



Designation: D7390 – 18^{ε1}

Standard Guide for Evaluating Asbestos in Dust on Surfaces by Comparison Between Two Environments¹

This standard is issued under the fixed designation D7390; 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.

^{ε1} NOTE—Editorial corrections were made throughout in October 2018.

1. Scope

1.1 There are multiple purposes for determining the loading of asbestos in dust on surfaces. Each particular purpose may require unique sampling strategies, analytical methods, and procedures for data interpretation. Procedures are provided to facilitate application of available methods for determining asbestos surface loadings and/or asbestos loadings in surface dust for comparison between two environments. At present, this guide addresses one application of the ASTM surface dust methods. It is anticipated that additional areas will be added in the future. It is not intended that the discussion of one application should limit use of the methods in other areas.

1.2 *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.* For specific warning statements, see 5.7.

1.3 *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

D5755 Test Method for Microvacuum Sampling and Indirect Analysis of Dust by Transmission Electron Microscopy for Asbestos Structure Number Surface Loading

D6480 Test Method for Wipe Sampling of Surfaces, Indirect Preparation, and Analysis for Asbestos Structure Number Surface Loading by Transmission Electron Microscopy
E456 Terminology Relating to Quality and Statistics
E2356 Practice for Comprehensive Building Asbestos Surveys

3. Terminology

3.1 *Definitions*—Unless otherwise noted all statistical terms are as defined in Terminology **E456**.

3.1.1 *activity generated aerosol, n*—a dispersion of particles in air that have become airborne due to physical disturbances such as human activity, sweeping, airflow, etc.

3.1.2 *background samples, n*—samples taken from surfaces that are considered to have concentrations of asbestos in surface dust that are representative of conditions that exist in an environment that is affected by only prevailing conditions and has not experienced events, disturbances or activities unusual for the environment.

3.1.3 *control, n*—an area that is used as the basis for a comparison.

3.1.3.1 *Discussion*—This could be an area where the dust has been previously characterized, an area thought to be suitable for occupancy, an area that has not experienced a disturbance of asbestos-containing materials, or that is for some other reason deemed to be suitable as the basis for a comparison.

3.1.4 *control samples, n*—samples collected for comparison to the study samples.

3.1.4.1 *Discussion*—These differ from background samples in that they are collected: either: in an area where the dust has been previously characterized, or in an area that has not experienced a disturbance of asbestos-containing materials, or in an area that is for some other reason deemed to be suitable as the basis for comparison.

3.1.5 *dust, n*—any material composed of particles in a size range of <1 mm.

3.1.6 *environment, n*—well defined three-dimensional area and everything that is in it.

¹ This guide 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.

3.1.7 *homogeneous samples, n*—group of samples that are collected from surfaces that are visually similar in texture, dust loading and environment.

3.1.8 *laboratory blank, n*—a cassette or wipe taken from laboratory stock that are not affected by field activities.

3.1.9 *loading, n*—quantity of asbestos in the dust found on a surface as measured by the ASTM standard methods for evaluating asbestos in dust on surfaces.

3.1.10 *open field blank, n*—cassette or wipe opened in the field as if for sample collection and then immediately closed that is analyzed in the same manner as a regular sample.

3.1.11 *power, n*—power of the test is the probability, expressed as a decimal fraction, that a specified difference between asbestos surface loadings in two environments will be detected by the test.

3.1.12 *replicates, n*—samples collected from an area that is visually identified as homogeneous.

3.1.13 *sampling set, n*—samples collected on the same day on surfaces in an area for the purpose of characterizing the asbestos loading in the dust of the samples surfaces in that area.

3.1.14 *sealed field blank, n*—cassette or wipe taken to the field but remaining closed at all times.

3.1.15 *study samples, n*—samples collected in an area believed to have experienced events, disturbances or activities affecting asbestos-containing materials.

3.1.15.1 *Discussion*—The area in which these samples are taken is called the study area. Study samples are compared to background samples or control samples.

