
Gravimetry/Asbestos Quantitation

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Gravimetry refers to a method of analysis in which the quantitative measurement is the weight of an object or sample.

1. Gravimetric Industrial Hygiene Analysis

The presence of nuisance dust and respirable dust in air are determined by weighing the dust collected on an air sample. The current NIOSH method requires that a 5 um pore size PVC filter be brought to standard temperature and humidity and then weighed before sample collection and then brought to the same conditions and weighed after sample collection. This assumes that the same conditions can be duplicated at those different times. An alternate method is to use readily available "double" filters: these are two 5 um PVC filters placed by the manufacturer in the same cassette, and guaranteed to weigh within 0.00002 gm of each other. Using these cassettes, there is no weighing prior to sampling, because the bottom filter can be used to determine what the top filter weighs.

2. Gravimetric Asbestos Analysis

The analysis of bulk asbestos samples using the polarized light microscope (PLM) is very accurate in identifying the types of fibers present, but can be biased or inaccurate in quantifying the percentage of certain fibers. The initial method of quantitation is by *calibrated visual estimate*, which, depending on how rigorously and how often the lab calibrates its analysts using known standards, can vary from an estimate good to +/- 0.5% in the 1-5% range to grossly over-estimating a 1% asbestos sample to contain 5% or more. Since quantitation is an important issue, Fiberquant pursues the rigorous and often option: one per every 100 samples our analysts perform is one of over 50 prepared standards of known asbestos concentration and varying matrix components. We feel this validates our estimated asbestos percentages.

When a friable layer of a bulk sample is estimated to contain <=1% asbestos, NESHAP requires that layer to be point-counted if it is to be considered to be negative. Point counting merely consists of the observation and identification of 400 points of sample. The asbestos percentage is the number of asbestos points divided by the total points. We perform point counting as a matter of course at no extra cost for those samples required to be point-counted by NESHAP, in order to keep our clients in compliance. Though point-counting produces a number with apparent precision, it is not precise. Assuming a random distribution of asbestos particles, we can calculate that at the 1% level (4 points), the 95% confidence range for the point count is 0.0-2.0%.

A method of quantitation which is much more precise and accurate than either estimation or point-counting is gravimetric asbestos analysis. The sample to be quantified is weighed on a 0.0001 gm or better balance. Then it is ashed in a furnace to remove any volatile or organic components and re-weighed in order to calculate the % volatile. Then it is digested in dilute hydrochloric acid to remove any carbonates (a common matrix material) and re-weighed. Finally, the residue is observed and any fibers identified on a transmission electron microscope. The % of asbestos in the residue is estimated on the TEM, and the total % asbestos calculated from the weights. This method is called the *semi-quantitative* method of gravimetry because the % asbestos in the residue is estimated. It is especially useful for samples having a lot of volatiles and carbonates, such as mastics, floor tiles, and textures. A typical floor tile 95% confidence range for such an analysis would be 5.2-5.8%. There is also a *fully-quantitative* method in which a known weight of the residue is suspended in liquid, filtered, and each observed asbestos fiber measured. Provided enough asbestos fibers are seen, and their sizes are representative of the whole, this method is potentially more precise than the *semi-quantitative*, but costs four times as much as the *semi-quantitative* method. It would be best used for materials that are not readily reduced by ashing or acid and that also have relatively uniformly-sized asbestos fibers.