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Silicosis

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This pamphlet presents a summary of the outstanding facts and suggestions contained in the reports of the National Silicosis Conference, organized and consummated by the U. S. Department of Labor, Washington, D. C.

1. During the past few years so many conflicting statements have been made about silicosis that many persons have become confused. Alarmed workers have filed claims against their employers, sometimes unjustly. In some cases apprehensive employers have established labor policies that have reacted unfavorably against both themselves and the workers. A few incompetent attorneys and physicians, particularly in court cases, have further complicated the situation.

2. To aid in bringing order out of chaos, the Secretary of U. S. Department of Labor on April 14, 1936, called the First National Silicosis Conference. It was attended by more than 300 persons representing workers, employers, state and federal agencies, insurance companies and other interested groups. Four committees were organized:

1. Committee on Prevention of Silicosis through Medical Control.
2. Committee on the Prevention of Silicosis through Engineering Control.
3. Committee on the Economic, Legal and Insurance Phases of the Silicosis Problem.
4. Committee on the Regulatory and Administrative Phases of the Silicosis Problem.

3. The reports of these committees were completed and considered by the Second National Silicosis Conference, February 3, 1937. This pamphlet presents a summary of the outstanding facts and suggestions contained in the reports, although much of the discussion concerning the insurance and legal phases of the subject has been ignored because it is comparatively unimportant to engineering and medical technicians. There are, of course, numerous other dusts that are harmful to workers under certain conditions, but the Conference confined its deliberations to a discussion of silica dust. Thus this pamphlet, too, is limited to a discussion of silica dust.

What Is Silicosis?

4. Silicosis may be defined as "a chronic disease due to the breathing of air containing silica (SiO_2), characterized anatomically by generalized fibrotic changes and the development of miliary nodulation in both lungs, and clinically by shortness of breath, decreased chest expansion, lessened capacity for work, absence of fever, increased susceptibility to tuberculosis (some or all of which may be prevented), and by characteristic roentgenological findings."

5. In other words, silicosis is a disease of the lungs in which the normal lung tissue is replaced by fibrous or scar tissue due to breathing air containing high concentrations of silica dust.

6. Unfortunately there is no known cure for silicosis—*but silicosis can be prevented.*

How Many Workers Have Silicosis?

7. No one knows how many workers have silicosis. Most of the surveys made in this and other countries have been confined to the mining industry. From these reports, and from other available data, a number of estimates have been advanced on which there is rather general agreement.

8. It is estimated that of the 49,000,000 workers in the United States, only 1,000,000 (2 per cent) are in any way exposed to the hazard of silicosis. Perhaps half of this number, 500,000 (1 per cent of the total), are exposed to a serious hazard. Approximately 110,000 (2/10 of 1 per cent of the total) have silicosis in some degree. But it is likely that the number of persons at work who suffer any disability from this disease is on the order of 4,000 to 5,000. This is approximately 1/100 of 1 per cent of the total.

9. From a purely statistical point of view, the problem of silicosis is not nearly so serious or so general as some other industrial problems, such as lead poisoning and industrial accidents.

What About the Workers Who Have Silicosis?

10. In answering this question, perhaps it would be well to consider four groups of workers as already suggested:

a. A percentage of the 4,000 to 5,000 workers who are completely or partially disabled because of silicosis and whose difficulties are further complicated with tuberculosis.
b. The remainder of the 4,000 to 5,000 who have silicosis and some degree of disability, but no tuberculosis.
c. The 105,000 who have silicosis, but no disability and no tuberculosis.
d. The 900,000 who are exposed to silica dust, but who do not have silicosis.

11. *Group A.* From the standpoint of these men in Group A, the problem is a serious one, and there seems to be no doubt in anyone's mind that these workers should be removed from employment and compensated for total disability just as if they had been incapacitated by accidental injury.

12. *Group B.* The remainder of the 4,000 to 5,000 workers who have silicosis and disability in some degree, but have no tuberculosis, should in the majority of cases continue to work. While a few persons may be of the opinion that such workers are doomed to an early death, every study conducted thus far confirms the fact that the great majority of these men will not necessarily progress from bad to worse. Perhaps it may be wise to transfer some workers to other employment, but many may be continued at their regular occupations *if* known methods are applied to control the dust and if special care is employed to prevent the development of tuberculosis, pneumonia and other lung complications.

