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Occupational Diseases

FRIDAY MORNING SESSION

October 18, 1935

The session was called to order by Mr. W. Dean Keefer, director, Industrial Division, National Safety Council. Dr. C. H. Watson, newly-elected President of The National Safety Council and Medical Director, American Telephone and Telegraph Company, New York City, presided.

Present and Prospective Occupational Disease Legislation

By F. ROBERTSON JONES

General Manager, Association of Casualty and Surety Executives
New York, N. Y.

Since the prevention of diseases is, to some degree, a community problem, the state ought to do its part toward the prevention of occupational diseases, along with all others. The public health authorities should study the causes of such diseases, their prevalence, virulence and the means for their prevention. They should advise as to such means of control, and, as a last resort, appeal to legislatures for power to order compliance with their rules. Statutory regulations for prevention, emanating from other sources, such as are common in "labor" or "factory" laws, have too serious drawbacks to be efficient. They are apt to be inflexible and quickly become "out of date"; and they are too apt to be perverted for the establishment of fictitious bases for wasteful and demoralizing damage-suit litigation. Scientific bureaus of occupational hygiene, under direction of public health authorities, are the best public instrumentality. Efficient bureaus of that character are now to be found in several states; but, generally, such public health organizations are inadequately manned and equipped. Therefore the primary need in occupational disease legislation is for measures to improve our public health services.

Emphasis should be placed on prevention, not merely because "an ounce of prevention is worth a pound of cure," but because public measures for the assurance of relief to victims are perilously susceptible of being so perverted that those affected will tend to rely upon and abuse the protection afforded as a substitute for, instead of as a supplement to , means for self-protection.

Expert opinion now calls strongly for the entire elimination of employers' liability for "damages" for occupational injuries—by disease as well as by accident—based upon negligence. That remedy is too uncertain in operation, litigious, demoralizing and wasteful; it furnishes relief to too few of the victims unless it be so liberalized as to be grossly unjust and financially perilous to employers—and thereby harmful to industry and all dependent upon industry.

Losses from ill-health among workmen are primarily subjects for self-providence or for "social insurance"—for "sickness insurance" to help out during brief illnesses, and for "invalidity," "old age" and "widows' and orphans'" insurance where illnesses or infirmities result in long or permanent disability or untimely dealth. The cost of these insurances against the common misfortunes of life cannot rightly or expediently be imposed wholly upon industry, but needs to be distributed somewhat in proportion to responsibility. And benefits, at a high scale of maximum earnings, as in workmen's compensation, simply cannot be provided for all such workmen's misfortunes. In invalidity, old-age and life insurance, at least, the benefits must be graded, more or less, in proportion to the individual workmen's contributions to the requisite reserves; and the right to benefit must be conditioned upon some minimum number of contributions. It is only for some relatively small proportion of the injuries and physical ills to which workmen are subject that it is reasonable and practicable to impose the full responsibility on industry.

From its beginnings, the workmen's compensation law has covered all injuries to health resulting from occupational accidents. Further it has now, in this country and abroad, been extended to cover many specified diseases, not resulting from accidents, classified as "occupational." And in a few states in this country and Latin America it has been extended indefinitely further to cover "all inclusively" all injuries to health "arising out of and in the course of the employment" or all "occupational diseases," undefined, "arising out of the employment."

In this country there is strong political pressure in favor of this "all inclusive" coverage of injuries by disease based upon the contention that there is no difference in principle between "injuries by accident" and "injuries by disease"; therefore, industry ought to be liable for both classes of injuries on the same terms and conditions. This contention is fallacious. The fundamental principles of the compensation law are that industry shall be held responsible and liable to compensate for the losses from those injuries only which are caused by "trade risks", resulting from employment and which the employer can control; and that the liability for such risks shall be sufficiently well defined as to be insurable at practicable and equitable rates, fixed in advance. The standard compensation laws have been framed to carry out those principles in application to injuries by accident. But the factual conditions relative to injuries by disease are so different from those relative to injuries by accident as to necessitate different treatment.

The crucial difference between accidents and diseases is the time factor. An accident is a sudden event, happening at a definite time and place. Generally the causal relation between the employment and the accident and between the accident and the resulting injury can be traced with reasonable certainty. Generally the employer is automatically identified. And there is a clear-cut event from the date of which time-limits on notices, claims, etc., can be measured. In contrast, many diseases attributable to occupational risks are of slow contraction, and may be of equally slow progress to harmful results. In silicosis there may be an interval of as much as twenty or thirty years between the first exposure and disability or death. In the meantime, many causes for disablement or death, other than the occupational disease may have operated. Often it is a matter of extreme difficulty to determine whether disability or death really has resulted from an occupational disease or from other causes. Medical diagnosis of the mere existence of a particular disease is often uncertain; yet for the proper operation of compensation for occupational diseases it is essential to obtain true medical diagnoses, not merely of the existence of the disease, but also of its causes and consequences.

A further difficulty is that, where the disease is of slow contraction, it may be contracted by a workman under several different employers or insurance carriers. In such cases it is essential for the protection of the workman that some one existent employer or insurance carrier shall be directly liable for the entire compensation. That is a highely vicarious and harsh liability to impose upon an employer or insurer —whether or not accompanied by a right to claim contribution from earlier employers and insurers—and, in all fairness, should be subject to strict limitations.

Moreover there is a difficulty incidental to the provision of new insurance for compensation for such diseases of slow contraction as silicosis. Under such conditions, the liability imposed upon the employer includes a liability for disability or death in the future; in other words, a liability, not merely for future risks but also for the cost of a volume of physical impairments already incurred though the liability therefor is not yet matured. In insurance parlance, these are termed "accrued liabilities." Such accrued liabilities, under a law newly imposing a liability to compensate for silicosis, would, it is estimated, in a state such as New York, aggregate many millions of dollars. This cost is additional to losses from current risks; and how to meet it and how to fix reasonable charges for insuring it is a complex financial problem.

The situation, then, in my opinion, is this: The principle of compensation, regardless of fault, may well be extended to cover those disabling diseases that are characteristic of and peculiar to and have their origin in the occupation or process in which a person is engaged. This would exclude the diseases of ordinary life, and would be applicable only to the specific hazards which arise out of and because of industrial processes and occupations. The provisions for such coverage should be separate and distinct from the provisions of law applicable to compensation for accidental injuries, and these distinctions should be constantly emphasized. The problem of formulating such provisions is relatively simple with reference to those recognized diseases set forth in the older occupational disease laws, since such diseases are reliably diagnosable, of quick contraction and non-progressive. But it is difficult in respect to such progressive diseases of slow contraction as silicosis and asbestosis—now generally regarded as being truly "occupational." Fortunately, however, there are promising models for our guidance in some of the foreign compensation laws, whereas experience under indefinite, "all inclusive" coverage in Connecticut, Massachusetts, Wisconsin and California is helpful with lessons of faults to avoid.

