



Standard Practice for Dermal Wipe Sampling for the Subsequent Determination of Metals and Metalloids¹

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1. Scope

1.1 This practice describes a procedure for the wet wiping of potentially exposed skin of workers for the subsequent determination of metals and metalloids.

NOTE 1—For guidance on collection of wipe samples on surfaces other than skin, refer to Guide [D7659](#).

1.2 This practice does not address the sampling design criteria that are used for hazard evaluation, risk assessment, or other purposes.

1.3 This practice contains notes that are explanatory and are not part of the mandatory requirements of this practice.

1.4 The values stated in SI units are to be regarded as standard.

1.5 This practice offers a set of instructions for performing one or more specific operations. This practice cannot replace education or experience and should be used in conjunction with professional judgment. Not all aspects of this practice may be applicable in all circumstances. This practice is not intended to represent or replace the standard of care by which the adequacy of a given professional service must be judged, nor should this practice be applied without consideration of a project's many unique aspects. The word "Standard" in the title means only that the practice has been approved through the ASTM consensus process.

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.*

¹ This test method 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](#)

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

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

[D7144 Practice for Collection of Surface Dust by Microvacuum Sampling for Subsequent Metals Determination](#)

[D7659 Guide for Strategies for Surface Sampling of Metals and Metalloids for Worker Protection](#)

[D7707 Specification for Wipe Sampling Materials for Beryllium in Surface Dust](#)

[E1792 Specification for Wipe Sampling Materials for Lead in Surface Dust](#)

2.2 *ISO and European Standards*:

[ISO 14294 Workplace atmospheres—Measurement of dermal exposure—Principles and methods](#)³

[EN 689 Workplace Atmospheres—Guidance for the Assessment of Exposure by Inhalation to Chemical Agents for Comparison with Limit Values and Measurement Strategy](#)⁴

[EN 1540 Workplace exposure—Terminology](#)⁴

3. Terminology

3.1 For definitions of terms not listed here, see Terminology [D1356](#).

3.2 *Definitions*:

3.2.1 *agent*—any chemical or biological entity on its own or admixed as it occurs in the natural state or as produced by any work activity, whether or not produced intentionally and whether or not placed on the market. **EN 689**

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.

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

⁴ Available from European Committee for Standardization (CEN), Avenue Marnix 17, B-1000, Brussels, Belgium, <http://www.cen.eu>.

3.2.2 *dermal exposure*—process of contact between an agent and human skin at an exposure surface over an exposure period. **ISO 14294**

3.2.2.1 *Discussion*—Dermal exposure can originate from contact with surfaces or from airborne contaminants. The exposure period may or may not be known.

3.2.3 *dermal exposure loading*—dermal exposure mass divided by the dermal exposure surface area. **ISO 14294**

3.2.3.1 *Discussion*—For practical reasons dermal exposure loading can be expressed as the mass divided by area-averaged skin contaminant layer surface area in mg/cm².

3.2.4 *dermal exposure mass*—mass of agent present in the dermal contact volume. **ISO 14294**

3.2.4.1 *Discussion*—For practical reasons, dermal exposure mass is defined by the amount of agent present in the skin contaminant layer. The outcome of the process of dermal exposure (that is, the contact) can be expressed by different parameters of exposure, such as mg/cm², or mg/hand, though ascertaining the exact area of the exposure is preferred.

3.2.5 *dermal exposure surface*—the skin surface area where an agent is present. **ISO 14294**

3.2.5.1 *Discussion*—For practical reasons this may be determined from a two dimensional representation, such as a tracing of the hand for the skin contaminant layer in cm². It may also be represented by specifying the part of the body with a description of the anatomical limits of the sampling area (for example, the hand as far as the wrist).

3.2.6 *skin contaminant layer*—compartment on top of the stratum corneum of the human skin formed by sebum lipids, sweat and additional water from transepidermal water loss, also including products from cornification and unshed corneocytes. **ISO 14294**

3.2.7 *workplace*—the defined area or areas in which the work activities are carried out. **EN 1540**

4. Summary of Practice

4.1 Wipe samples of workers' skin are collected from estimated dermal surface areas with wetted wipes using a specified wiping procedure.

4.2 The collected wipes are then ready for subsequent determination of the metals and metalloids of interest by using spectrometry or other laboratory analysis techniques such as atomic or mass spectrometry.

5. Significance and Use

5.1 This practice is intended for the collection of samples of skin contamination to be used for the estimation of dermal exposure to metals and metalloids. The practice is meant for use in the collection of dermal samples that are of interest in hazard evaluation, risk assessment, or other purposes. This practice is meant to provide a standardized means for estimating exposures to body parts that are potentially exposed via dermal contact with airborne or surface contaminants, or both.

5.2 The techniques described in this practice may not accurately reflect the transferability or bioavailability of metal or metalloid residues by way of dermal contact.

5.3 Additional information on the principles and methods for the measurement of dermal exposure can be found in ISO 14294.

6. Materials

6.1 *Wipes*, for collection of metals samples from skin surfaces. The background metal(s) content of the wipes should be as low as possible. At a maximum, the background level of target metal(s) shall be no more than one-tenth the target concentration the metal(s) to be measured. Wipes shall be fully wetted prior to use. Wipes may be wetted on site in the field by the person collecting the samples, or may be purchased pre-wetted.

NOTE 2—Wipes meeting the requirements of Specification E1792 or D7707, or both, may be suitable.

6.2 *Sample Containers*, sealable, disposable, clean rigid-walled, of sufficient volume for the wiping material to be used.

NOTE 3—Screw-top plastic centrifuge tubes are an example of a suitable rigid-walled sample container.

6.3 *Measuring Tool*, tape or ruler, capable of measuring to ±0.1 cm.

6.4 *Disposable Gloves*, powder-free, to avoid the possibility of contamination and to protect hands from contact with toxic and corrosive substances. PVC or nitrile gloves are suitable.

6.5 *Cleaning Cloths*, for cleaning of templates and other equipment.

6.6 *Digital camera or graph paper*, if necessary for assistance in estimating the surface area of the skin surface sampled.

6.7 *Timer*, when necessary to measure the sampling time period.

6.8 *Sampling Templates*, one or more of the following: 25 cm² (for example, 5 cm by 5 cm minimum dimensions); reusable or disposable flexible plastic template(s) (for example, full-square, rectangular, ovals, circles and triangles); or templates of alternative areas having accurately known dimensions (see Practice D6966). Templates shall be flexible or otherwise capable of being adjusted (that is, flexible) to conform to the skin surface. To minimize the risk of cross-contamination, the use of disposable templates is generally preferred. Reusable templates shall be cleaned prior to each use.

6.9 *Marker*, permanent or semi-permanent (metal-free ink) may be used in place of the template (see 6.8) to mark the area of skin to be wiped.

NOTE 4—Caution should be exercised to avoid disturbing or touching the area to be sampled when marking the sampling area.

6.10 *Medical Tape (adhesive tape)* may be used instead of a sampling template (see 6.8) to mark an area of skin to be wiped or to immobilize the sampling template on the skin.

NOTE 5—Caution should be exercised to avoid disturbing or touching the area to be sampled when marking the sampling area.

7. Procedure

7.1 *Sampling*: