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ENVIRONMENTAL CONTROL OF ASBESTOS

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ABSTRACT

This paper outlines the formation of the Asbestosis Research Council in the U.K., and illustrates how through very early legislation (1931) techniques of dust control were developed. It records the fact that much of this experience is available in control and safety guides issued by the A.R.C.

The relevant medical information is briefly summarized. After outlining the techniques of dust control used both for personal sampling and for monitoring works a description is given of the complete re-circulation of the air system in an asbestos textile plant. This shows the reliability of dust control and is important from a fuel economy point of view.

The first and most commonly known disease associated with asbestos is asbestosis which is a fibrosis of the lung very similar to pneumoconiosis and silicosis. This may be caused by exposure to any form of asbestos, but normally one would have to be exposed for several years to fairly high levels of dust well over the current U.K. standard before developing this disease. Even with gross over exposure not all people will develop asbestosis. Asbestosis takes up to 17 years to develop from initial exposure.

The second disease of lung cancer is one which is more often than not associated with asbestosis and those suffering from asbestosis stand a high risk of developing this later in life. The risk is increased if smoking is involved.

The third disease is mesothelioma. This is a cancer of the outer layer of the lung or the diaphragm. It is most usually associated with blue asbestos and exposure in this case may be of shorter duration. Weeks rather than years, and at relatively low levels. This disease on average takes from 35–45 years to develop but once developed is usually terminal in the space of 2–3 years.

In the case of asbestos workers in the U.K. regular examinations are carried out. These would cover a two-year cycle as follows: lung function test; examination by Government doctor; chest X-ray examination and an examination by Company doctor.

With proper observation of the regulations no worker should be put at risk and the asbestos related diseases will become part of history. This is illustrated

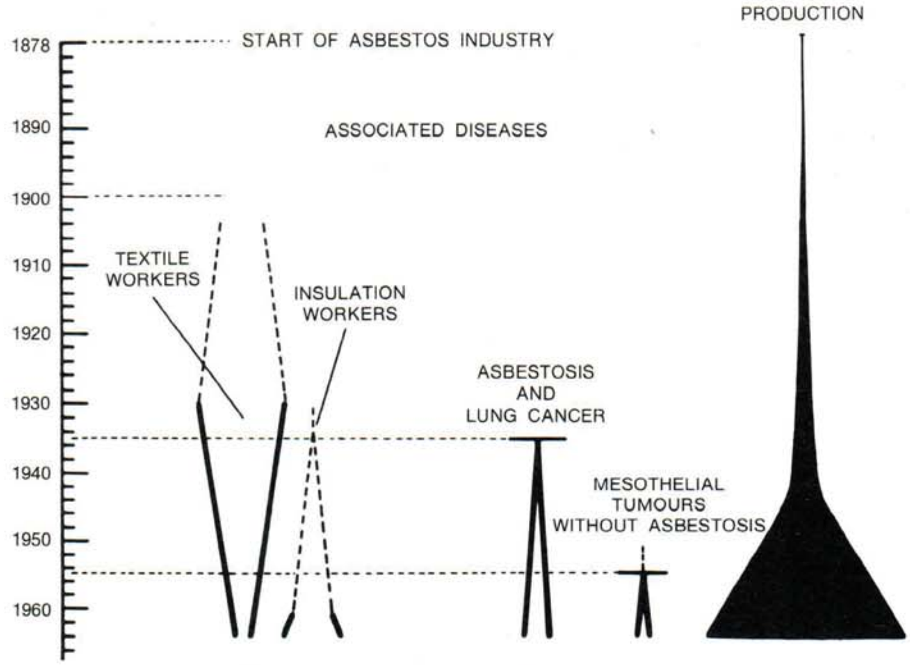

FIG. 1 – Asbestos related diseases in the U.K.

by Figure 1, which shows the incidence of the asbestos related diseases in the U.K. On the right of the figure the use of asbestos expanding over the later years can be seen. The incidence of asbestosis in textile workers started to diminish after the introduction of the 1931 regulations. The disease has been brought under control. In the case of insulation workers, however, where no controls were applied until 1969, there has been continuing expansion of the number of cases. However, we are confident that in the 1980's this will follow the same pattern. Mesothelioma, however – which takes longer to develop, will probably stay around the same level until the turn of the century when it too will diminish.