4. Summary of Guide

4.1 The guidance contained in this document was developed for applications of Test Methods [D5755](#) and [D6480](#). The application addressed in this document is sampling to test for differences in surface loading in two or more environments including comparison to environments that may be considered to be “background.”

4.2 Factors affecting the selection of sampling sites and types of samples to be collected are described in [Appendix X1](#). These factors include:

- 4.2.1 Uniformity and distribution of dust within a building,
- 4.2.2 The nature of dust found within buildings,
- 4.2.3 The nature of the surface from which samples are to be collected,
- 4.2.4 Past disturbances of asbestos-containing materials,
- 4.2.5 Environmental conditions,
- 4.2.6 Ventilation,
- 4.2.7 Building history,
- 4.2.8 Occupation and activity of occupants, and
- 4.2.9 Outdoor sampling.

4.3 This guide describes statistical procedures to be used for:

4.3.1 Defining sampling needs including the size, number and location of samples required to address a particular application; and

4.3.2 Interpreting analytical results—estimating loadings or loadings from single or multiple-sample results, establishing

confidence intervals for such estimates, and comparing between such estimates.

5. Significance and Use

5.1 This guide describes factors to be considered by an investigator designing a sampling program to compare the asbestos dust loadings in two environments and presents statistical methods for making the comparison. Each user is responsible for the design of an investigation and the interpretation of data collected when using dust data.

5.2 This guide does not deal with situations where dusts of different compositions or from different surfaces are to be evaluated.

5.3 This guide describes methods for interpreting the results of sampling and analysis performed in accordance with Test Methods [D5755](#) and [D6480](#). It may be appropriate to use the procedures in this guide with other dust collection and analysis methods, but it is the responsibility of the user to make this determination.

5.4 The methods described in this guide are not intended to be used alone. They are intended to be used along with various evaluation methods that may include consideration of building use, activities within the building, air sampling, asbestos surveys (refer to Practice [E2356](#)), evaluation of building history and study of building ventilation systems.

5.5 This guide describes methods for comparing environments and does not draw any conclusions relating asbestos surface loadings to the potential safety or habitability of buildings.

5.6 This guide does not address risk assessments or the use of dust sampling in risk assessment. Health based risk assessments are beyond the scope of this guide.

5.7 **Warning**—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. Regulatory requirements addressing asbestos are defined by USEPA^{3,4} and OSHA.⁵

6. Comparison Between Environments

6.1 One use of dust sampling is to compare the asbestos dust loadings on surfaces in two environments. This guide describes several ways in which such a comparison might be made. The user should consider these and other site-specific factors in [Appendix X1](#), Factors Affecting Sample Collection, that may affect the interpretation of results and the need to proceed beyond the Baseline Calculations in Section [7](#).

6.1.1 *Comparison to Background Samples*—If one environment is considered to represent conditions that are typical of a building this could be used as the source of background

³ USEPA, 40 CFR Part 61, Subpart M.

⁴ USEPA, 40 CFR Part 763, Subpart E.

⁵ OSHA, 29 CFR Parts 1910, 1915, and 1926.

samples against which study samples from areas in questions could be compared. Areas may be in question due to disturbance of an asbestos-containing material, damage to the building materials, change in occupancy or any other occurrence that could change the asbestos loading in dust.

6.2 *Sample Collection Requirements:*

6.2.1 *Homogeneous Dust*—A visual determination should be made about the homogeneity of the dust and site to be sampled. Samples should be collected from homogeneous locations within each area—study and background. A location is considered to be homogeneous if:

6.2.1.1 The sample sites have visually similar depositions of dust on their surfaces, including the absence of visible dust.

6.2.1.2 The surfaces to be sampled have the same type of surface texture based upon a visual determination.

6.2.2 The efficiency of dust collection on a given surface is likely to be different for wipe and microvacuum methods (see Crankshaw et al. (1)⁶). As such, the same sample collection method should be used for samples that are to be compared.

6.3 *Selection of Sampling Locations:*

6.3.1 *Representative Locations*—Samples should be collected from locations and surfaces that are representative of the environments to be tested. In the study area proximity to sources of asbestos fiber release may be a consideration.