13. *Group C.* To the 105,000 workers who have silicosis, but no disability and no tuberculosis, the problem is not particularly serious. Certainly such men should be permitted to continue work at their regular occupations but, as already suggested, known methods of controlling dust should be applied and care should be used to prevent the development of tuberculosis, pneumonia, and other lung complications.

14. *Group D.* For the benefit of the 900,000 workers who are exposed to silica dust but who do not have silicosis, all emphasis again should be placed upon the application of known methods of controlling dust.

Where Do Workers Contract Silicosis?

15. Silica dust is found in many industrial operations, but the hazard is acute only in such industries as metal mining; anthracite coal mining; quarrying, drilling, and tunneling in granite, ganister, and sandstone; smelting and refining of metals; foundries; potteries; glassworks; stone products; grinding; buffing; sandblasting.

Under What Conditions Is Silica Dust Hazardous?

16. It should not be assumed, however, that all establishments in these industries are hazardous. To tell whether or not a certain operation is hazardous, it is necessary to determine at least three things:

a. The concentration of dust in the air—number of dust particles per cu. ft. of air.

b. The chemical composition of the dust—percentage of free silica.

c. The size of the silica dust particles—measured in microns. (A micron is approximately 1/25,000 of an inch.)

17. But even when these determinations are made, it frequently is difficult to say that one operation is hazardous or that another is not hazardous. While it has been proved that particles larger than 10 microns in their greatest dimension are not hazardous, the factors of safety with respect to concentration and composition are not so definite.

18. In general, dust concentrations of less than 5 million particles per cu. ft. of air are at the present time considered safe even in cases where the dust contains a high percentage of free silica. To secure a more definite correlation of these two factors, it has been suggested that the dust count be multiplied by the percentage of free silica; then if the result is under 5 million, one can be almost sure that the conditions are safe. But the reverse is not so definite. If the result is more than 5 million, one cannot say with assurance that the conditions are unsafe.

19. For example, 10 per cent (of free silica) times 30 million (particles per cu. ft. of air) equals 3 million—safe.

20. But 30 per cent of free silica times a concentration of 50 million particles per cu. ft. of air is 15 million—perhaps not as safe as the preceding example, but present knowledge does not warrant a statement branding this unqualifiedly as a hazardous condition.

How Can You Tell Whether or Not a Man Has Silicosis?

21. Physicians who are most familiar with the subject agree that this question can be answered only by taking into consideration the man's past occupational and medical history, his present complaints, a careful physical examination and X-ray of his chest, and a laboratory examination of his sputum. And in addition to these data, the physician should also consider the man's environment; that is, he should know the number of years he has been exposed to silica dust, as well as the dust count, composition, and particle size.

How Long Does It Take to Develop Silicosis?

22. Contrary to popular belief, silicosis is slow to develop. Usually it takes seven years or more of exposure to silica dust for a worker to contract the disease. It is said that a few cases have been known to develop in as short a period as 1½ years, but these were under extreme and unusual conditions. On the other hand, many workers have labored under ordinary conditions for more than 30 years without demonstrating any trouble that could be diagnosed as silicosis.

Can Silicosis Be Prevented?

23. Although there is no known cure for silicosis, there no longer is any doubt that *silicosis can be prevented.*

How Can Silicosis Be Prevented?

24. In general, there are three ways to prevent silicosis: first, by preventing the creation of silica dust; second, by preventing the dispersion of dust into the atmosphere of the working area; and third, if it is impracticable to apply the first two methods, by the use of approved personal protective equipment, such as respirators, to prevent the inhalation of dust.

Who Can Prevent Silicosis?

25. There are many agencies that must cooperate if silicosis is to be prevented. Certainly the employer is called on to do most of the work and to spend most of the money. But his work and money will never accomplish the maximum results unless the worker is willing to cooperate and carry his share of the responsibility for helping to control dust and for using the personal protective equipment.

26. In addition, physicians can play a definite part in preventing silicosis, as can engineers, insurance companies, legislators, administrators and others.

