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 in accordance with the BC Contaminated Sites Regulation (CSR). Contamination may be caused by construction, mine and manufacturing wastes, naturally occurring asbestos (NOA), and other sources.

Method Summary

The sample is dried and passed through two nested sieves (2 mm and 106 µm) into a collection pan. The <2 mm to 106 µm fraction (medium), and <106 µm fraction (fine) are analyzed separately using stereomicroscopy and polarized light microscopy (PLM), along with visual area estimation (VAE).

For application to the CSR, soil is defined as the <2 mm fraction. Results from the medium and fine fractions are summed together and reported as “asbestos (soil <2 mm)”.

This method does not require analysis of the >2 mm (coarse) fraction. However, if building materials or other foreign materials believed likely to contain asbestos are found in this fraction, the reported result should be qualified to indicate that such materials were found in the sample. Analysis of these materials could be necessary (by EPA 600/R-93/116 or NIOSH Method 9002) to determine compliance with the Hazardous Waste Regulation. 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.

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.

MDL(s) and EMS Analyte Codes

Analyte	CAS #	Approx. MDL	EMS Analyte Code
asbestos (soil <2 mm)	1332-21-4	0.5 %/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

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.

Minerals that have similar chemical or crystalline properties to asbestos may interfere and may result in a false positive. Minerals that may interfere include:

- Antigorite, picrolite
- Palygorskite (attapulgite)
- Halloysite
- Pyroxenes
- Sepiolite
- Vermiculite scrolls
- Fibrous Talc
- Hornblende and other amphiboles
- Clays associated with talc deposits
- Scrolled materials (lizardite)

To avoid misidentification, it is recommended to have literature references for the above minerals for comparison purposes.

Sample Handling and Preservation

Samples should be collected in rigid, sealable containers. Wide-mouth 250–500 mL plastic containers are recommended.

Stability

Holding Time: Samples should be dried to constant weight within 14 days from sampling date at 110 ± 10°C to minimize microbial growth. The hold time is indefinite for dried soils.

Storage: Ambient or refrigerated temperatures are acceptable.

Procedure

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

If requested, bulk building materials found in the >2 mm fraction can also be analyzed by stereomicroscopy / PLM, but must be reported separately.

Samples should be dried at 110 ± 10°C within 14 days of receipt. Record the weight of sample (or representative sub-sample) before drying and after achieving constant weight to enable calculation of moisture content. A subsample of at least 200 grams (before drying) is recommended. Samples with organic or soluble materials may be gravimetrically reduced before sieving using the procedure found in EPA 600/R-93/116.

It is recommended to perform the sieving in a ventilated fume hood. Arrange and secure the sieves in order of decreasing size (2 mm, 106 µm, and collection pan).

The entire portion of dried sample is poured into the top (2 mm) sieve. Isopropyl alcohol mist may be used to reduce static charge. 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 106 µm sieve (medium fraction) into a tared sealable container and record the weight. Repeat for the contents of the collection pan (fine fraction). The contents of the 2 mm sieve (coarse fraction) may also be retained for further investigation, especially if bulk materials are present. Between each sample, sieves should be thoroughly cleaned with hot soapy water, sonicated, rinsed and dried.

The 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 any asbestos is found in the fine fraction by stereomicroscopy, PLM is used to estimate the relative percentage by VAE or point counting or both. If asbestos is identified in the fine fraction at a level below 1%, perform a point count as described in EPA 600/R-93/116, by preparing eight separate slide mounts and examining at 100x until 400 points are counted. If no asbestos is found in the fine fraction, and if lower detection limits are required, TEM analysis is recommended (See ASTM D7521-16 section 11.6 Optional TEM Analysis of Fine Fraction for more information).

Calculations

Asbestos content of the soil (the medium and fine fractions) as determined by PLM analysis is calculated using the following calculation:

$$\text{asbestos (\%)} = \frac{[\%_F \text{ PLM PC} * W_F] + [\%_M \text{ PLM} * W_M]]}{W_F + W_M}$$

Where:

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

$\%_M$ = % Asbestos in the medium 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)

Reporting:

For each soil sample analyzed, report the total concentration of asbestos as determined by PLM in %.

If analysis of the > 2 mm fraction is requested (including bulk material, if present), the results are reported separately and not combined with the total asbestos calculation of the fine and medium fractions.

Reporting of results for each sieved fraction (medium and fine) is optional. Identification of the type(s) of asbestos present (e.g. Chrysotile, Amosite, Crocidolite Tremolite, Actinolite, and/or Anthophyllite) is also optional.

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.

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 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.		

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.

Prescribed Elements

The following components of this method are mandatory:

1. Samples must be dried to constant weight, and sieved as described in this method.
2. The medium and fine fractions must be analyzed separately and must be combined and reported as “asbestos (soil <2 mm)”.
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.

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

Sept 15, 2017 First version of method added to lab manual in support of 2017 CSR updates.