[ASTM D7144-05a\(2016\)](#)

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¹ This practice is under the jurisdiction of ASTM Committee D22 on Air Quality and is the direct responsibility of Subcommittee D22.04 on Workplace Air Quality. Current edition approved March 1, 2011/Oct. 1, 2016. Published March 2011/October 2016. Originally approved in 2005. Last previous edition approved in 2005/2011 as D7144 – 05a/D7144 – 05a (2011). DOI: 10.1520/D7144-05AR11; 10.1520/D7144-05AR16.

² Reynolds, S. J., et al., "Laboratory comparison of vacuum, OSHA, and HUD sampling methods for lead in household dust." *American Industrial Hygiene Association Journal*, Vol. 58, pp. 439–446 (1997); Reynolds, S. J., et al., "Laboratory Comparison of Vacuum, OSHA, and HUD Sampling Methods for Lead in Household Dust," *American Industrial Hygiene Association Journal*, Vol. 58, 1997, pp. 439–446.

2. Referenced Documents

2.1 ASTM Standards:³

[D1356 Terminology Relating to Sampling and Analysis of Atmospheres](#)

[D3195 Practice for Rotameter Calibration](#)

[D4840 Guide for Sample Chain-of-Custody Procedures](#)

[D5438 Practice for Collection of Floor Dust for Chemical Analysis](#)

[D6966 Practice for Collection of Settled Dust Samples Using Wipe Sampling Methods for Subsequent Determination of Metals](#)

2.2 ISO Standard:⁴

[ISO 15202-1 Workplace air—Determination of metals and metalloids in airborne particulate matter by inductively coupled plasma atomic emission spectrometry—Part 1: Sampling](#)

3. Terminology

3.1 *Definitions*—For definitions of terms relating to sampling and analysis of dust not given here, refer to [Terminology D1356](#).

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *air sampling pump*—a portable pump that is used to draw air through a filter holder/collection nozzle assembly for micro-vacuum collection of surface dust. An example would include a personal sampling pump (pump [D1356](#)): [D1356](#)

3.2.2 *batch*—a group of field or quality control samples, or both, that are collected together in a similar environment and are processed together using the same reagents and equipment.

3.2.3 *collection nozzle*—a piece of flexible plastic tubing cut at a 45° angle at the inlet end, and connected at the outlet end to the inlet orifice of a filter holder (sampling cassette).

3.2.4 *field blank*—a sample that is handled in exactly the same way that field samples are collected, except that no air is drawn through it.

3.2.5 *filter holder*—an apparatus that supports and contains the filter medium upon which dust is collected. It is also often referred to as a sampling cassette.

3.2.6 *internal capsule*—a device inserted into a filter holder (sampling cassette) that allows complete capture of contaminant within its envelope and prevents deposition of collected material on the internal walls of the sampling cassette. Use of an internal capsule is necessary for gravimetric analysis purposes.

NOTE 1—Such capsules are commercially available.

³ 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.

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

3.2.6.1 Discussion—

Such capsules are commercially available.

3.2.7 *sampling device (assembly)*—for micro-vacuum sampling, an apparatus consisting of the collection nozzle, filter holder (containing internal capsule, if necessary), and air sampling pump, used to collect surface dust. The collection nozzle is attached to the inlet end of the filter holder. The filter holder houses the filter, through which air is drawn by using the air sampling pump. The filter holder is attached to the pump by flexible tubing.

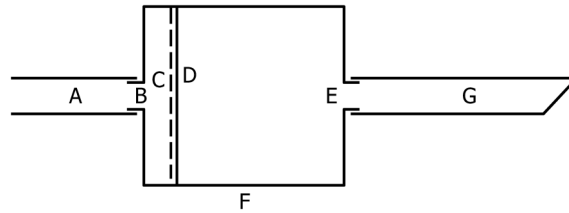
3.2.8 *surface dust*—particulate matter on a given surface which has been transported to its present location by various means, such as settling through the air or tracking from other sources.

4. Summary of Practice

4.1 Samples of surface dust are collected from selected sampling locations into individual filter holders by using a micro-vacuum collection technique that employs a personal sampling pump.⁵ The sample is then processed for transport and subsequent laboratory analysis for determination of metals content.