What Can the Employer Do to Prevent Silicosis?

27. The reports of two Conference Committees on "Engineering Control" and "Medical Control" discuss the answers to this question in elaborate detail and should of course be used for reference purposes. Nevertheless, this summary would be incomplete if it did not list at least a few things the employer should consider when formulating his silicosis-prevention program.

28. *Survey the Working Conditions.* Any employer who has reason to believe that his workers are exposed to the hazard of breathing silica dust should make a survey of the working conditions. This will enable him to determine the severity of the hazard and will possibly indicate what, if anything, needs to be done to decrease the hazard. Assistance in making this survey, in making dust counts, and in handling some other details can be obtained from bureaus of industrial hygiene now established in most industrial states, insurance companies, state labor departments, U. S. Bureau of Mines, U. S. Public Health Service, U. S. Department of Labor, and other agencies.

29. *Secure information on best procedure.* Before formulating a program for decreasing the silicosis hazard, the employer should secure the best information obtainable. Usually he can secure valuable data from the leaders in his industry, perhaps from the codes prepared by certain industries, and from other agencies such as those enumerated in Paragraph 28. It is surprising how often effective results can be secured at little cost through the installation of mechanical equipment.

30. *Comply with laws, rules and regulations.* It should be borne in mind, of course, that the employer must comply with the laws, rules, and regulations that apply to his operations. Such requirements, however, are "minimum not maximum requirements."

31. *Design plant for dust control.* Much can be accomplished through design when new buildings are contemplated or when old buildings are to be remodeled. For instance, structural projections and ledges may be minimized to prevent the accumulation of dust that might later be released into the atmosphere by air currents or by building vibration. Building interiors should be so constructed that they may be easily cleaned by washing, hosing, vacuum cleaning or brushing. In some cases operations may be located over gratings beneath which equipment is provided for removing the materials and dust that fall through.

32. *Provide building ventilation.* Special facilities for natural or mechanical ventilation are frequently provided and sometimes serve their purpose in helping to eliminate dust. Usually, however, such methods cannot be relied upon to provide complete protection in dusty operations.

33. *Store dusty materials in dust-tight bins.* Dusty materials should be stored in dust-tight bins, tanks, or enclosures, but each structure of this type should be provided with a breather or vent stack—perhaps with an exhaust fan in the stack — to permit the air displaced during loading to be carried outside the building. Basements may be used for storage purposes but should not be used for dusty manufacturing operations.

34. *Enclose material-handling equipment.* Excessive dust that is created by material-handling equipment can usually be confined by housing, and removed by an exhaust system. Some materials can be kept in a moist condition while being handled, but when this is done, the material may dry out and be dispersed into the atmosphere as dust.

35. *Isolate dusty processes.* Where possible, several or all dusty processes may be isolated from the rest of the plant. This sometimes permits the installation of a more compact exhaust system resulting in more efficient operation and lower maintenance cost.

36. *Provide wet methods of operation.* Water, oil, and other liquids may be used to control dust:

a. To suppress dust at the point or origin in such operations as rock-drilling; handling, pulverizing, and milling rock and ore; grinding metal on grindstones; abrasive-wheel cutting of granite and sandstone.

b. To prevent the re-dispersion of dust that has settled on the floors, walls, and other surfaces such as in the granite industry and in foundries.

37. *Design equipment to control dust.* When new machinery or other equipment is contemplated, the manufacturer can frequently be encouraged to include dust control features, such as exhaust hoods, as an integral part of the design and construction.

38. *Provide exhaust systems.* In some operations exhaust systems may be installed to remove dust at its point of origin. The technicalities of this subject are discussed in the Conference Committee reports which should be referred to for detailed data. (See also N. S. C. Safe Practices Pamphlet No. 32, "Exhaust Systems" as well as American Standards Association report, "Fundamentals Relating to the Design and Operation of Exhaust Systems."

