

THE DEFINITION OF AN ASBESTOS FIBRE

When the United Kingdom Asbestosis Research Council was founded in 1957, its main objective was to carry out research into the causation of the pulmonary fibrosis of the lung known as asbestosis. The existence of protein coated asbestos fibres, known as asbestos bodies, in the lungs of asbestos workers had been known for some considerable time, and it was noticed that such bodies "aged" in the lung, so that the protein envelope disintegrated, releasing the fibre core, which itself often broke up in the process. This breakdown of the asbestos body was considered at the time to play some part in the development of disease.

In sampling airborne asbestos, it had been customary up to this time to count all particles, mother rock and fibres, visible in an optical microscope at 800 to 1000 x magnification. The medical experts had noted, however, that asbestos bodies were only formed on true fibres generally in the length range 10 to 50 microns, and the scientists were asked to provide a sampling and measuring system which would include all fibres within this range. To give adequate cover at both ends of the scale, it was decided to provide counts of all fibres whose length was

between 5 and 100 microns, and it was eventually found that this could best be achieved by collecting on a membrane filter and counting on a phase contrast optical microscope at about 500 x magnification. The development of the method was reported by me at the New York Conference on the Biological Effects of Asbestos in 1964 and published in the Annals of the New York Academy of Sciences in December, 1965.

At the time, we were largely concerned with chrysotile asbestos, and it was necessary to give guidance to those engaged in counting to distinguish between particles of serpentine rock and what could be regarded as fibrous structures. It was found that a suitable convention to adopt was to regard as a fibre only those particles with a length/diameter ratio (aspect ratio) of at least 3 to 1, but it should be emphasised that this choice was purely arbitrary. The definition of a fibre for counting purposes, therefore, became—"a particle of length/diameter ratio of at least 3 to 1 and at least 5 microns in length." Later an upper limit of 3 microns was placed on the diameter, because fibres of larger diameter than this were outside the respirable range.

A delegation from the U. S. Public Health Service under Dr. L. G. Cralley visited the Asbestosis Research

Council in 1963 and were given details of the method, which they subsequently adopted, with minor modifications. In 1970, a meeting of the Asbestosis Subcommittee of the Permanent Commission and International Association on Occupational Health recommended the membrane filter method, fibre definition and all, as the standard method for measuring occupational exposure to airborne asbestos.

Modern thinking now believes that asbestos bodies play no part in the asbestos lung diseases, but it is the uncoated fibres which are also present and remain in the lung which are responsible. It is comforting to know, however, that the fibre definition was well chosen, because it has been recently shown that the lung clearance mechanisms can deal with fibres shorter than 5 microns long and definitely cannot deal with those larger than 15 - 25 microns.

It must be emphasised that all of the foregoing was concerned with inhalation of asbestos dust and the control of asbestosis and its associated lung cancers. The measuring system was developed before mesothelioma was recognized as an asbestos induced disease. Its relevance to the question of ingestion of asbestos is extremely doubtful, except that the body clearance mechanisms appear to be able to deal with short fibres and particles, but have difficulty with the longer fibres. It seems to me to

be a pre-requisite to carcinogenesis that the causative agent should remain in the body for a period of time.

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BB 0015815