Whilst there has been an expanding use of asbestos within the industrialized nations over the whole of the 20th century, few countries will have had legislation as long as the United Kingdom. Here the first regulations appeared in 1931 and covered certain specified parts of industry, particularly the asbestos textile industry.

As a result of this the U. K. manufacturers of asbestos textiles have been the pioneers in establishing methods of dust exhausting fibrous materials and indeed of measuring airborne fibres. The Asbestosis Research Council was founded in 1957 and over the intervening years has recorded and up-dated much of this basic information. Copies have been made freely available to all who handle or process asbestos materials. Following on the 1931 regulations new and more wide reaching regulations were brought in 1969.

Carding is the dustiest of the textile operations and ideally one should enclose carding operations on three sides and above and provide sufficient airflow to remove dust from both the key points on the card and from the enclosure itself (Figure 2). Such a system will need approximately 3.5 m^3/sec to keep the working environment at the appropriate level of less than 2 fibres/ml.

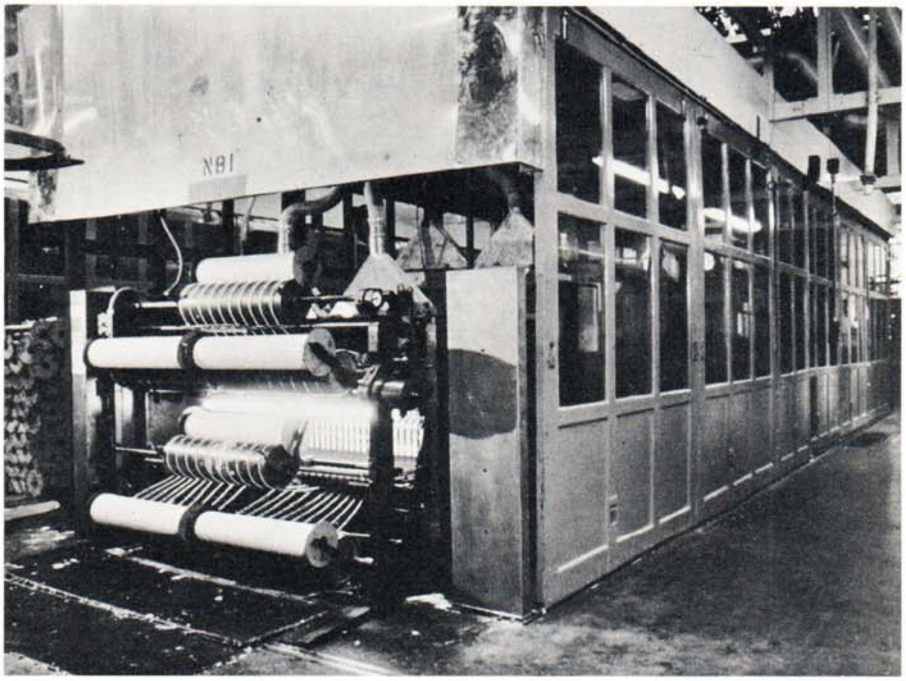

FIG. 2 – Carding in textile operations.

Ideally such a system will incorporate automatic return of waste which falls from the card. Naturally less dusty operations will need a lesser volume of air, but the air flow must be maintained at the levels indicated in our Control and Safety Guides if one is to adequately move the fibrous material along the duct work.

Figure 3 shows a typical exhaust fitted to an asbestos loom. There is no need to exhaust the creel holding the yarn for the movement here is slow and although one gets some coarse material falling out, respirable dust is not created. However, in the fast moving parts of the looms exhaust is needed. Fixed heads to the rear and moving heads at the front of the loom.

