

Asbestos in Soil - PBM

Parameter	Asbestos in Soil						
Analytical Method	Mechanical sieving, analysis using polarized light microscopy (PLM).						
Introduction	This method is applicable to the quantitative determination of asbestos in soil. Contamination may be caused by construction, mine and manufacturing wastes, naturally occurring asbestos (NOA), and other sources.						
Method Summary	<p>The sample is dried and passed through a series of sieves (19 mm, 2 mm, and 106 µm) into a collection pan. The <19 to >2 mm fraction (Coarse), <2 mm to 106 µm fraction (Medium), and <106 µm fraction (Fine) are analyzed using stereomicroscopy and polarized light microscopy (PLM), along with visual area estimation (VAE). The sample fraction that is >19 mm may be analyzed using stereomicroscopy and PLM and reported separately, but are not part of this method. Building materials found in the soil samples may also be analyzed and reported separately.</p> <p>Transmission electron microscopy (TEM), selected area electron diffraction (SAED) and energy dispersive X-ray analysis (EDXA) may optionally be used for more detailed identification and quantitation of asbestos in soil.</p> <p>This method is performance-based. Laboratories may adopt alternative options to improve performance or efficiency if all stated performance requirements and prescribed (mandatory) elements are met.</p>						
MDL(s) and EMS Analyte Codes	<table><thead><tr><th><u>Analyte</u></th><th><u>Approx. MDL (units)</u></th><th><u>EMS Analyte Code</u></th></tr></thead><tbody><tr><td>Asbestos</td><td>0.25 %/wt</td><td>FIBR</td></tr></tbody></table>	<u>Analyte</u>	<u>Approx. MDL (units)</u>	<u>EMS Analyte Code</u>	Asbestos	0.25 %/wt	FIBR
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Asbestos	0.25 %/wt	FIBR					
EMS Method Code(s)	***Refer to EMS Parameter Dictionary on the ministry website for all current EMS codes.						
Matrix	Soil						
Interferences and Precautions	<p>Asbestos poses a health hazard in that it can cause lung cancer, asbestosis or mesothelioma. Routes of exposure are through inhalation only. Avoid creating and breathing airborne asbestos fibers when handling samples. It is the responsibility of the laboratory to establish appropriate safety and health standards prior to handling samples.</p> <p>Minerals that have similar chemical or crystalline properties to asbestos may interfere and may result in a false positive. Minerals that may interfere are:</p> <ul style="list-style-type: none">• Antigorite, picrolite• Palygorskite (attapulgite)• Halloysite• Pyroxenes• Sepiolite• Vermiculite scrolls• Fibrous Talc• Hornblende and other amphiboles• Clays associated with talc deposits• Scrolled materials (Lizardite) <p>To avoid misidentification, it is recommended to have literature references for the above minerals for comparison purposes.</p>						

Sample Handling and Preservation Samples should be collected in rigid, sealable, non-breakable containers that can hold 250-500 cm³ (125-250 mL) of sample. Each sample container should be sealed with tape.

Stability **Holding Time:** Samples should be dried to constant weight within 48 hours at 110 ± 5°C to minimize microbial growth. Sample retention is determined by the laboratory and client.

Storage: Ambient temperature.

Procedure Microscopes (PLM, TEM, EDXA) should be calibrated daily or before use. The microscopes should be checked that they are in good working order. Detailed calibration procedures are not provided as they vary. Refer to the microscope operating manual provided by the manufacturer.

Any bulk building materials found in the soil samples should be analyzed by stereomicroscopy / PLM and reported separately.

Samples should be dried at 110 ± 5°C within 48 hours of receipt. Record the weight of sample (or representative sub-sample) before drying and after achieving constant weight, so that the change of weight can be recorded for moisture content.

Samples with organic or soluble materials may be gravimetrically reduced before sieving using the procedure found in EPA 600/R-93/116.

In a HEPA exhaust or fume hood, arrange and secure the sieves in order of decreasing size (19mm, 2 mm, 106 µm, and collection pan).

The dried sample is poured into the top (19 mm) sieve and lightly misted with isopropyl alcohol to reduce static charges. A sieve shaker is recommended but not required. Place a lid on the top sieve and shake for at least 5 minutes or until the particles are separated. Wait at least 5 minutes to let the particles settle into each sieve. Each sieve should be separated carefully to avoid disturbing the particles. Place the contents of the 2 mm sieve (coarse fraction) into a tared sealable container and record the weight. Repeat for the contents of the 106 µm sieve (medium fraction) and collection pan (fine fraction). Between each sample, sieves should be thoroughly cleaned with hot soapy water, sonicated, rinsed and dried.

