



Designation: D7521 – 22

Standard Test Method for Determination of Asbestos in Soil¹

This standard is issued under the fixed designation D7521; 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 test method covers a procedure to: (1) identify asbestos in soil, (2) provide an estimate of the concentration of asbestos in the sampled soil (dried), and (3) optionally to provide a concentration of asbestos reported as the number of asbestos structures per gram of sample.

1.2 In this test method, results are produced that may be used for evaluation of sites contaminated by construction, mine and manufacturing wastes, deposits of natural occurrences of asbestos (NOA), and other sources of interest to the investigator.

1.3 This test method describes the gravimetric, sieve, and other laboratory procedures for preparing the soil for analysis as well as the identification and quantification of any asbestos detected. Pieces of collected soil and material embedded therein that pass through a 19-mm sieve will become part of the sample that is analyzed and for which results are reported.

1.3.1 Asbestos is identified and quantified by polarized light microscopy (PLM) techniques including analysis of morphology and optical properties. Optional transmission electron microscopy (TEM) identification and quantification of asbestos is based on morphology, selected area electron diffraction (SAED), and energy dispersive X-ray analysis (EDXA). Some information about fiber size may also be determined. The PLM and TEM methods use different definitions and size criteria for fibers and structures. Separate data sets may be produced.

1.4 This test method has an analytical sensitivity of 0.25 % by weight with optional procedures to allow for an analytical sensitivity of 0.1 % by weight.

1.5 This test method does not purport to address sampling strategies or variables associated with soil environments. Such considerations are the responsibility of the investigator collecting and submitting the sample. **Appendix X2** covering elements of soil sampling and good field practices is attached.

1.6 *Units*—The values stated in SI units are to be regarded as the standard. Other units may be cited in the method for informational purposes only.

1.7 *Hazards*—Asbestos fibers are acknowledged carcinogens. Breathing asbestos fibers can result in disease of the lungs including asbestosis, lung cancer, and mesothelioma. Precautions should be taken to avoid creating and breathing airborne asbestos particles when sampling and analyzing materials suspected of containing asbestos.

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.*

2. Referenced Documents

2.1 *ASTM Standards:*²

C136 Test Method for Sieve Analysis of Fine and Coarse Aggregates

D1193 Specification for Reagent Water

D3670 Guide for Determination of Precision and Bias of Methods of Committee D22

D6281 Test Method for Airborne Asbestos Concentration in Ambient and Indoor Atmospheres as Determined by Transmission Electron Microscopy Direct Transfer (TEM)

D6620 Practice for Asbestos Detection Limit Based on Counts

D7712 Terminology for Sampling and Analysis of Asbestos

E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

¹ This test method is under the jurisdiction of ASTM Committee **D22** on Air Quality and is the direct responsibility of Subcommittee **D22.07** on Sampling, Analysis, Management of Asbestos, and Other Microscopic Particles.

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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.

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

2.2 EPA Standards:³

EPA 600/R-93/116 Method for the Determination of Asbestos in Bulk Building Materials

2.3 ISO Standards:⁴

ISO 10312:2019 Ambient Air -Determination of Asbestos Fibers—Direct Transfer Transmission Electron Microscopy Method (2nd Ed. 2019-10)

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

ISO 22262-1:2012 Bulk materials—Part 1: Sampling and qualitative determination of asbestos in commercial bulk materials

3. Terminology

3.1 Definitions:

3.1.1 *asbestiform*, *n*—type of fibrous habit in which the fibers are separable into thinner fibers and ultimately into fibrils.

3.1.1.1 *Discussion*—This habit accounts for greater flexibility and higher tensile strength than other habits of the same mineral. For more information on asbestiform mineralogy, see Steel and Wylie⁵ and Zussman.⁶

3.1.2 *asbestos*, *n*—a collective term that describes a group of naturally occurring, inorganic, highly-fibrous, silicate minerals that are easily separated into long, thin, flexible, strong fibers when crushed or processed.