In my opinion, a law for the compensation of occupational diseases should contain provisions to the following effect:

1. Diseases to be made "compensable" should be distinctly specified—by listing in a "schedule" or otherwise. They should include all those diseases, but only those, to be found in the state, which, according to prevailing medical opinion, can be traced, in individual cases, to origins in "trade-risks"—*i. e.*, risks, not of ordinary life, but created by special practices or processes in industrial occupations.

2. There should be a special regime for expert adjudication of medical questions in occupational disease cases.

3. There should be definite periods of exposure required as a condition to the right to compensation for various occupational diseases; the time within which, in order to be compensable, disability or death must follow exposure should be limited; and cases resulting from exposures prior to the effective date of the compensation coverage, or in industries wholly outside the particular state, should be excluded.

4. Prompt notice either of the first manifestation of the disease or of disablement—the time of such event to be determined as a medical question—should be strictly required; and every presumption should be against the validity of a claim not made as promptly as practicable.

5. In case an occupational disease merely aggravates, prolongs or accelerates disability or death due primarily or proximately to a non-occupational disease or infirmity or, above all, to old age, the compensation should be reduced to be proportionate to the degree to which the occupational disease contributes to the disability or accelerates death.

6. The employer, as of the time of the workman's last substantial exposure to hazards of the disease, and the insurance carrier then on the risk should be liable for the entire compensation—with or without right to contribution from earlier employers and insurers. But all such liabilities, whether directly for compensation or for contribution to the compensation payable by others, should be subject to brief time limitations.

7. In incurable diseases, especially silicosis, the obligatory medical benefits should be specially limited in time and kind.

8. In silicosis and other diseases of slow contraction, there should be special provisions for limited compensation to workmen laid off before actual disablement, with the alternative, under some conditions, of waiver of compensation by such workmen for aggravations resulting from being allowed to continue in the hazardous occupation.

9. A law newly imposing liability to compensate for silicosis and other diseases of slow contraction should leave a substantial interval for preparation between the date of its enactment and that when it shall take effect; the compensation for such diseases should be specially reduced and limited below what would otherwise be appropriate until the "accrued liabilities" are worked off.

10. Compensation for occupational diseases should be insurable separately from compensation for accidents; and, in the initial stage, at least, of a regime of compensation for such diseases as silicosis, the rating practices now imposed upon insurance carriers need to be radically modified.

The above program is sound and would be highly conducive to occupational disease prevention. But I am not so confident that it would be safe. The pressure is strong for "liberality" in compensation laws. Merely a few among a large number of probable slight diversions from what I suggest would convert compensation for occupational diseases into indefinite health, old-age and life insurance for workmen in many industries. The cost might ruin the industries, and, at least, would be so incalculable as to make the risks "uninsurable," except on the unlimited assessment plan, with all its financial perils and uncertainties.

In regard to prevention, there are still some practices to be decided upon in perfecting a regime of compensation for occupational diseases about which there remains much doubt. For example: Such a regime will practically compel employers, in giving employment, to discriminate against all the ailing or aging—against all except the most healthy and robust. That seems to be desirable in occupations when the occupational disease hazards are great. But is it desirable otherwise?

Again, an ideal common to those of us who emphasize prevention is to require the prompt removal from exposure of workmen manifesting the first symptoms of an occupational disease. But for the elderly or skilled workman the loss of his trade-job may be worse, in every respect, than the danger of continuing his exposure. How then should such cases be defined and treated and how should the law be framed to effect or induce such treatment?

Political impatience is the chief obstacle to a just and equitable settlement of the occupational disease problem. If those thoroughly informed as to this complex subject who have sincerely at heart the welfare of workers could be delegated the authority to devise a solution, some progress might be made. But when political propaganda is injected into the situation there is little chance for an adjustment satisfactory to all concerned. The greatest need today is the divorcement of occupational disease legislation from politics or political considerations.

Some Practical Considerations in Dust Control

By J. J. BLOOMFIELD

Sanitary Engineer, United States Public Health Service, Washington, D. C.

The prevention of occupational diseases due to the inhalation of industrial dust is primarily an engineering problem. Until recently, however, little attention had been devoted to the control of dust, accounting for the paucity of fundamental data on the subject. The consequences of the neglect to furnish adequate protection from dust hazards are now being felt, and the cost is becoming a serious drain on industry. It is now well established that exposure to certain kinds of dust, such as those containing considerable amounts of quartz, has increased the morbidity and mortality rates from respiratory diseases; while metallic dusts, such as lead and its compounds, have been associated with general systemic poisoning of workers. It is obvious, therefore, that any serious attempt to control the dust hazard should, in time, result not only in the improvement of the health of workers, but also be of definite economic benefit to industry.

The benefits of a preventive program in the field of accidents are well known. Industry is fast realizing the need of a similar preventive program with respect to occupational diseases.

Evaluation of the Dust Hazard

The first step in the evaluation of the dust hazard is the determination of the occupational exposure to the dust in question. A typical example of such a study may serve to clarify the methodology involved.

Table 1 shows the various occupations in a granite quarry and the number of workers employed in each occupation. Drillers are the only persons using pneumatic tools, known to produce considerable quantities of dust. In other words, 38 per cent of the quarry personnel are shown to be exposed to a potentially dangerous dust hazard. The occupational analysis at once indicates that the dust investigation

table

Table 1—Occupational Classification of Granite Quarriers

Occupation	Number in Each Occupation
Drillers:	
Leyner	17
Plug and jack hammer	37
Other quarry employees:	
Superintendent	1
Foremen	7
Compressor engineer	1
Hoisting engineers	12
Locomotive engineer	1
Locomotive fireman	1
Steam-shovel man	1
Crane operator	1
Derrick men	24
Muckers	24
Blacksmiths	6
Tool boys	2
Water boys	1
Machinists	3
Air-line repairers	1
Pipe fitters	2
Total	142

Table 2—Occupational Dust Exposure of Granite Quarriers

Occupation	Number in each occu- pation	Dust counts in millions of particles per cubic foot of air. Weighted Average
Leyner drillers	17	144.4
Plug and jack-hammer drillers (quarry-hole)	37	112.1
Plug drillers (yard)		36.9
All other workers	88	5.8

should especially concern itself with these workers. The next step involves the determination of the occupational dust exposure. Table 2 shows the results of such a study.

It is apparent in this table that the drillers are exposed to high dust concentrations, especially the Leyner and jackhammer drillers working in the quarry hole. From a further analysis of the occupational dust exposure of drillers it is possible to determine which activities are responsible for the dust. For example, experience has taught us that the various activities comprising the processes of most dusty occupations are usually associated with dissimilar dust exposures. For this reason it is essential to estimate the amount of time spent in each activity in any one occupation and to determine the dust exposure for each. Table 3 shows the results of such a study in the case of a Leyner driller.

