Health hazards of asbestos

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Inhaled fibres of asbestos can cause fibrosis of the lungs and two kinds of cancer. Protection of asbestos workers calls for monitoring and controlling their working environment and linking these records with records of their health

HISTORICAL

Asbestos was the first inorganic fibre to be used in composites. More than 4000 years ago clay pots in Finland were strengthened by adding anthophyllite fibres[1]. In classical times asbestos cloth was used to preserve the ashes of the eminent. The oldest known piece of asbestos cloth from the New World, dating from about 1740, is a small purse made of tremolite in the Sir Hans Sloane collection of minerals in the British Museum (Natural History).

The modern asbestos industry is about 100 years old, starting nearly simultaneously in Canada and the USSR, but it was not until 30 years later that the first medical reports appeared in France and England, indicating that there might be a specific type of damage to the lungs following inhalation of the dust. By the late 1920s it was clear from surveys made in this country and in USA[2,3] that a high proportion of older workers in the asbestos textile industries were becoming severely disabled by a specific type of chest disease due to the dust. This was named asbestosis.

DISEASES CAUSED BY ASBESTOS DUST

Research carried out in the 1930s, supported by the greatly expanded investigations during the last 15 years into the types of disease caused by asbestos, now provides a much clearer picture of the specific hazards and how damage to health can be avoided in the future. Table I lists the diseases.

Table I Diseases caused by asbestos dust

Asbestosis	Fibrosis of lungs
Cancer	Bronchial (lung) Mesothelioma
Asbestos Corns	Skin

Asbestosis

In asbestosis the dust causes scarring and thickening of the tissues of the lung. The two parts particularly affected are the finest air passages (respiratory bronchioles) where they branch into the terminal air sacs (the alveoli), and the surface of the lung (pleura). The thickening of the tissues caused by the asbestos dust affects the function of the lung in three ways. The volume when fully inflated at the end of a full inspiration is less than normal. The tissues become stiffer than normal so that the compliance is reduced. The thickening in the alveolar walls, when the disease is extensive, also reduces the gas transfer for oxygen, so that the blood leaving the lung is no longer fully saturated with this gas. The transfer of carbon dioxide from the blood to the air in the lungs is not, however, appreciably affected. The reduced oxygen transfer is partly compensated for by an increase in the frequency of breathing so that the subject notices breathlessness on slight exertion. These alterations of lung function are used to assist in diagnosis of asbestosis and measure the severity of the damage.

Asbestosis takes a number of years to develop, even under very dusty conditions, but once established it is a progressive disease not materially affected by avoiding further dust exposure. The less the dust exposure, the longer interval before the onset of disease, the less its severity; and the less chance of being affected. This dose response relationship is used to fix the acceptable dust levels – threshold limit values – for those working with asbestos. The article by Holmes in this issue describes how these standards are applied in practice. Prevention by avoiding exposures to a dangerous quantity of dust is an essential step towards the safe use of asbestos.

Asbestos cancers

Some years after the recognition of asbestosis as an important problem in the asbestos textile industry, articles began to appear in the medical journals[4] suggesting an association between asbestosis and lung cancer. A survey in 1955 firmly established that those who had worked in the asbestos textile industry before the improvements in dust control, introduced in the 1930s, had a 10-fold excess risk of developing lung cancer[5]. The survey, however, also indicated that the improvement in dust control introduced at a particular factory after 1933 had very materially reduced the risk. Later surveys at this factory have confirmed this[6].

The lung cancers seen in asbestos workers are similar to those caused by cigarette smoking. Recent research indicates that there is likely to be a synergistic effect of cigarette smoking and exposure to asbestos dust[7]. The precise quantitative inter-relationship between asbestos, cigarettes, and other factors is not fully established, but present evidence indicates that those who smoke cigarettes and are exposed to asbestos dust have a risk of developing lung cancer at least fifty times greater than non-smokers who are not exposed to asbestos dust.

In the last 15 years there has been much new information about the link between exposure to asbestos and another previously very rare type of cancer affecting the

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