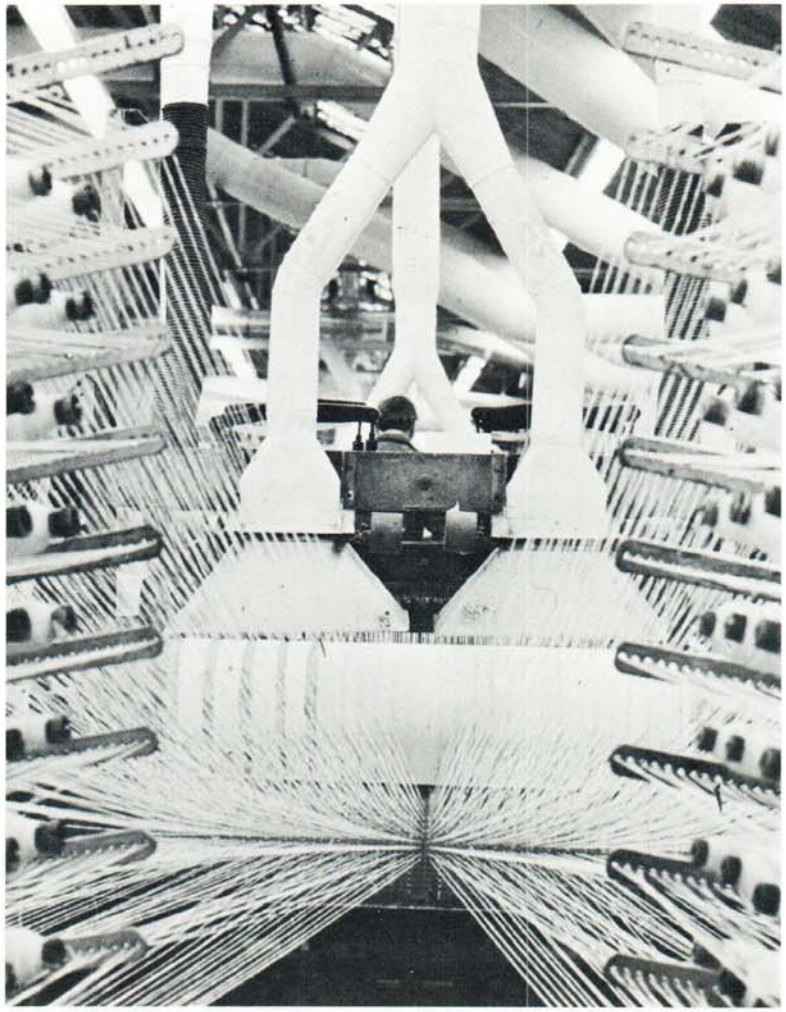

FIG. 3 – Typical exhaust fitted to an asbestos loom.

Under the U. K. regulations it is obligatory to provide dust exhaust if this is practicable, but there are situations where this is not possible – for example in the maintenance of dust exhaust equipment and under these circumstances an approved mask must be provided and worn. These are listed in Control and Safety Guide No. 1.

The dust laden air is taken to a filtration system as indicated in Figure 3. One should not be put off by this vast exhaust system. Obviously for smaller units and for less arduous duties less sophisticated plant is necessary.

Now obviously if one is removing large quantities of air from a factory one must replace it. Normally one puts in about 10% more air than one takes out to keep a slight positive pressure which assists in the operation of the exhaust system. The air comes through plenum heaters and is distributed throughout by ducts and diffusers.

Figure 4 shows the different types of asbestos in common use. Amosite fibre accounts for 3–4% of world production and is used mainly in insulation board. Short bundles of fibres are very brittle and cannot be used for textile production.

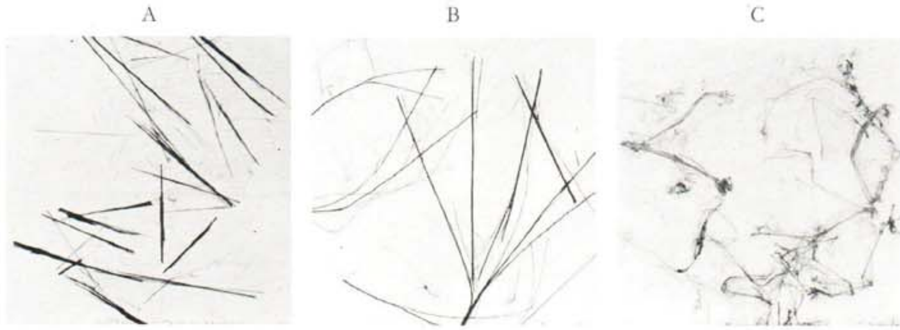

FIG. 4 – Types of asbestos in common use: A – amosite fibres; B – crocidolite or blue asbestos; C – chrysotile or white asbestos.