39. *Establish maintenance and good housekeeping procedure.* Good housekeeping is unquestionably the cheapest single method of controlling dust. Maintenance goes with it hand in hand. The best equipment in the world will not control dust if superintendents, foremen and workers are careless and disorderly in their work. Eight suggestions are advanced by the Conference Committees:

a. If dust-tight equipment is installed, it should be inspected at regular and frequent intervals and all defects should be corrected as soon as they are detected.

b. Operations should be performed in a manner that will create the minimum amount of dust.

c. Use water under pressure where possible to clean building interiors.

d. If practicable, combine water with air for cleaning purposes.

e. Vacuum cleaning removes dust without dispersing it elsewhere.

f. Brushing is particularly adaptable for cleaning buildings of the older type of construction.

g. Low-pressure steam can sometimes be used to advantage.

h. A responsible person should be assigned the task of supervising maintenance and housekeeping activities. Among other things he should make tests from time to time to make sure that the program of dust control is achieving the desired results.

40. *Provide respirators.* The Conference Committees agree unqualifiedly that dust elimination must be given primary consideration in solving the silicosis problem. Nevertheless, when known methods of elimination are impracticable, there is still one more thing that can be done: that is, provide respirators so that the workers will not

breathe dust into their lungs. It is important to note that respirators are recommended only as a last resort and for occasional exposure only. Rotation of personnel under these conditions is advisable.

41. There are two general types of respirators that are suitable for protection against silica dust:

a. Air-purifying respirators that filter out the dust particles.

b. Supplied-air respirators in which dust-free air breathed by the worker comes to him from an uncontaminated outside source.

42. Most respirator manufacturers have submitted their devices for testing and approval by the U. S. Bureau of Mines. Lists of such devices can be secured by writing to the Bureau at Washington, D. C.

43. To maintain their effectiveness, a regular procedure should be established for cleaning, sterilizing, and repairing all respirators. The Conference Committees also present numerous suggestions for obtaining the cooperation of workers in wearing and maintaining respirators.

44. *Instruct the workers.* Giving the workers proper instructions is another duty of the employer. A great deal can be accomplished through the use of posters; by distributing pamphlets, pay-envelope enclosures, and other literature. As in accident prevention, the foreman is the key man—his full cooperation is essential.

What Can the Worker Do?

45. There can be no disagreement about the desirability and necessity for the cooperation of workers if the hazard of silicosis is to be reduced to the minimum. The worker should realize that the safe practices recommended and the equipment provided are designed to prevent injury to himself and to his fellow workers. The equipment should be used as directed and every effort should be made to maintain it in good working order. Furthermore, the worker is frequently in a position to observe faulty equipment and unsafe practices, and he should make it a point to report all such conditions to his supervisor.

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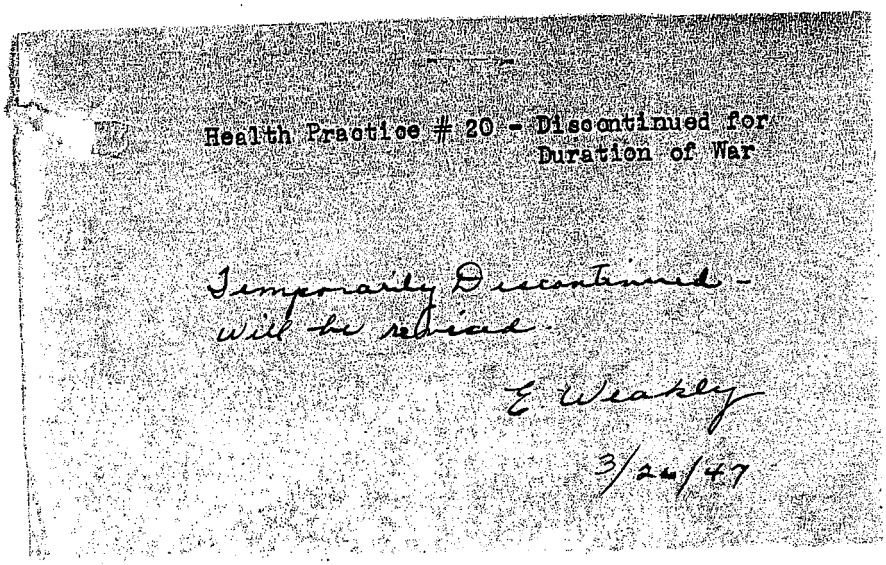
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