4.2 The collected sample may include particles which adhere to the internal walls of the filter holder. This material should be rinsed or wiped off and added to the sample meant for subsequent chemical analysis. However, this material cannot be included in gravimetric determination unless an internal capsule that can be accurately weighed is used during sample collection.

⁵ Que Hee, S. S., et al., "Evolution of efficient methods to sample lead sources, such as house dust and hand dust, in the homes of children." *Environmental Research*, Vol. 38, pp. 77-95 (1985); Que Hee, S. S., et al., "Evolution of Efficient Methods to Sample Lead Sources, Such as House Dust and Hand Dust, in the Homes of Children." *Environmental Research*, Vol. 38, 1985, pp. 77-95.



- A: Flexible tubing connecting the filter holder to the sampling pump (not shown);
- B: Outlet of filter holder;
- C: Back-up pad/support;
- D: Filter;
- E: Inlet of filter holder;
- F: Housing of filter holder;
- G: Flexible tubing collection nozzle.

FIG. 1 Schematic of Sampling Assembly for Micro-Vacuum Surface Dust Sampling

A: Flexible tubing connecting the filter holder to the sampling pump (not shown); B: Outlet of filter holder; C: Back-up pad/support; D: Filter; E: Inlet of filter holder; F: Housing of filter holder; G: Flexible tubing collection nozzle

5. Significance and Use

5.1 Human exposure to toxic metals present in surface dust can result from dermal contact with or ingestion of contaminated dust. Also, inhalation exposure can result from disturbing dust particles from contaminated surfaces. Thus, standardized methods for the collection and analysis of metals in surface dust samples are needed in order to evaluate the potential for human exposure to toxic elements.

5.2 This practice involves the use of sampling equipment to collect surface dust samples that may contain toxic metals, and is intended for use by qualified technical professionals.

5.3 This practice allows for the subsequent determination of collected metals concentrations on an area (loading) or mass concentration basis, or both.

5.4 Because particle losses can occur due to collection of dust onto the inner surfaces of the nozzle, the length of the collection nozzle is specified in order that such losses are comparable from one sample to another.

5.5 This practice is suitable for the collection of surface dust samples from, for example: (a) soft, porous surfaces such as carpet or upholstery; (b) hard, rough surfaces such as concrete or roughened wood; (c) confined areas that cannot be easily sampled by other means (such as wipe sampling as described in Practice D6966). A companion sampling technique that may be used for collection of surface dust from hard, smooth surfaces is wipe sampling (Practice D6966). A companion vacuum sampling technique that may be used for sampling carpets is described in Practice D5438.

5.6 Procedures presented in this practice are intended to provide a standardized method for dust collection from surfaces that cannot be reliably sampled using wipe collection methods (for example, Practice D6966). Additionally, the procedure described uses equipment that is readily available and in common use for other environmental and occupational hygiene sampling applications.

5.7 The entire contents of the filter holder, that is, the filter plus collected dust, is targeted for subsequent analysis for metals content. An internal capsule is used if gravimetric analysis is necessary.

6. Apparatus

6.1 ~~Dust sampling equipment~~—*Sampling Equipment*—The sampling assembly (see Fig. 1) for the micro-vacuum collection of surface dust samples has the following components:

6.1.1 *Filters*, of a diameter suitable for use with the filter holders, and with a collection efficiency of not less than 99.5 % for particles with a diffusion diameter of 0.3 μm , and with a very low metal content (typically less than 0.1 μg of each metal of interest per filter) (see ISO 15202-1).

6.1.1.1 Weight-stable filters or matched-weight filters shall be used if it is desired to determine the mass of collected dust.

NOTE 1—If the filters are to be weighed in order to determine the mass of dust collected, it is important that they be resistant to moisture retention, so that blank weight changes that can occur as a result of changes in temperature and humidity are as low and repeatable as possible. Also, filters selected for weight stability should not be excessively brittle, since this can introduce weighing errors due to loss of filter material.

6.1.2 *Filter holders*, for 25- or 37-mm diameter filters.

6.1.3 *Internal capsules, for gravimetric analysis*—If it is desired to determine the mass of collected dust, internal capsules shall be weighed to the nearest 0.1 mg.

NOTE 2—If pre-weighed internal capsules and filters are used, it will be necessary to tare the internal capsules, plus backup pads, prior to use.