It will be seen that a Leyner driller has five different dust exposures. A differential analysis, as presented in Table 3, yields several valuable findings. First, it enables one to obtain a true average dust exposure for workers engaged in the occupation of Leyner drilling. (In this case the weighted average is 144.4 as contrasted with 213.4 million particles per cubic foot found during drilling operations only.) Second, it enables one to determine which activity, or activities, contribute most to the

Table 3—Summary of Dust Exposure of Leyner Drillers in a Granite Quarry

Activity	Average dust exposure in millions of particles per cubic foot of air (a)	Number of hours spent in each activity (b)	Particle-hours in millions per cubic foot (a × b)
Drilling	213.4	4	853.6
Changing drills	9.8	1	9.8
Watching drills	8.0	2	16.0
Broaching	6.0	¾	4.5
Blowing off holes	1,085.0	¼	271.3
Total		8	1,155.2

$$\frac{1{,}155.2 \text{ particle-hours in millions per cubic foot}}{8 \text{ hours}} = 144.4 \text{ million particles per cubic foot}$$

dust hazard. It is evident that the practice of blowing off holes by means of inserting a compressed air line into each hole is attended with a great amount of dust; and though this activity lasts but 15 minutes of the 8-hour working day, it is responsible for 23 per cent of the total dust exposure. It is evident that 23 per cent of the Leyner driller's dust exposure may be at once eliminated by prohibiting this practice. And lastly, such an analysis indicates the necessity for devoting all one's efforts to the removal of dust during the drilling process, since this activity accounts for 74 per cent of the total dust exposure, although a Leyner driller spends but one-half of the working day at his drill.

So far we have dealt with an industry in which the workers, as a rule, do not change their occupation. Often workers have had several occupations, either in the same industry or in several different kinds of establishments. If the worker has been employed in various occupations in the industry, it is a simple matter to determine his total dust exposure in that industry. This is important from the viewpoint of correlating a worker's dust exposure and his clinical condition. A typical example is shown in Table 4.

Table 4—Total Occupational Dust Exposure of an Anthracite Coal Worker

Occupation	Number of years in each occupation	Dust concentration in millions of particles per cubic foot	Millions of particle-years per cubic foot
Slate picker	2	380	700
Patcher	2	71	142
Mule driver	3	71	213
Miner's laborer	3	480	1,440
Miner	15	480	7,200
Section foreman	5	7	35
Total	30		9,790

$$\frac{9{,}790 \text{ millions of particle-years per cubic foot}}{30 \text{ years}} = 326 \text{ millions of particles per cubic foot}$$

In Table 4 the worker's occupations are arranged in the order of employment, the last one being his present occupation. It is obvious that had one considered this occupation only, the dust exposure would not have yielded a true state of affairs, nor would it have been possible to correlate this dust exposure with the man's clinical picture. In the above technic, correct weight is given to the number of years spent in each occupation and the dust exposure associated with each. Only by such an analysis is it possible to arrive at a fair estimate of a worker's dust exposure and his proper designation. Such an analysis is justified by the fact that results obtained with this technic yield excellent correlations with the clinico-roentgenological studies conducted on anthracite coal miners.[3]

It is thus apparent that there is more to engineering dust surveys than the taking of dust samples and their analysis. Owing to the fact that the making of dust studies is rapidly being adopted in industry, it has seemed necessary to emphasize the important factors in such investigations. Although the making of dust counts, *per se*, is not a difficult procedure, the collection of dust samples in industry and their proper interpretation should be done by a thoroughly trained investigator. The examples just given show the value of this technic in the subsequent steps to be taken in the control of the industrial dust hazard.

General Dust Control Methods

The selection of any method of dust suppression will depend primarily upon its effectiveness in reducing a given hazard and its adaptability. A large percentage of reduction in dust does not necessarily indicate that the method used is efficient, unless the reduction has actually been sufficient to bring the exposure below the safe limit, and does not interfere with the industrial operations involved. In general, there are four methods of dust control: (1) substitution of nondust-producing or harmless substances; (2) isolation of the dusty operation; (3) wetting the dust at its source; (4) local exhaust ventilation. These methods may be supplemented by personal respiratory protection.

The first method has a limited application. One example is the use of a nonsilica parting compound for a silica compound in connection with the making of foundry molds. Table 5 shows that although the use of parting compound, in this particular study, only necessitated an exposure of 54 minutes of the 540 minutes of a molder's work day (10 per cent), actually this activity accounted for approximately 58 per cent of the molder's total exposure. It is obvious that the employment of a parting compound, which is not as harmful as one composed of free silica, will lessen the dust hazard in this instance to a considerable extent.

Table 5—Dust Exposure of Molders

Activity	Time of Exposure in minutes (a)	Average Dust Exposure in Millions of Particles per Cubic Foot (b)	Particle-Minutes in Millions (a × b)
Use of Parting Compound........	54	63.8	3,445
Remaining tasks in molding.......	412	4.4	1,813
Pouring	58	3.1	180
Dumping molds ("shake-out")....	16	32.5	520
Total......................	540	....	5,958

$$\frac{5958 \text{ million particle-minutes}}{540 \text{ minutes}} = 11.0 \text{ million particles (per cu. ft.)}$$

In the case of abrasive cleaning with steel instead of sand, we have the example of the substitution of a substance involving a lesser dust exposure as well as the use of a material not as toxic as sand.[4] Table 6 shows the improvement effected by this type of substitution. Not only is the dust concentration reduced from an average of 969 to 155 million particles per cubic foot, but the potential exposure to quartz dust is diminished from 42-99 to 3 per cent.

Table 6—Showing Reduction in Concentration and Quartz Content of Dust in Sandblast Rooms With the Substitution of Steel for Sand Abrasive

Type of Abrasive	Average dust concentration in millions of particles per cubic foot	Percentage of Quartz
Sand	969	42-98
Steel	155	3

The second method of dust control, isolating the dusty process, possesses many possibilities, but unfortunately is not widely used. The theory underlying isolation is to concentrate the dust sources to one locality or to a single closed space. In this way, a minimum number of employees are exposed. At present, many foundries, during shake-out expose workers who normally are engaged in occupations with low dust concentrations. Thus, molders in a foundry may be exposed to a dust concentration of 3 million particles per cubic foot under normal occupational conditions, but when shake-out operations are carried on close by, their exposure may be increased to more than 50 million. The same condition exists when annealing flasks containing ground slag are emptied in malleable iron foundries, exposing grinders and tumbling barrel attendants at work close by.

Perhaps the best example of isolation of a dusty process is the abrasive cleaning room. This completely encloses a hazardous process and exposes only the blaster who is generally equipped with a protective helmet. The room is also exhausted, which further reduces the dust concentration. Processes which are isolated require good ventilation. Other examples of isolation are the automatic turntable for abrasive cleaning, tumbling barrels, and batch-mixing rooms found in some pottery establishments.

The third method, perhaps the oldest known, is the practice of wetting the dust at its source. In Table 7 an example is depicted in connection with the drilling and loading of rock in anthracite coal mine operations.[3] It is apparent that a tremendous reduction in dust has been effected by this method. However, as already pointed out, unless a particular method is attendant with a reduction of the dust to a safe limit, it cannot be considered successful. In the present instance, the workers engaged in drilling are still exposed to unsafe concentrations of a highly dangerous dust and the more positive method of controlling the dust in drilling operations by dust traps would be indicated. For drilling and loading operations involving an exposure to dusts less toxic than those containing high amounts of free silica, as in the case of coal or certain talcs, the reduction shown by the use of wet methods may be considered effective.

