

by an unduly high incidence of tuberculosis.

Other dusts and silicate compounds so far studied produce, at most, only a mild non-progressive reaction in the lungs, provided there is no significant amount of free silica in their composition. While not serious clinically, such conditions may give rise to considerable litigation.

Adequate statistics on morbidity and mortality from occupational disease, to serve as a basis for effectively focussing the efforts to study and control dust diseases of the lungs, are non-existent.

In concluding this section, the following quotation from a court decision in Wisconsin is pertinent (Schaefer v. Industrial Commission, 265 N. W. 390 (Supreme Court, February, 1936)):

"... It will be necessary to distinguish carefully between medical or pathological disability and actual physical incapacity to work. The medical experts apparently ignore this distinction, and so increase the difficulty of arriving at a just result under the law."

Preventive Engineering

It would be needless repetition to discuss in a technical way the engineering phases of dust control. All interested are referred to "Industrial Dust," by Drinker and Hatch, which deals comprehensively with the subject; U. S. Bureau of Mines Information Circulars 6840 and 6848, by Harrington and Davenport, a review of literature on "Prevention of Dust Diseases"; U. S. Public Health Service Bulletin 217, by Bloomfield and DallaValle, on "The Determination and Control of Industrial Dust"; Report 29 of the American Standards Association; and to the U. S. Bureau of Mines for a list of approved protective devices.

It may be said that, in general, the engineering specialist can and will devise the necessary equipment to meet the conditions specified to him. But the setting of limits of permissible dust concentration is not his but the physician's responsibility. The engineer is concerned with keeping dustiness to or below the limits at present considered satisfactory.

Methods of Determining Dust

Some dusts (as lead) are determined by chemical methods and the concentra-

tions in air are recorded gravimetrically as milligrams per cubic meter. Others (as silica, where size is a factor in determining dangerous particles), are given by count. Neither method gives the whole story, but in both cases it may be possible to secure the information necessary for the purpose.

In one of the reports referred to earlier, there occurs this statement: "There is no doubt in the mind of anyone familiar with the present dust-sampling and dust-estimating methods that they will be amended and changed from time to time. At the present writing we would advise the use of the simplest possible procedures where dust control alone is in question. If one wishes to obtain values which can be compared with published data, it is generally necessary to copy with considerable care the technique used in the original case. This is another way of admitting the annoying fact that results by one method are usually not comparable to those obtained by another method."

In another place, the report says: "It is very doubtful if any useful purpose is served by determining accurately extremely dense dust concentrations—the only excuse for such data is to show the skeptic that the workplace is much dustier than it should be."

"It is probable that any sampling procedure which fixes concentrations in groups 100 per cent apart is sufficient and that the results of any attempts to come closer to the concentration at the moment of sampling are simply misleading. Thus ranges such as 0-5, 5-10, 10-20, 20-40, etc., suffice for dust control."

As dust particles in the lungs are of the order of 1 micron, with rarely a particle over 10 microns, dust control for hygienic reasons should be aimed at particles in the size range found to have been breathed and retained. Again quoting: "... if one could avoid use of the dusts of 1 micron or less or exclude them from the dust which passes a 325-mesh screen, nearly all dust diseases would be eliminated."

Dust Elimination

Obviously, it is better, when possible, to purchase equipment already supplied with exhaust hood, rather than to have to worry to fit one to equipment not designed to be hooded. Thus the responsi-

bility for potential efficiency is upon the manufacturer.

There is available comparatively little information upon which to base the scientific design of hoods. The Preventive Engineering Committee of Air Hygiene Foundation includes in its recent report a table of minimum air velocities to capture certain industrial dusts (for use in granite cutting, grain elevators, paint spraying, sand pulverizing and electric welding).

For protective equipment such as dust respirators, air supplied masks, sand blast helmets, and goggles, very complete information is available, because of the work of the U. S. Bureau of Mines, the Bureau of Standards, and the American Standards Association in preparing and issuing specifications to be met if the equipment is to be used under conditions where approval is necessary.

Of course, all agree that, where possible, dust should be controlled at the source, and protective equipment used where this action cannot be accomplished.

Permissible Dustiness

There are various figures that have been and are being used as guides to permissible dustiness where free silica is present. It should be noted that many of the data were not determined as the medical requirement, but as being attainable in good practice and apparently satisfactory from a safety standpoint.

In South Africa the figure is 1 milligram per cubic meter (or 300 particles per cubic centimeter, or approximately 8.5 million per cubic foot).

Dr. Lanza found in 1917 in the Joplin, Mo., district that, with good engineering practice, a figure of 1 milligram per 100 liters of air could be attained.

The U. S. Public Health Service, in its study in the anthracite region of Pennsylvania, found that 50 million particles per cubic foot with 5 per cent quartz in the coarse dust and 10 million particles per cubic foot with 35 per cent quartz were apparently satisfactory and often were attained.

The figure of 10-20 million particles per cubic foot for granite dust with 35 per cent quartz content is often quoted from the Vermont granite studies of the U. S. Public Health Service.

Some metal-mining companies have gone further, setting the maximum of permissible dustiness at 5 million particles per cubic foot.

Certainly, there is a degree of air cleanliness that is safe, from the standpoint of concentration of harmful dust. But the engineer may find himself in the position of practically being forced to control any dust, harmful or otherwise, if he would protect his employers against suits at common law and the possibility of award of damages to men who have breathed dust containing little or no free silica. A dusty workplace is difficult to defend in court. Neither courts nor compensation boards, and certainly not juries, have seemed to be greatly impressed with a low silica dust count in an otherwise dusty atmosphere.

Quoting from one of the reports referred to: "Each state is a unit—a sovereign—and it handles its problems in its own way. Uniformity is lacking, although of course the statutes of many states are similar. The courts of the various states follow such precedents as appeal to them; consequently, on any important question, there is likely to be a divergence of opinion among the courts, and often the courts fall into two or more groups, each group following a different theory with respect to the same legal problem."

Workmen's Compensation Acts

Workmen's compensation acts have been passed in 46 states (all except Arkansas and Mississippi) and the District of Columbia. These acts are compulsory as to private employers in 15 states and elective in 31 states. Insurance to cover the risk is compulsory in seven states.

A state fund, out of which compensation is paid, is maintained in 18 states; in two of these the employer may, by proving financial responsibility, carry his own risk with limited contribution to the state fund for the expense of administration; in 11 more of this group of states the employer is not required to avail himself of the privileges of the state fund and may provide compensation otherwise. In 28 states there is no provision for a state compensation fund.

Administration of the compensation act is vested in a commission, board, or single