The coarse, medium, and fine fractions are analyzed separately by stereomicroscopy and PLM using calibrated visual area estimation and identification consistent with EPA 600/R-93/116. If a single asbestos structure is observed in the coarse and medium fractions a value of 0.25% is used for nominal sensitivity. If any asbestos is found in the fine fraction by stereomicroscopy, the PLM is used to estimate the relative percentage by VAE or by point counting. If the amount of the asbestos found in the fine fraction is <1%, then perform a point count as described in EPA 600/R-93/116. It is recommended to use TEM analysis if no asbestos is found in the fine fraction (See ASTM D7521-16 section 11.6 Optional TEM Analysis of Fine Fraction for more information).

Calculations

Total asbestos content of the soil (the coarse, medium and fine fraction) as determined by PLM analysis is calculated using the following calculation:

$$\text{TOTAL ASBESTOS \%} = \frac{[\%_F \text{ PLM PC} * W_F] + [\%_M \text{ PLM} * W_M] + [\%_C \text{ PLM} * W_C]}{W_F + W_M + W_C}$$

Where:

%_F = % Asbestos in the fine fraction, determined by PLM point counting.

%_M = % Asbestos in the medium fraction, determined by PLM VAE

%_C = % Asbestos in the coarse fraction, determined by PLM VAE

W_F = Weight of the fine fraction of sample (g)

W_M = Weight of the medium fraction of sample (g)

W_c = Weight of the coarse fraction of sample (g)

Reporting:

For each soil sample analyzed report the following:

Record the concentration of asbestos in each sieved fraction and the total asbestos as determined by PLM in %.

Record the Analytical Sensitivity in weight % by multiplying the weight of the fine fraction by the single-fiber PLM detection limit of 0.25%

Record the types of asbestos present (e.g. Chrysotile, Amosite, Crocidolite Tremolite, Actinolite, and/or Anthophyllite),

For analysis of the >19 mm fraction, the results are reported separately and not combined with the total asbestos calculation of the fine, medium and coarse fractions.

For Bulk Material (Building debris), the results are reported separately.

For TEM analysis calculations, see method ASTM D7521-16 sections 13.1.2.

For TEM reporting see sections 14.2 and 14.3 in method ASTM D7521-16.

Performance Requirements

Any analytical method options selected for this analysis must meet or exceed the performance requirements specified below.

Accuracy and Precision requirements are distinct from daily QC requirements, and apply to measures of long term method performance (averages and standard deviations). Achievement of these requirements is to be demonstrated during initial and ongoing method re-validation studies. For Initial Validations, averages of at least 8 Lab Control Samples or RMs must be assessed. Ongoing Re-validations (performance reviews) should assess QC data encompassing longer timeframes (e.g. 6 months to 1 year). A minimum frequency of 2 years is recommended for Ongoing Re-validations.

Accuracy Requirement: Laboratories must demonstrate method accuracy (measured as average recovery) of 80-120% or better for Lab Control Samples or Certified Reference Materials at concentrations above ten times the MDL.

Precision Requirement: Laboratories must demonstrate method precision equal to or better than 20% relative standard deviation for clean matrix spikes at concentrations above ten times the MDL.

Sensitivity Requirement: Where possible, the method should support Reporting Limits (and MDLs) that are less than 1/5 of applicable numerical standards. The method is not fit-for-purpose if an MDL exceeds a guideline, standard, or regulatory criteria against which it will be used for evaluation of compliance.

Quality Control

Summary of QC Requirements		
QC Component	Minimum Frequency	Minimum Data Quality Objectives
Method Blank (MB)	One per batch (max 20 samples)	Less than reported DL
Lab Control Sample (LCS) or Reference Material (RM)	One per batch (max 20 samples)	70 – 130%
Lab Duplicates (DUP)	One per batch (max 20 samples)	30% RPD [or within 2x reported DL for low level results]
If DQOs are not met, repeat testing or report qualified test results. DQOs do not apply to MS results where sample background exceeds spike amount.		

Method Blank: Blanks should be run through the nested sieves before each sample to check for contamination. Any known asbestos-free material can be used as a blank, e.g. Ottawa sand.

Lab Duplicates: Reanalyze a second preparation of dried and sieved sample.

Reference Material or Method Spike: Because it is difficult to prepare known quantitative samples of asbestos samples, quality control is based on reanalysis of samples containing asbestos. A standard reference material can be prepared by an outside source such as RTI International if desired.

Prescribed Elements The following components of this method are mandatory:

1. Samples must be dried to constant weight, and sieved as described in method ASTM D7521-16.
2. The coarse, medium and fine fractions must be analyzed separately and be recorded as total asbestos. Any asbestos found in the >19 mm fraction or in bulk building material must be recorded separately.
3. All stated Performance Requirements and Quality Control requirements must be met.

Apart from these limitations, and provided performance requirements are met, laboratories may introduce modifications to this method to improve quality or efficiency. Laboratories must disclose to their clients where modified or alternative methods are employed.

References

1. ASTM D7521 -16 Standard Test Method for the Determination of Asbestos in Soil, 2016
2. US EPA 600/R-93/116, Method for the Determination of Asbestos in Bulk Building Materials, July 1993.

Revision History

Jan 6, 2017 First instance of method