Table 7—Contrasting "Wet" and "Dry" Methods of Rock Drilling and Loading

Processes	No. of Samples	Average dust count in millions of particles per cubic foot "Dry"	"Wet"
Drilling	23	568	33
Loading	10	636	32

The fourth method—exhaust ventilation—is perhaps the most effective, and one with the widest application. We cannot discuss here the details of the theory and design of local exhaust systems, except to point out there is a real need for more fundamental studies of the type conducted by DallaValle with reference to the design of local exhaust hoods, which he has presented in Public Health Bulletin 217. The work of Hatch and his colleagues[4] on the control of the silicosis hazard in the hard rock industries is another example of a scientific approach to the dust elimination problem.

Table 8—Summary of Results Contrasting the Dust Exposure of Mine Workers Under Controlled and Uncontrolled Working Conditions

Operation	Dust Concentration in millions of particles per cubic foot of air Controlled	Uncontrolled	Remarks
Firing charge	40	834	Unless at least 15 minutes elapsed after firing a charge, miners found to be exposed to high dust concentrations.
Loading coal or rock..	32	636	By wetting the loaded material the dust count is reduced as shown.
Loading coal	4-26	291-1138*	Mechanical loading decreases the dust exposure as indicated.
Drilling	33	568	Wet drilling is effective in reducing the dust concentration. Further reduction would necessitate exhaust ventilation.
Hauling coal in mines.	1.2	17	Wetting coal and empty cars reduces dust in haulageways.
Preparation of coal...	24	380	Wet breakers reduce dust counts as shown.

* The lower result is associated with the hand loading of wet coal while the higher average is based on the hand loading of dry coal.

It is apparent that there are no set rules for the mechanical protection of workers from the industrial dust hazard. Specific conditions in an industry, or a plant, will determine the type of protection to be employed. The present discussion has emphasized the importance of approaching the problem from the standpoint of the occupational exposure. Studies in representative plants of an industry often reveal the various methods which may be employed in controlling the dust hazard. The following two examples indicate the value of such investigations.

Table 8 indicates the various control measures which were found in use in the anthracite coal mines investigated in the study referred to earlier. Although no single mine practiced all of the control measures shown in this table, by an occupational study in several representative mines it was possible to show that methods are not known and practiced for the elimination of the dust hazard in this industry.

Another example is indicated in the results of a study now in progress in connection with mercurialism among workers in the hatters' fur cutting industry. Table 9 shows the exposure to mercury dust and vapor of some of the workers in this industry

Table 9—Exposure of Hatters' Fur Workers to Mercury Dust and Vapor Under Controlled and Uncontrolled Conditions

Occupation	Total Mercury Exposure in Milligrams per 10 cubic meters Uncontrolled	Controlled	Method of Control
Blowers	4.6	..	None practiced
Shippers	7.2	..	" "
Cutters	4.0	1.8	Local exhaust ventilation
Sorters	3.8	1.7	"
Brushers	3.1	1.2	"
Drummers	2.5	0.6	Segregation
Clippers	1.5	0.7	"

under controlled and uncontrolled working conditions. It is apparent that where some measure of control is practiced by such methods as segregation or local exhaust ventilation, a material reduction in the exposure to mercury has been effected. It is our belief that in the case of the blowers' exposure, a reduction may be effected by mechanical enclosure and local exhaust ventilation, and that the shippers' exposure to mercury vapor may be lessened by a general system of ventilation sufficient to change the air in the store room frequently enough to bring the mercury concentration to a lower level. Unfortunately, in the present investigation, it has been impossible to find a plant in which an attempt has been made to reduce the exposure for these two occupations.

In some dusty occupations the methods of controlling dust have not been developed. In fact, operations such as removing the cores from very large foundry castings, sand-blasting, handling of used storage battery plates, paint chipping, and cadmium oxide manufacture appear to offer no practical means of adequately controlling the dust generated. In such cases, it is therefore necessary to furnish the worker with personal respiratory protection devices to prevent his exposure to the harmful effects of the dusts present. These devices consist of various types of respirators, masks, and helmets.

It is important to hold in mind the limited use of personal protection devices. Because a worker cannot with comfort wear a mask or helmet continuously, such devices must be employed intermittently. Their use is generally extended to those operations where all other methods have failed or supplementary to them, as in storage battery repair where the exposure to small amounts of lead breathed is known to be detrimental to health.

It should be pointed out that the U. S. Bureau of Mines is equipped to conduct approval tests of respirators used for protection against various dusts and fumes (Schedule 21). These tests are conducted against the dust for which the device is to be used and are rated, not on an efficiency basis, but on the quantity of dust which actually passes the respirator. The results of a study of masks or helmets of the positive pressure type, made during the sandblast investigation conducted several years ago by the Public Health Service in cooperation with the National Safety Council,[3] showed that the only practical safeguard to the worker inside the sandblast room was to provide him with a mask or helmet of the positive pressure type. In studying the efficiency of such devices it was found that a relationship existed between the amount of air supplied to the helmet and the concentration of dust inside the helmet during blasting. To determine the optimum air volume to be supplied to such protective devices, it was necessary to obtain dust samples from inside the helmet while varying the air volume, at the same time maintaining the dust concentration in the sandblast room (outside the helmet) constant. The positive supply of 6 cu. ft. of dust-free air per minute will protect a worker under the operating conditions now in practice in sand-blast rooms. The ultimate criterion of protection, however, is the result of dust determinations of the air within the helmet, that is, the air actually breathed by the worker and not the volume of air supplied.

Too much emphasis cannot be stressed on the necessity of maintaining in good order the personal respiratory devices for the protection of the worker against various toxic dusts. Maintenance of exhaust ventilation systems, and other types of protective equipment, should be a rule in industry rather than an exception. Too often the term "good housekeeping" has been interpreted as signifying only the periodic removal of dust collected on floors, rafters, etc. Although such practice contributes to the general state of cleanliness of a workroom and should always be in force, the time has surely come when serious attention should be given to the installation and rigid maintenance of all types of dust control devices. In every plant there should be some responsible individual charged with the periodic inspection of all workrooms as to sanitation, ventilation, and maintenance of all dust removal and other protective devices. Perhaps the best criterion of the effectiveness of these devices is the periodic determination of the dust content of the air at the workers' breathing zone. Only by constant vigilance and an approach to the problem as outlined in this paper may one hope to make progress in the control of the dust hazard in industry.