Crocidolite or blue asbestos makes around 3–4% of world production but is not now used in the U.K. because of the stringent regulations – one tenth that applied to white asbestos. One should note the long needle like fibres. The fibre is very strong and very resistant to acids. Chrysotile or white asbestos is the most commonly used fibre amounting to over 90% of world production. It is present in asbestos cement products and the better grades are used for textile production. One should note the curly nature of the fibre. The fibre shape determines the ease of rendering the material airborne. Once chrysotile has settled out it tends to agglomerate and one would normally have to do some work on the material to break it down into the respirable range. On the other hand the straight crocidolite fibre will not agglomerate but will be readily rendered airborne by currents of air. This is one of the reasons why this material is considered more dangerous than white asbestos.

The standard method of measuring airborne dust is the membrane filter method which was developed and refined by the Asbestosis Research Council in its early days. Before that there was no satisfactory method of measuring such dust. This test comprises two parts – the first is the sampling which can be done manually or by means of this unit used here as a personal sampler (Figure 5). The membrane is carried in this case on the lapel of the worker but the same unit could be used for static sampling.

FIG. 5 – Personal sampling unit.

FIG. 6 – Unit for assessment of dust levels in a major installation.

Given the appropriate equipment one can take many samples simultaneously but each membrane has to be carefully cleared, mounted on a slide and the fibres in the appropriate size range (5 – 100 μm) counted over several fields of vision. This takes time but is the most accurate method so far established.

For controlling a major installation a more rapid method of assessing dust levels is desirable. Such a unit is shown in Figure 6. The air is drawn through a light chamber. The light which is reflected from each particle is picked up by a photo electric cell and the particles are sized. The number of particles in each size range is seen visually on the digital display and the results are printed out every ten minutes. With this unit all particles are measured but nevertheless the unit is ideal for monitoring an asbestos textile plant.

Should an abnormal reading be obtained the environmental engineers can be alerted and the system corrected. The monitoring unit would stay in position until a satisfactory reading was obtained.

With the improved systems now available it is possible to re-cycle the air in an asbestos factory. Such a system which was commissioned earlier this year in the U.K. operates in a modern asbestos processing shed with a false ceiling through which the exhaust systems are fed to the equipment. The false ceiling prevents dust accumulating overhead and thus reduces the need for difficult overhead cleaning.

The air from the equipment passes through the filter gallery and passes through the secondary and tertiary filters through an air conditioning plant and back into the work room (Fig. 7).

Louvres can control the amount of returned air and the amount of fresh air drawn into the system. This will be dependent on the temperature of the outside air.

The secondary filter is made from a felted material supplied in a roll form and can be fed forward as required.

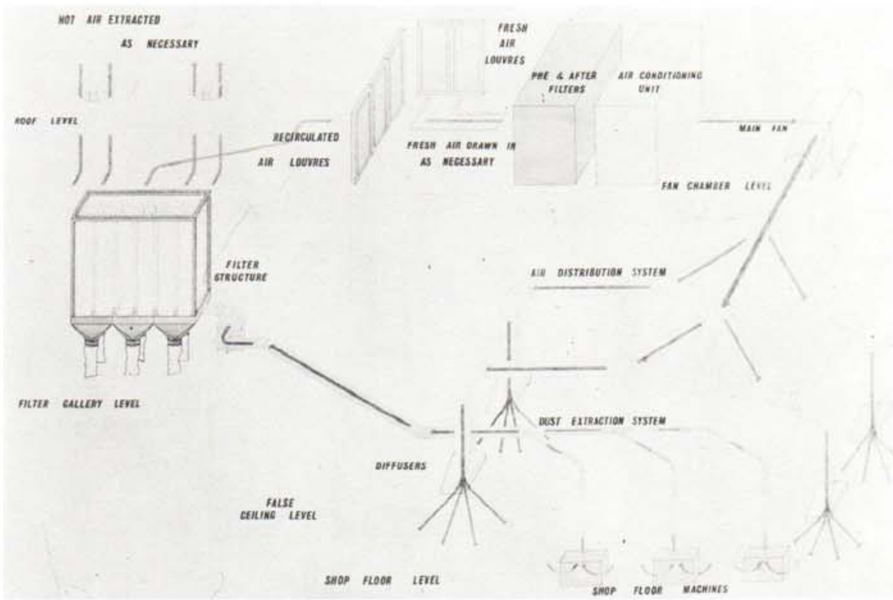

FIG. 7—Re-cycling of the air in an asbestos factory.

