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- I. Occurrence of Pulmonary Fibrosis and other Pulmonary Affections in Asbestos Workers
- II. Processes giving rise to dust and methods for its suppression

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Each of these has its particular sphere of utility, and the particular indications for their adoption are put forward *inter alia* in the recommendations below.

RECOMMENDATIONS.

(1) Application of Efficient Localised Exhaust Ventilation at dust-producing points.

This measure, of the greatest importance where manufacturing and incidental processes occasion escape of dust not controlled by enclosure or other measures, is necessary for:—

(a) Dust-producing machines, e.g.—

(i) Crushing, disintegrating, teasing and other opening machines; sieving machines; fibre grinding machines; dry mixing machines; rolls fed with dry mixings.

(ii) Carding machines (to suppress dust from cylinder and doffers, caused by stripping and grinding, in addition to that produced by carding); card side waste exhaust machines; looms for dry weaving; stripping and grinding machines; other textile machines, if the dust evolved renders this preventive measure necessary.

(iii) Sawing, grinding, trimming, polishing and other abrading machines, used on dry asbestos products.

(b) Feeding and delivery ladders, or other conveyors, at machines or other plant; feed hoppers at elevators; bagging ladders; feeding of dry material at wet mixing machines.

(c) Chambers, containers, "cyclone" hoppers, or other enclosed space into which fiberized asbestos or mixtures containing it are delivered, or pass.

(d) Work benches, e.g. for mattress making, waste sorting.

(e) Various hand operations, e.g., sack emptying and filling, weighing, mixing.

This is the principal measure hitherto adopted, and is probably that most generally applicable. It has been applied to some only of the above machines, and appliances, but not to hand work. The methods of applying the exhaust draught, and other associated factors, are becoming more effective, but there are few fully satisfactory plants. Special difficulties remain to be overcome in some cases, e.g., looms, mixing, mattress making. If not surmounted, an alternative, viz., general ventilation of a high standard applied so as to draw the dust-laden air away from the worker, should be provided.

(2) Substitution of enclosed mechanical methods for hand conveyance, and for dusty hand work generally.

This measure—

(a) avoids depositing material in chambers, intermediate filling and emptying of sacks or skips, hand feeding of machines, and other incidental hand work;

(b) permits of final filling and weighing, under the least dusty conditions, of materials for dispatch;

(c) renders exhaust draught more effective, or, in some cases, unnecessary.

It is already employed to some extent, and its further application, wherever possible, is greatly to be desired.

(3) Effective enclosure of dust-producing machines and plant.

(a) To prevent escape of dust not controlled by exhaust draught, or

(b) to render its application more efficient.

(4) Substitution of wet methods for dry.

To reduce the dust given off in certain processes and work, e.g.,

- (a) a considerable amount of weaving;
- (b) mattress making, by wetting the covers before filling, and by frequent wetting of floors and benches;
- (c) final sawing, and other machine processes, in asbestos-cement sheet and tile factories, before the prepared material has had time to dry;
- (d) works' cleaning, by damping floors and benches, before brushing or sweeping.

This measure might be adopted to a greater extent than at present.

(5) Elimination of certain dust-producing appliances.

Certain appliances are used in a few works, sometimes with a measure of precaution, but which emit much dust, difficult or impossible to control by efficient enclosure or exhaust draught. They should not be retained unless effectively modified.

- (a) exposed doffer brush at carding machines;
- (b) card side waste exhaust machines, delivering under pressure;
- (c) certain willows and tappers, particularly old machines.

(6) Abandonment of Settling Chambers in Manufacturing Processes, to the utmost extent.

(7) Effectual separation of processes to prevent unnecessary exposure to dust.

New factories should be laid out so as to avoid exposing workers to risk from processes upon which they are not engaged. In particular, there should be effectual separation of—

- (a) opening, carding and weaving, from each other, and from any other process;
- (b) spinning, doubling, plying and similar processes, from work not causing dust;
- (c) mattress making, from all other work;
- (d) chambers, containing fiberized asbestos in bulk, and dust settling chambers and apparatus, from any workroom.

The separation of mattress making should be adopted in existing works, and other separation referred to, as far as practicable.

(8) Wide spacing of dust-producing machines in new factories and, as far as practicable, in existing works.

This measure would bring about permanent reduction of dust concentration in the air of the workroom as a whole, and provide improved cleaning facilities.

(9) Use of sacks of close texture material for internal work.

(10) Efficient cleaning system with wide use of vacuum methods. (See also (4).)

(11) Storage of asbestos and other goods to be outside workrooms.

(12) Exclusion of young persons from specially dusty work.

Note.—Particular preventive measures of a medical nature are referred to in Part I, where also the limited value of respirators as a safeguard in this industry is briefly discussed.

NOTE ON EXHAUST VENTILATION IN ASBESTOS WORKS.

Some exhaust plants are carefully designed and reasonably efficient, but some are ill-designed and inefficient; others, again, do not effect removal of dust to a sufficient extent. The draught may not be applied as closely as possible to the dust-producing points, or may be too weak. The emission of a visible dust cloud at a point where exhaust is applied is a clear indication of inadequacy.

Extensive alterations of existing plants may produce serious loss of efficiency. Exhaust provision for new machinery and processes should, therefore, generally speaking, be made independently. While advantages result from dealing with many dust-producing points, by a single exhaust plant, a number of self-contained plants, with independent fans and settling apparatus, is often more effective.

Exhaust ventilation applied on a large scale entails continuous removal of a considerable volume of air from the room. The supply of fresh air must be ample or the efficiency of the exhaust ventilation may be reduced. In winter, the workers are liable to bring about this result by closing windows and doors. Plenum ventilation capable of supplying the volume extracted, the incoming air being warmed, may therefore be desirable, where extensive exhaust plants are installed.

Efficiency of an exhaust ventilation plant may be greatly reduced by inefficient dust-settling methods. Each fan should discharge into an independent settler. Settlers adopted in asbestos works include cyclones, large chambers connected with cyclones, large chambers enclosed with sacking or other filtering material, and bag filters. Cyclones and chambers are usually well separated from workrooms. Bag filters are now being commonly adopted, for small installations. These filters and "balloons" are sometimes placed inside workrooms, a bad practice. They are best placed in freely ventilated rooms, effectively separated from workrooms.

Filtering fabrics for settling dust gradually become clogged; and as this effect increases the exhaust plant becomes more and more inefficient, the volume of air moved by the fan being reduced. Such settlers must therefore be kept clean. The usual practice is to beat the filtering material. Arrangements for shaking bags from outside, or automatic shaking apparatus are not provided. Asbestos dust does not appear to be so difficult to detach from suitable filtering material as some dusts, but much dust is produced in beating. Efficient shaking arrangements, avoiding this exposure, should be provided if this method of settling is retained. Some firms strongly support the view that it should be given up because of the difficulty of maintaining the exhaust plant at the highest efficiency. The matter merits careful consideration. In particular, the efficiency of the exhaust plant should be kept under constant observation by a responsible person.

Cyclones should be of adequate dimensions. The combination of chamber and cyclone is used extensively, the fan discharging the air into the chamber, in which the cyclone inlet is connected. The efficiency of this arrangement should remain practically constant.

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14th March, 1930.