Often the benefits of even a most extensive program of dust control are not immediately realized. This is especially true in dealing with fibrosis-producing dusts in plants where some of the workmen have already inhaled sufficient quantities to cause disability. However, in dealing with such dusts as lead, cadmium, and mercury compounds, control measures may produce salubrious results in a relatively brief period. It is difficult, because of lack of sufficient reliable data, to indicate here the economic benefits resulting from a preventive program of dust control. It has been estimated by Dean K. Brundage, statistician of this office, that the minimum expectancy in savings to employer and employee from an indicated reduction of the accident rate and of the time lost on account of illness (or an equivalent reduction in mortality), demonstrated as attainable, is $20,000 per year per 1,000 employees. And this estimate is for plants whose accident rate is considerably below the average, in which there are no occupational health hazards. In plants where hazards are known to exist the savings should be far in excess of this conservative estimate. When one realizes that in this country there are approximately 15 millions of workers engaged in manufacturing, mechanical, and mineral industries, then it is evident that the magnitude of the problem has not been overemphasized.

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Silicosis and Silico-Tuberculosis
Medical Problems of an Important Industrial Disease

By EDGAR MAYER, M.D.

New York City

A hidden element of the cost of production is industrial disease. Industry has reached a stage beyond the concern only of wages and hours. Far more important is conservation of man power by preventive medicine and improved engineering. Disease preventive measures are not a cost, but, in the long run, a great economic saving.

Incidence. In the United States it has been computed that there are from 500,000 to a 1,000,000 people employed in occupations where a silicosis hazard exists. In New York City there are about 65,000 such employees. In a representative group of granite workers in Massachusetts silicosis alone was present in about 15 per cent and silicosis complicated with tuberculosis in almost 8 per cent. Tuberculosis was the cause of death in over one-third of the granite workers which is four times the incidence for males of 20 years and over in this country. In foundry men studied in Massachusetts, silicosis was less frequent (about 9 per cent) and less advanced in degree than in granite workers. The duration of exposure in foundry workers with pneumonoconiosis has averaged many more years than that required to produce silicosis in an industry such as gold mining. The tuberculosis hazard in foundries is nearly as great as that reported for some of the other dusty trades, but the figures are much lower than those of miners of gold, silver, copper and lead, among whom the mortality from tuberculosis is 8 to 18 times the general expectancy. Death rates for all non-tuberculous infections have been reported higher among workers in siliceous dusts than in the general population. It is suggested that the worker in silica succumbs more often to acute pulmonary infections rather than surviving the chronic fibrosis.

Silicosis is defined as a pathologic condition of the lungs due to the inhalation of silica, whether free or combined in such a state as to be capable of setting up its characteristic pathogenic effects. The principal factors that determine the incidence of silicosis are (1) the percentage of free silica in the inhaled dust; (2) the concentration of silica particles less than 10 micra in diameter in the atmosphere; (3) the duration of exposure to the dust, and (4) the susceptibility of the individual exposed as modified by age, complicating infections, etc. The occupational disease resulting from such inhalation has been defined as "morbid results of occupational activity traceable to specific causes or labor conditions and followed by more or less extended incapacity for work."

Metabolism of Silica. Significant amounts of silica are present in all body tissues and fluids. It enters the body through the digestive tract and the lungs. Most of that entering the stomach is eliminated in the stools, but a fairly large amount is absorbed into the blood as shown by the constant excretion of silica in the urine. All vegetable foods contain silicon especially the hulls of grains, hay and straw. The low silica content of the liver, spleen and kidneys indicates the little retention of the absorbed silica in the body. Silica content of the urine of animals may be influenced at will by diet. The body possesses a very efficient mechanism for the disposal of silica because of the low kidney threshhold. Silica entering the lungs in particulate form is expectorated in part with its enveloping cells, but most of it is carried into the pulmonary lymph channels. Many such particles reach the lymph nodes and even the spleen by way of the blood. The finest particles however, may be dissolved in alkaline body fluids and carried away in solution, to be excreted in the urine. There may be a constant drainage of silica from the lung through the inhalation of extremely fine particles of silica in dusty atmospheres, so small that they are not seen under the microscope.

Attempts to influence the absorption of silica from the lungs by administration of alkali have been inconclusive. Elimination of silica by way of the sputum from patients having deposits of silica in their lungs appears to be higher than those having no history of exposure to dust. Only small amounts of silica are in the blood and this level is little different in normals than in silicotics.

Pathology. This disease is essentially a fibrosis of the lungs developing especially in such industries as hard-rock metal mining, granite cutting, metal grinding and sand-blasting. The pathological changes are believed to result from two causes, a blocking of the lung lymphatics by mononuclear cells laden with dust in addition to the action of colloidal silica, the exact nature of which is in doubt. The small particles under 10 micra are the only ones capable of penetrating the lung tissue.

Although silica plays the dominant role in the production of silicosis, the admixture of other dusts tends to modify the pathological changes in the lungs so that these resemble then those of other forms of dust inhalation, and the modification bears some relation to the percentage of free silica in the mixture. Silicates, as in asbestos, produce a definite change in the lung, as well as other dusts such as marble, coal, etc. Such changes are represented by a fibrosis brought about because relatively insoluble minute particles of minerals in sufficient concentration have been brought by the activity of phagocytic cells into intimate contact with the pulmonary connective tissue. This fibrosis is a diffuse cellular one that occurs in the walls of the smaller bronchi and of all their finer divisions and extends to involve the supporting connective tissue of the adjacent blood vessels and to some extent also the walls of adjacent air spaces. However, when the great majority of the inhaled particles are composed of or contain silica, there develops, in addition, a specific and localized type of fibrosis called the silicotic nodule—an orderly whorled arrangement of cells and fibres, and with sharp definition from the adjacent parenchyma. Many dusts create a generalized fibrosis but only one, namely one combined with silicon dioxide produces the special fibrosis of silicosis. Sericite, known as white mica, which is a hydrated silicate of aluminum and potassium, has not produced in animal experiments the silicotic nodule, but instead generalized fibrosis resulted.

Dusts must be differentiated into those which are *chemically active* and those which are inert when inhaled into the respiratory tract. Silica is a chemically active dust which must necessarily be *soluble* to a degree in the body fluids and its activity depends on its solubility. This activity which is manifested in the areas where dust particles are carried along the lymph stream by phagocytes, causes lesions of two types, "toxic" and "sclerotic" both of which have been reproduced experimentally. Toxic lesions depend upon local necrosis and slow death and appear to favor the growth of tubercle bacilli; the sclerotic lesions produce the nodular fibrosis. The *inert dusts* are insoluble in body fluids and cannot exert chemical action in the lung tissue, but if they accumulate to a marked extent their effect is mechanical which may lead to a certain amount of diffuse fibrosis around the dust deposits. Certain dusts, such as carbon, may have physical effects, they may adsorb toxic substances and it has been suggested that on this basis there is a relatively lower incidence of active clinical tuberculosis in silico-anthracotics than in silicotic lungs.

Other dusts may even protect, as in the case of certain clays, gypsum and aluminum oxide. Pure pneumonoconiosis may be only a laboratory disease, as the pulmonary fibrosis of workers in dusty trades probably results from the combined action of dust and infection, whether it be tuberculous or not.