6.3.2 Depending on the configuration of the sampling site and surfaces to be sampled, it may be possible to randomize the selection of sampling locations with a random number table or other means. Accessibility of sites for sampling may be limited by safety, security, or other considerations.

6.4 *Number of Samples:*

6.4.1 A sufficient number of samples should be collected to be able to discern differences that may exist between the study area and background area. For the examples of Baseline Calculations in Section 7 this number is defined as five study samples and, where taken, five background samples. Cost and accessibility being factors that affect the number of samples taken, this combination of sample sets is seen as the minimum from which a reasonable comparison of results may be made. If the user cannot do so, additional samples or statistical tests as described in [Appendix X2](#) may be considered.

6.5 *Sampling and Analytical Requirements:*

6.5.1 Collect and analyze samples as described in Test Methods [D5755](#) and [D6480](#).

6.5.2 *Quality Control Requirements*—The following blanks should be collected as part of the sampling:

6.5.2.1 A sealed field blank per lot of cassettes or wipes.

6.5.2.2 One open field blank for each set of five study samples and one open field blank for each set of five background samples, if taken.

6.5.2.3 Blanks should be sent to the laboratory for analysis in the same manner as a regular sample. Blanks need not be analyzed if no asbestos is found in the study samples or background samples. If asbestos is found the “Open Field Blanks” should be analyzed. If asbestos is found on the “Open

Field Blanks,” then the “Sealed Field Blanks” should be analyzed. If no asbestos is found on the “Open Field Blank” there is no need to analyze the sealed blanks. If any blank is found to contain more than the limit set forth in the section on blanks in the appropriate method then the sampling may be considered to be suspect. Do not adjust the sample results with the results of the blank filter analyses.

6.6 *Data Interpretation:*

6.6.1 For each sample set the Analytical Parameters tabulated for the examples in Section 7 should be extracted from the laboratory report. For each sample the number of asbestos structures counted, analytical sensitivity of the analysis, and surface loading should be entered in the tables for the study samples and background samples. Where both study samples and background samples are taken, the upper and lower 95 % confidence limits (95 % combined upper confidence limit (95 % UCL) and 95 % combined lower confidence limit (95 % LCL)) can be calculated for the background samples and study samples, respectively, using the procedures in Section 7. The example most descriptive of the user’s investigation should be used as a guide.

6.6.2 For each sample set the Combined Measurements tables in Section 7 should be completed according to the instructions provided. Where both study samples and background samples are taken, if the 95 % LCL of the study samples is less than the 95 % UCL of the background samples the distributions overlap, indicating no statistical difference.

6.6.3 Where no background samples are taken, Section 7 presents appropriate comparisons from which the user may also draw reasonable inferences. After reviewing the results of the study sample analyses and, in consultation with the laboratory, the user may want to dispense with analysis of the background samples if the information from them would not justify the cost or time required.

6.6.4 If the overlap or separation of the confidence intervals is small the Baseline Calculations in Section 7 may be augmented with other statistical tests described in [Appendix X2](#) to confirm the conclusion.

6.7 *Asbestos Structure Types and Sizes:*

6.7.1 The mineral form(s) of the asbestos found during analysis of dust samples should be considered. If the mineral form of the asbestos within or between sample sets (study and background) differs, the user shall consider the impact on the interpretation of the data and the decisions derived therefrom.

6.7.2 If the size or type of asbestos structures differs between the study samples and background samples this also may indicate a difference in the dust loadings at each site. For example, if one set of samples consists of small fibers and the other set has large matrices, then these areas would appear to be different. As such, additional investigation may be necessary in such an instance, even if statistical analysis of the number or mass of particles finds no difference between the sites.

6.8 *Reporting:*

6.8.1 The user’s report should contain sufficient information to allow the reader to locate the sampling sites, and repeat the sampling if conditions permit.

6.8.2 The complete data set should be reported, including results of blanks and background samples.

⁶ The boldface numbers in parentheses refer to a list of references at the end of this standard.