



Standard Practice for Asbestos Detection Limit Based on Counts¹

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1. Scope

1.1 This practice presents the procedure for determining the detection limit (DL)² for measurements of fibers or structures³ using microscopy methods.

1.2 This practice applies to samples of air that are analyzed either by phase contrast microscopy (PCM) or transmission electron microscopy (TEM), and samples of dust that are analyzed by TEM.

1.3 The microscopy methods entail counting asbestos structures and reporting the results as structures per cubic centimeter of air (str/cc) or fibers per cubic centimeter of air (f/cc) for air samples and structures per square centimeter of surface area (str/cm²) for dust samples.

2. Referenced Documents

2.1 ASTM Standards:

D 1356 Terminology Relating to Sampling and Analysis of Atmospheres⁴

D 5755 Test Method for Microvacuum Sampling and Indirect Analysis of Dust by Transmission Electron Microscopy for Asbestos Structure Number Concentrations⁴

D 6281 Test Method for Airborne Asbestos Concentration in Ambient and Indoor Atmospheres as Determined by Transmission Electron Microscopy Direct Transfer (TEM)

D 6480 Test Method for Wipe Sampling of Surfaces, Indirect Preparation, and Analysis of Asbestos Structure Number Concentration by Transmission Electron Microscopy⁴

E 456 Terminology for Relating to Quality and Statistics⁵

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

¹ This practice is under the jurisdiction of ASTM Committee D22 on Sampling and Analysis of Atmospheres and is the direct responsibility of Subcommittee D22.07 on Sampling and Analysis of Asbestos.

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² The DL also is referred to in the scientific literature as Limit of Detection (LOD), Method Detection Limit (MDL), and other similar descriptive names.

³ For purposes of general exposition, the term “structures” will be used in place of “fibers or structures.” In the examples in Section 8, the specific term, “fiber” or “structure,” is used where appropriate. These terms are defined separately in Section 3.

⁴ Annual Book of ASTM Standards, Vol 11.03.

⁵ Annual Book of ASTM Standards, Vol 14.02.

3.1.1 *average, n*—the sum of a set of measurements (counts) divided by the number of measurements in the set.

3.1.1.1 *Discussion*—The *average* is distinguished from the *mean*. The *average* is calculated from data and serves as an estimate of the *mean*. The *mean* (also referred to as the *population mean, expected value, or first moment*) is a parameter of the underlying statistical distribution of counts.

3.1.2 *background, n*—a statistical distribution of structures introduced by (i) analyst counting errors and (ii) contamination on an unused filter or contamination as a consequence of the sample collection and sample preparation steps.

3.1.2.1 *Discussion*—This definition of *background* is specific to this practice. The only counting errors considered in this definition of *background* are errors that result in an over-count (that is, false positives). Analyst counting errors are errors such as, determining the length of structures or fibers and whether, based on length, they should be counted; counting artifacts as fibers; determining the number of structures protruding from a matrix; and interpreting a cluster as one, two, or more structures that should be counted only as zero or one structure. For purposes of developing the DL, assume that background contamination sources have been reduced to their lowest achievable levels.

3.1.3 *blank, n*—a filter that has not been used to collect asbestos from the target environment.

3.1.3.1 *Discussion*—Blanks are used in this practice to determine the degree of asbestos contamination that is reflected in asbestos measurements. Contamination may be on the virgin filter or introduced in handling the filter in the field or when preparing it for inspection with a microscope. The data required to determine the degree of contamination consists, therefore, of measurements of field blanks that have experienced the full preparation process.

3.1.4 *decision value, n*—a numerical value used as a boundary in a statistical test to decide between the null hypothesis and the alternative hypothesis.

3.1.4.1 *Discussion*—In the present context, the decision value is a structure count that defines the boundary between “below detection” (the null hypothesis) and “detection” (the alternative hypothesis). If a structure count were larger than the decision value, then one would conclude that detection has been achieved (that is, the sample is from a distribution other than the background distribution). If the count were less than or