In silicosis it is not the mineral particles that are breathed in during life that record the cause of disease, but the particles that have been dissolved. Risk to work, efficiency and health may be greatly accentuated through the inhalation of finely divided particles even of a chemically inactive dust when there has occurred a lymph stasis which is known to follow exposure to silica. This lymphatic blockage leads to retention and accumulation of the inert dust. In soft coal miners who get what is called "miner's asthma" we have this accumulation of carbon. Such patients are very liable to have a high incidence of bronchitis with mechanical and physical changes due to retention of anthracotic dust. Furthermore, unequivocal cases of silicosis, with or without tuberculosis, can no longer be doubted.

Tuberculosis. Most apical tuberculosis is acquired before the age of 25 and so silicosis at the age of 30 makes a previous tuberculosis more serious. Most workers with tuberculosis going into the mines before the age of 30 die of tuberculosis by the age of 45. The silicotic develops a sputum that contains tubercle bacilli late in life and the children who are contacts with tubercular silicotics develop very little clinical tuberculosis. It is impossible to say definitely that tuberculosis engrafts itself upon the silicotic or vice versa, for we see apical tuberculosis in silicosis that spreads downward, while other silicotics show only the tuberculosis in the lower lobes. It has been found that most silicotics die of tuberculosis.

The diagnosis of silicosis is made primarily on two findings, the proper history of occupational exposure to siliceous dust and the presence of abnormal shadows on the pulmonary X-ray. The physical examination and the patient's symptoms are of less value. There are other diagnostic aids such as the finding of large quantities of silica particles in the sputum, quantitative determinations of silica in urine, and at post mortem, chemical analyses of the lung ash supplemented by petrographic examination, roentgen-ray spectrum analysis and special incinerating studies of lung tissue. We must at times rely on the pathologist to determine the amount and distribution of fibrosis due to silica and from microscopic studies give an opinion on the importance of this fibrosis as the ultimate cause of disease and death.

Lung fibrosis may be present without any silica. Silica may be present in lung tissue or the pulmonary lymph channels without associated fibrosis. Finely divided siliceous particles from lung tissue may contain innocuous silicate which cannot be distinguished from harmful silica particles. Hydrated silica which is not doubly refractive cannot be demonstrated with prisms. Therefore in the pathological section the presence of siliceous fibrosis can be suspected but cannot be specifically identified with the siliceous material that it may contain. Accordingly the microincineration method of Irwin with hydrochloric acid is now included in the microscopic examination of any lung as a means toward a surer diagnosis.

Diagnostic difficulties in clinical medicine may be more obvious if we examine first the occupational history. Quartz grinders working under conditions of massive exposure may develop silicosis in acute form even in a period of months, whereas in other occupations it may take 25 years. Workers in the same industry, indeed in the same room, experience different degrees of exposure dependent upon perhaps the dust-filtering capacity of the nose and functional condition of the lung as determined by constitutional characteristics and antecedent disease. The size and colloidal structure of the particles of silica, as well as the dosage and total amount of silica, will influence the rate of development of the disease. Apparently particles that are larger than 10 micra are not phagocytosed in the lung. So a definite history of exposure must be established and in general hospitals where patients are migratory, conditions under which they worked are very vaguely described and there are not available data on dust counts and silica concentration, so that the history is often misleading.

As to symptoms, patients can perform strenuous labor despite extensive disease and the symptoms of dyspnea and cough are common to many diseases. Fever is absent unless infection occurs, but most important is the great disproportion between a patient's complaints and what is seen on the X-ray, the latter showing extensive abnormal shadows in comparison with the symptoms.

On physical examination, extensive disease may be present and few abnormal physical signs. The physical signs are merely those of a general pulmonary fibrosis with emphysema, such as restriction of costal and disphragmatic movement, diminution of or intensified breath sounds and a hyperresonant note. Rales are usually absent unless infection is present.

As to the *X-ray*, there are 3 essential types of shadows described, linear strands, small discrete shadows, and homogeneous shadows of varying sizes; these correspond to the fibrous strands, silicotic nodules, and the conglomerate masses of fibrosis. The nodular shadows are usually characteristically around the hilum, or conglomerate nodular shadows of bat-wing appearance extend into both upper lung fields, or nodular shadows may be distributed in the upper two-thirds of the lung fields, perhaps more pronounced on the right side, with the lower third kept clear by emphysema. With infection present, the shadows are less sharp or the linear strands interconnect or fuse. Large conglomerate shadows appearing out from the hilum leaving the periphery of the lung clear throughout because of emphysema. The distribution of some of these lesions may be determined by the posture assumed by the workers, and infection may likewise determine an ultimate atypical distribution. Many variations from these patterns are seen in the X-ray, especially under excessive exposure or when other dusts are inhaled, or in the presence of infection. It is probable that the main source of the diagnostic difficulties is caused by the emphysema which muffles the physical signs and is responwith emphysema, such as restriction of costal and diaphragmatic movement, diminusible in great part for the absence of symptoms. It may blot out, even on X-ray, the silicotic lesions of fine size. Examples of such difficulties in diagnosis as encountered by us are the following:

Case I—Mr. T. A forty-five year old man entered the New York hospital complaining of mild cough and expectoration of four months' duration. He appeared acutely ill, his fever was 103 degrees and respiration 28. Rales were elicited over the upper half of both sides of the chest. Examination of his eye grounds revealed bilateral retinal tubercles; his sputum contained numerous acid-fast organisms. The X-ray revealed fine mottled shadows distributed throughout both lung fields and a small cavity at the left apex. A diagnosis of miliary tuberculosis was made. However, after one weeks' stay in the hospital, his temperature and pulse returned to normal and during the following month he gained 18 pounds. The signs in his chest now became confined to the left apex. In view of his unusual progress the diagnosis of miliary tuberculosis was doubted. His occupational history revealed that up until three years before entrance to the hospital he had worked for 20 years polishing leather on a sandpaper wheel. There were numerous machines in the work room and no precautions were observed to clear the very dusty air. His sputum was examined through the kindness of Dr. Burke of Raybrook, N. Y. who found it laden with numerous doubly refractile silica particles. He expressed the opinion that this was consistent with silicosis for he had found such numerous particles only in cases of silicosis. The patient subsequently died of a tuberculous meningitis. Retinal tubercles were demonstrated on microscopic section. The pathologist's report was miliary tuberculosis. Ashing of the lung showed increased silica content, consistent with undue exposure to dust (more than 2 mgm. silica per gram dried tissue).

Case II—Mr. R., aged 54, entered the New York hospital complaining of hemoptyses, dyspnea and chest pain. On physical examination there were rales and dullness over the upper third of the right chest anteriorly. He ran a low grade fever but was robust and felt quite well. The chest X-ray disclosed enlarged hilum shadows, particularly on the right, and diffuse mottled discrete shadows throughout both lung fields with a circumscribed density near the right apex. He gave a history of having worked for twenty-four years as a cutter and sizer of asbestos-containing paper box boards. The rooms were in a continuous cloud of dust. Examination of the dust revealed 5 per cent silica content. The hemoptysis, we felt, was to be explained on the basis of infection or neoplasm, but we did not know whether we were dealing with one of those processes alone or an associated silicosis or asbestosis. A small nodule in the neck was subsequently removed and showed carcinoma. We are inclined to believe that this does not explain the whole process, as the man is still alive and certainly, from the X-ray standpoint, we cannot say that there is no silicosis.