3.1.2.1 *Discussion*—Included in the definition are the asbestiform varieties of serpentine (chrysotile); riebeckite (crocidolite); grunerite (grunerite asbestos [Amosite]); anthophyllite (anthophyllite asbestos); tremolite (tremolite asbestos); and actinolite (actinolite asbestos). The amphibole mineral compositions are defined according to the nomenclature of the International Mineralogical Association.

3.1.2.2 *Discussion*—The mineral fibers described in this definition are listed below. This method is also applicable to other mineral fibers of interest not listed in Table 1.

3.1.3 *aspect ratio*, *n*—ratio of the length of a fibrous particle to its average width.

3.1.4 *bundle*, *n*—structure composed of two or more fibers in a parallel arrangement with the fibers closer than one fiber diameter to each other.

3.1.5 *cluster*, *n*—structure with fibers in a random arrangement such that all fibers are intermixed and no single fiber is isolated from the group; groupings of fibers shall have more than two points touching.

3.1.6 *fiber* (transmission electron microscopy, TEM), *n*—structure having a minimum length of 0.5 μm , an aspect ratio of 5:1 or greater, and substantially parallel sides.

3.1.7 *fibril*, *n*—single fiber that cannot be separated into smaller components without losing its fibrous properties or appearance.

3.1.8 *fibrous* (polarized light microscopy, PLM), *adj*—mineral composed of parallel, radiating, or interlaced aggregates of fibers from which the fibers may or may not be separable, that is, the crystalline aggregate may be referred to as fibrous even if it is not composed of separable fibers but has that distinct appearance.

3.1.8.1 *Discussion*—The term fibrous is used in a general mineralogical way to describe aggregates of grains that crystallize in a needle-like habit and appear to be composed of fibers. The term fibrous has a much more general meaning than asbestos. While it is correct that all asbestos minerals can have a fibrous habit, not all minerals having fibrous habits are asbestos.

3.1.9 *free fibers*, *n*—during sample collection, these are fibers that are not associated with discrete pieces of building material or debris in the soil.

3.1.9.1 *Discussion*—Free fibers may or may not be visible to the unaided eye. Their source (for example, weathered asbestos-cement products) may or may not be present in the soil in an amount sufficient to collect a bulk sample, if at all.

3.1.10 *matrix*, *n*—structure in which one or more fibers, or fiber bundles that are touching, are attached to or partially concealed by a single particle or connected group of nonfibrous particles.

3.1.10.1 *Discussion*—The exposed fiber shall meet the fiber definition (see fiber (TEM)).

3.1.11 *point count*, *n*—quantitative regimen with definitions that can be found under EPA 600 R-93/116. A technique used to determine the relative projected areas occupied by separate components in a microscope slide preparation of a sample. For asbestos analysis, this technique is used to determine the relative concentrations of asbestos minerals to non-asbestos sample components.

3.1.12 *soil*, *n*—for this test method, soil is considered material of variable particle size and composition generally less than 19 mm in size.

3.1.12.1 *Discussion*—Examples may include loosely consolidated sediments, building materials, and other accumulated materials at the surface. Other materials larger than 19 mm may also be submitted at the collector's discretion as separate bulk samples.

3.1.13 *structures* (TEM), *n*—term that is used to categorize all the types of asbestos particles which are recorded during the analysis (such as fibers, bundles, clusters, and matrices).

³ Available from United States Environmental Protection Agency (EPA), Ariel Rios Bldg., 1200 Pennsylvania Ave., NW, Washington, DC 20004, <http://www.epa.gov>.

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

⁵ Steel, E., and A. Wylie, "Mineralogical Characteristics of Asbestos," in *Geology of Asbestos Deposits*, P. H. Riordon, Ed., SME-AIME, 1981, pp. 93–101.

⁶ Zussman, J., "The Mineralogy of Asbestos," in *Asbestos: Properties, Applications and Hazards*, John Wiley and Sons, 1979, pp. 45–67.

TABLE 1 Asbestos

Asbestos	Chemical Abstract Service No.
Chrysotile	12001-29-5
Crocidolite	12001-28-4
Amosite	12172-73-5
Anthophyllite asbestos	77536-67-5
Tremolite asbestos	77536-68-6
Actinolite asbestos	77536-66-4
Asbestos	1332-21-4