Figure 8 shows the outside of the final filter and a single unit from which the whole filter is constructed.

There are eight points at which air is sampled. The unit selects a point in sequence, vents the duct and takes a reading. Provided this is below the control level (in this case 0.2 fibres/ml) then the selector passes to the next sampling point. If, however, the reading was above the level, a further sample would be

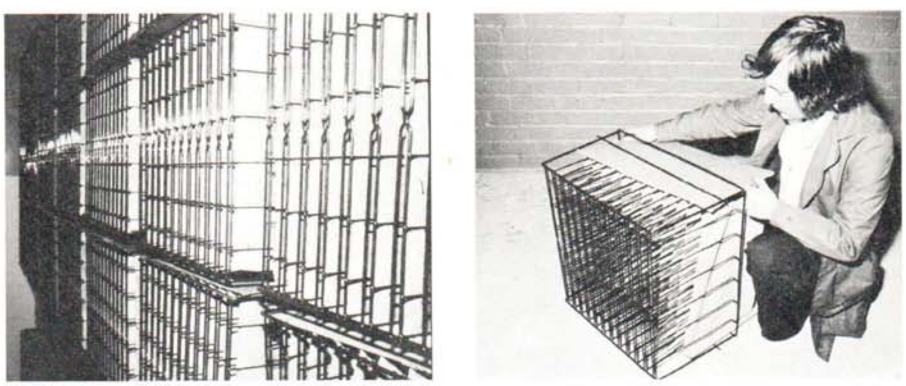

FIG. 8—Outside of the final filter (left) and a single unit (right) from which the whole filter is constructed.

taken. If this were still above the predetermined level, a warning would be sounded and fresh air would be brought into the system and the return air vented to atmosphere.

The diagram (Figure 9) shows the air conditioning unit which is reasonably standard in design.

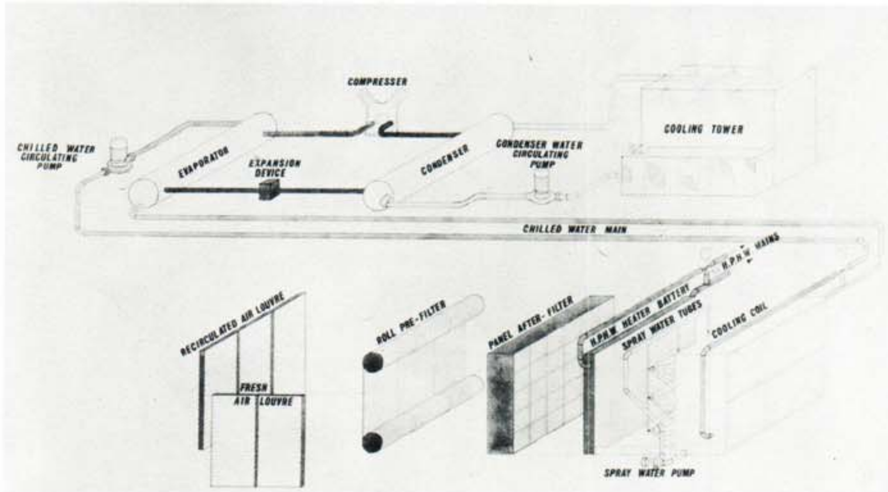

FIG. 9 – Diagram of the air conditioning unit.

Such a re-circulatory system is extremely important from a fuel economy point of view and as such will be of particular interest to those living in areas where the winter temperatures are low.

It is hoped that in this paper I have stimulated interest in the methods of dust control which can be used to reduce and ultimately eliminate the dangers to health which have been a major problem in the asbestos industry. My Council will be pleased to provide additional information to anyone within the industry.