Case III—Mr. C. A dish-washer, aged 46, entered Bellevue hospital because of cough and expectoration, associated with dyspnea. There was some dullness and rales at the right base posteriorly. Chest X-ray revealed a homogeneous shadow at the right base. His sputum contained no tubercle bacilli and lipiodol study revealed no abnormalities. Bronchoscopic examination disclosed a bleeding mass in right main bronchus. Symptoms and disease progressed during the following four years. Discrete mottled shadows first appeared in the upper right lung field and the shadow at the right base cleared somewhat. Three years later extensive abnormal shadows were present throughout both lung fields, particularly on the right. Diagnosis of chronic penumonia of unknown etiology was made. At no time was a diagnosis of silicosis entertained, because as far as could be determined he had no history of exposure. Furthermore if there were silicosis it behaved very atypically having the lesion confined practically to the right base at the beginning and then spreading to the left lung. Autopsy however, revealed a typical silicosis associated with a small degree of tuberculosis. A picture of the lung showed how much more extensive the silicotic process was in the right lung. There was stenosis of the right middle lobe bronchus with bronchiectasis in this lobe. Chronic infection in the lung field probably accounted for the unusual localization. This case illustrates how necessary it is to have the history of dust exposure for without it here we are unable to even suggest a diagnosis.

Case IV—Mr. C., aged 45, complained of cough and dyspnea with slight expectoration and gave a history of having worked for many years repairing tires, using talc powder. It was difficult to obtain accurate details as to the possibility of silica exposure except that the rooms were filled with clouds of dust. Rales were present at both apices and a few tubercle bacilli were found in the sputum. Discrete and stringy shadows were disseminated throughout both lung fields. We know from the positive sputum that tuberculosis is present. The patient has, however, been well for a period of two years. The doubtful history of exposure together with the numerous discrete nodular shadows in his lung, which are consistent with silicosis, makes this patient a problem. Is this tuberculosis alone or is this tuberculosis with silicosis? The patient is still living a year later and working.

Conclusion. Cases such as these are exceptional, but their existence must always be borne in mind. If occupational history is inadequate and X-ray, clinical and laboratory studies prove misleading, the diagnosis may present great difficulty. However, a comprehensive study of all possible data usually clears up the problem with reasonable certainty.

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- C. B. Boulet, Wisconsin Public Service Corp., Milwaukee, Wis.
- G. A. Doeller, Dayton Power & Light Co., Dayton, Ohio.
- E. J. Kreh, Philadelphia Co., Pittsburgh, Pa.
- Wills Maclachlan, Electrical Engineer, Toronto, Ont., Canada.
- B. B. McCulloch, Bureau of Safety, Chicago, Ill.
- George Opp, The Detroit Edison Co., Detroit, Mich.
- F. M. Pepper, Illinois Bell Telephone Co., Chicago, Ill.
- C. J. Rutland, Texas Power & Light Co., Dallas, Texas.
- J. L. Vandegrift, The Chesapeake and Potomac Telephone Co., Washington, D. C.
- H. F. Webb, West Penn System, Pittsburgh, Pa.
- H. M. Webber, Illinois Bell Telephone Co., Chicago, Ill.

TUESDAY MORNING SESSION

October 15, 1935

The first session was called to order by General Chairman E. J. Kreh, Philadelphia Company, Pittsburgh, Pa., who welcomed the delegates and outlined the activities of the section during the past year with special reference to the work of standing committees.

of the units had a rate below this average and fifteen had perfect records. In this contest eighteen plaques were awarded and seven certificates.

The plaques were presented to Contest winners by C. H. Dinsmore, director of safety, Wisconsin Power and Light Co., Madison, Wis., and Statistics and Contest Committee Chairman, Public Utilities Section, National Safety Council, as follows:

Combination Gas and Electric Division, Group A—Central Illinois Light Co., Peoria, Ill., 1,978,291 hours, 3 injuries.

Combination Gas and Electric Division, Group B—Three tied for first place—Panhandle Power & Light Co., Borger, Texas, 334,491 hours, no injuries; Eastern Oregon Light & Power Co., Baker, Oregon, 162,866 hours, no injuries; Moncton Electricity & Gas Co. Ltd., Moncton, N. B., Canada, 107,968 hours, no injuries.

Electric Division, Group A—Duquesne Light Co., Pittsburgh, Pa., 5,612,804 hours, 18 injuries.

Electric Division, Group B—Ten tied for first place—Savannah Electric and Power Co., Savannah, Ga., 447,900 hours, no injuries; Fall River Electric Light Co., Fall River, Mass, 419,456 hours, no injuries; Erie County Electric Co., Erie, Pa., 351,134 hours, no injuries; Maine Public Service Co., Presque Isle, Maine, 172,324 hours, no injuries; Worcester Suburban Electric Co., Uxbridge, Mass., 161,220 hours, no injuries; Gloucester Electric Co., Gloucester, Mass., 159,140 hours, no injuries; Newport Electric Corporation, Newport, R. I., 148,344 hours, no injuries; Citizens Power & Light Co., Council Bluffs, Iowa, 126,075 hours, no injuries; Canada Electric Co., Ltd., Amherst, Nova Scotia, Canada, 116,025 hours, no injuries; Kaministiquia Power Co., Ft. William, Ont., Canada, 81,324 hours, no injuries.

Gas Division, Group A—The Laclede Gas Light Co., St. Louis, Mo., 2,274,476 hours, 3 injuries.

Gas Division, Group B—Two tied for first place—Reserve Gas Company, Pittsburgh, Pa., 313,464 hours, no injuries; Peoples Gas Company, Port Arthur, Texas, 146,979 hours, no injuries.

What the Utility Executive Expects of the Safety Director

By N. M. ARGABRITE

Vice President, American Gas and Electric Company, 30 Church Street, New York, N. Y.

The safety movement is, to the most of us, a comparatively recent thing. In the earlier days of the electric industry we paid little attention to accidents. An accident was something that just happened. Those were the days of small power houses, each manned by an engineer, a fireman, and an oiler. We had three or four electricians and linemen who did all sorts of work from unloading coal to stringing wire and wiring houses.

As I look back I can recall accidents in sufficient numbers to convince me that our accident rates must have been terrifically high. On one property that I recall we had 22 employees and on our present property we have 2,200 employees, or one hundred times the number.

During 1934, there were two deaths on the present property or one for each 1,000 employees. If we applied that rate to the property with 22 men, we would have had only one fatality in fifty years. We know that the record of the small properties was much worse than that. My guess is that our accident rate in those days was terrific.

We became accident conscious as our properties grew, for as the executive began to look through a magnifying glass, so to speak, he saw the original picture magnified one hundred times.

