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Respirable Asbestos Monitoring and Assessment

RESPIRABLE ASBESTOS

The key risk to human health arising from Asbestos exposure is when free fibres are suspended in air and inhaled into the lungs. Breathing asbestos fibres can cause a range of diseases, including pleural plaques, mesothelioma, lung cancer and asbestosis.

This risk is greatest for respirable fibres, which are the free fibres of width <3 µm and >5µm in length, with an aspect ratio of 3:1 or higher. These fibres penetrate deep into the lungs and accumulate throughout a person's life. Ambient or background air usually contains between 10 and 200 fibres every 1,000 litres (or cubic metre) of air, so we breathe in low levels of asbestos every day. Although autopsies on unexposed individuals have revealed millions of fibres per gram of dry lung tissue, accumulated over a lifetime, exposure to respirable asbestos fibres does not always lead to asbestos-related diseases. A range of factors affect the incidence of these diseases, such as the level and duration of exposure, length of time since first exposure, the fibre type, and concurrent exposure to tobacco smoke and other carcinogens.

Asbestos-related diseases can be extremely debilitating and are often fatal. Monitoring and assessment of exposure levels is essential for controlling and minimising risks.

ASSESSING EXPOSURE

The most widely accepted sampling and analysis method in Australia for the assessment of asbestos is the NOHSC Membrane Filter Method (MFM). This method is used to assist in monitoring the effectiveness of control measures for preventing exposure to airborne asbestos fibres, and in determining worker exposure to airborne asbestos fibres. The MFM does not distinguish between the different types of fibres, however it provides an upper limit for exposure to asbestos and thereby serves as a conservative measure for risk assessments.

Where the MFM indicates exposure risks, more detailed analysis may be conducted to confirm asbestos fibre types and concentrations.

METHOD INFORMATION

EA205: Membrane Filter Method for Estimating Airborne Asbestos Fibres
LOR: 10 fibres/100 Fields

THE MEMBRANE FILTRATION METHOD

Assessment of fibre concentrations in air is carried out by sampling a measured volume of air through a membrane filter with a sampling pump. In the laboratory, the filter is transformed from an opaque membrane into a transparent, optically homogeneous specimen. The fibres are then sized and counted, using a phase contrast microscope and eyepiece graticule. Results are reported as the number of fibres per 100 fields on the filter, which may be converted to fibres per millilitre of air using the measured volume of air sampled.

REGULATORY REQUIREMENTS

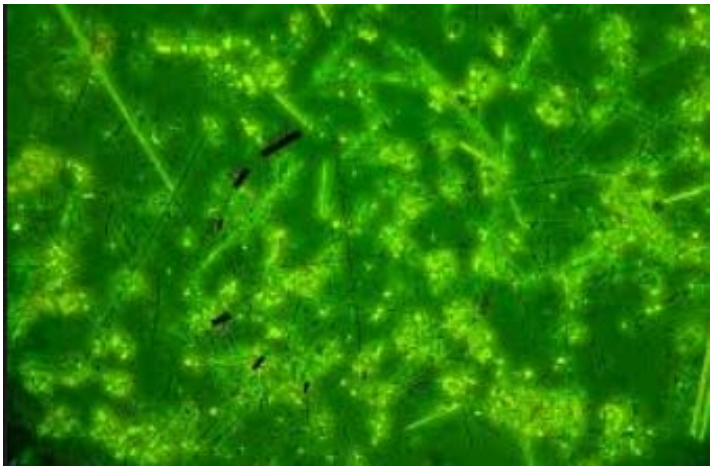
One of the main drivers for monitoring respirable fibre levels in Australia are the national occupational health and safety regulations. There is a risk of workers being exposed to asbestos in the course of their work, particularly in the construction, mining and industrial sectors. People exposed to asbestos may inadvertently transfer this risk into their homes, by carrying asbestos fibres on their clothing, boots, skin and hair and tools.

Under Regulation 476(1) of the National Work Health and Safety Regulations 2011 (Cth) (WHS Regulations), licensed asbestos removalists must provide immediate notice if respirable asbestos fibre levels are recorded at the asbestos removal area at more than 0.02 fibres/ml. This requirement applies when carrying out any Class A (friable) asbestos removal work. Other workplaces may also need to assess fibre concentrations in air, to ensure a safe work environment is maintained for all workers.

Consensus on and adherence to an agreed method for assessment of respirable fibre concentrations in air is essential to ensure consistent interpretation of exposure standards and criteria. The NOHSC MFM provides this accepted standard and allows results to be compared between laboratories and with legislated exposure limits.

ASBESTOS IN AIR MONITORING

Different types of monitoring[1] may be required, depending on the context and goals of assessment. Monitoring may be used to assess exposure, control risks during asbestos related work, clear a site for use after a cleanup, or to assess background levels prior to commencement of work that may disturb asbestos.



Amosite under a Phase Contrast Microscope

EXPOSURE MONITORING

Exposure monitoring involves taking air samples within the breathing zone to determine a person's risk from, or level of exposure to, airborne asbestos fibres. Exposure monitoring is designed to estimate a person's exposure to asbestos, so that it may be compared with the national exposure standard.

CONTROL MONITORING

Control monitoring means air monitoring using static or positional instruments to measure the level of airborne asbestos fibres in an area during work on asbestos containing material. The results of control monitoring cannot be used to compare with the national exposure standard for asbestos.

CLEARANCE MONITORING

Clearance monitoring means air monitoring using static or positional samples to measure the level of airborne asbestos fibres in, and immediately surrounding, an asbestos removal work area after work on asbestos containing material has been completed and the area decontaminated. An area is considered to be 'cleared' when the level of airborne asbestos fibres is measured as being below 0.01 fibres/ml.

DISTINGUISHING BETWEEN RESPIRABLE FIBRES AND ASBESTOS

The MFM Fibre Count does not distinguish between the different types of fibres that are detected using this method. As well as the various mineral forms of Asbestos, other fibres detected may include organic fibres from natural and synthetic sources (eg nylon, rayon) and synthetic mineral fibres (SMF) (such as glass wool).

For exposure monitoring, in the absence of other technically convincing information, all particles complying with the defined geometric conditions are considered to be respirable fibres and counted as such. This ensures that under-estimates of asbestos exposure are minimised. This rule also applies to control monitoring but with the knowledge that it frequently over-estimates the asbestos concentration. Results from the MFM procedure can also be used for epidemiology, however, for epidemiological purposes, more complex analysis may be required to achieve a complete understanding of occupational exposure. To provide technically convincing information, electron microscopy (SEM or TEM) may be used to determine the percentage of asbestos fibres relative to the total fibres count estimated by the MFM. This information is particularly important when the MFM is used in environments containing a significant proportion of non-asbestos fibres.

REFERENCES

NOHSC 3003 (2005) Guidance note on the membrane filter method for estimating airborne asbestos fibres 2nd Edition

[1] *Queensland Gov website www.deir.qld.gov.au*