Accidents are viewed by the executive from more than one standpoint. First and foremost, there is the humanitarian standpoint. He feels that he has no right to run a business that kills a number of men each year and leaves a trail of widows and orphans. He has no right, but also has no stomach for it. He is human. His heart aches for a faithful assistant and for the family that has been deprived of its breadwinner.

Then there is the standpoint of public opinion. People do not look kindly upon a company that is continually creating cripples and causing deaths. The local press cannot afford to let such things so unnoticed.

Then there is the financial standpoint. Liability insurance, both employee and public, is no small item. And there is the loss of trained men.

The executive, as his property grows, concludes that accidents must be stopped. He must place in his organization a man who can give his entire time to safety. Once he has come to this conclusion he has only started. Hiring a man sounds like an every day affair, but hiring the right man as safety director is a job of major importance.

What kind of a man do you want to guide and educate your organization? He must get the interest and command the confidence and respect of the organization.

First qualification the man must be mature. Seasoned linemen and power plant men will not pay as much attention to a youngster as to a mature man. I do not believe that you can get very far by taking a man without practical experience in your industry. I can hear a hard-boiled lineman remark: "What does that kid know about it; he never climbed a pole"; or, "What does that old duffer know about our business, he never was in it."

If I were selecting a man to head a safety organization I should look for a superintendent of broad experience and a two-fisted, red-blooded man. I should want him to be friendly and unafraid.

This man would be the representative of the executive head of the organization. He would speak with authority. He would be a teacher to the entire organization from the executive himself down to the laborer. And he must be courteous and give no offense. A big job to find such a man? Yet these are the qualifications for a successful safety man.

I should not expect this man to take the responsibility for the detailed task of accident prevention. I should expect him to train the organization in such a way that the "non-commissioned" officers would feel that the safety of the men working under them was in their keeping; and I should expect him to pass on the credit for all that is accomplished to those "non-commissioned" officers, and the men under them. I should expect the safety man to learn the best methods of first aid and resuscitation. I should expect him to pass on this knowledge group by group down through the non-commissioned" officers o fthe organization to the men. I should expect him to formulate, with the assistance of the engineering department, such rules as are needed and to each the "non-commissioned" officers how to study the root and the source of accidents.

I should expect the safety man to pick lieutenants for permanent or part time duty. He should study the organization and slowly take the square pegs out of the round holes and fit them in where they belong. He should do this in such a way that the suggestion seems to come from the foreman.

There are men climbing poles who have no business to because of some defect of which they, themselves, may not even be aware. There are men in boiler rooms who have no business in boiler rooms. There are many men driving cars and trucks who are not qualified. These men must be relocated.

We talk a great deal about teaching men, foremen and superintendents to guard against accidents, and yet we leave accident traps lying around our system. I believe that on a large property a safety director should have a full-time lieutenant whose job is the constant inspecting of the property looking for danger spots and accident traps, such as a place in a fence where a child can crawl through and come in contact with dangerous equipment.

When we go before a public service commission or a court to establish the value of our property for rate-making purposes pricing everything that we can lay our hands on, we say: "Your Honor, that is not all. In addition to these values we claim a GOING CONCERN value." Then we outline what we mean by this, and one of the principal things we mention (and it has been recognized by the Supreme Court) is that we have a trained, coordinated and efficient organization built up over a long period. We may claim that this one item has a value of a million dollars, and yet we may be going along letting this organization be shot to pieces by accidents. Sometimes we hesitate to hire a safety men who is big enough to do a real safety job because we don't want to pay the price for a mature, capable man.

What Does the Safety Man Expect of Management and How Does He Get It?

By J. L. VANDEGRIFT

Assistant Vice-President, The Chesapeake and Potomac Telephone Companies

The safety man may expect many things of his management. He may expect a large, well-equipped office, with push-buttons to summon messengers, clerks and secretary. He may expect a fat salary; experienced assistants to relieve him of arduous details; he may expect the dignity of an executive job and other luxurious appointments. But how a safety man is to get these things I cannot tell you, for I have tried to waggle them out of my management for years without success.

What is vastly more important is to determine how a safety man may obtain the moral support of the management in initiating an effective policy and in installing suitable practices with respect to the safety of the personnel.

Safety, to my mind, has to do with the very fundamentals of production and all of its operations. Accidents are a form of industrial waste, just like a product defective in quality, and therefore are indications of wrong methods, wrong engineering, faulty supervision or general inefficiency.

There are three principal factors to be considered and directed in guiding the accident prevention activities in any industry—the management, the men, and the machines.

By the management is meant all those who have any supervisory or management responsibilities. By the men is meant the general forces, the people who actually do the craft work. By the machines is meant the appliances and material with which the work is done. Production losses, such as accidents, arise from the failure of any one or from a combination of these factors.

It is necessary that the machines and appliances be built and operated according to approved standards which include necessary safety factors. In a public utility, for instance, it is essential that pole lines be built in accordance with recognized standards, and that they be maintained in a safe condition for the men who work on them. With respect to tools, these shall be constructed according to approved standards and maintained in satisfactory workable condition. The materials shall conform definitely to quality specifications. Perhaps there are fewer accidents that happen through the inherent fault of the machine or materials than is generally appreciated.

We must have certain standards for our workers in industry if we are to have the work efficiently performed, and, of course, it cannot be efficiently performed if there are accidents. The workers should be selected with regard to their physical and mental fitness for the job and with due regard to the potentialities of the individual for progress in the organization. After his selection, the employee should be trained in the work that he will be required to do, and adequately supervised. He should have inculcated in him the proper attitude towards the job with respect to its correct performance. While these factors affect the man, it is easily evident that they are in fact responsibilities not of the man but of the management.

We may all agree that a few of the classifications of accident causes which apply to the individual are recklessness, carelessness and ignorance. I have never seen a reckless person in the telephone business. I have heard the term careless applied to many accident causes during the last fifteen years and I have seen many accident reports which indicate ignorance of the employee, but I submit that the so-called ignorance and careless factors are management responsibilities. They indicate lack of training, or of overseeing, or of selection standards, or possibly of discipline, all of which are faults of supervision. The accident-prone employee is also a sad commentary on effective supervision.

If it is management's attitude that accidents are bound to happen, then certainly accidents will happen. If on the other hand their philosophy is that accidents are indications of inefficiency, that they interfere with production, that they cost money, that they are a waste which can be controlled and that they are a bad personnel influence, that is to say, that if the management views its accident as an indication of *management* inefficiency, then we have a correct and reasonable preamble to the safety movement. This attitude is one which the so-called safety man has a right to expect of his management.

Let us view some of the factors involved in safety activity, and please remember that these several factors are common to both safety and effective production. Their application to safety is merely incidental to efficient operation.

These factors are: Selection, which includes assignment of men; Training; and Supervision of Operations.

I. Selection

1. *Selection of Employees.* As indicated previously, it is necessary that great care be exercised in the selection of the men who are to do the work of an organization, because these are the people with whom supervision has to deal. Besides the mental and physical qualifications determined by the nature of the work to be done, it seems to me that there is to be considered another quality which is quite important not only from an accident prevention standpoint, but also from an all around performance standpoint. It may be called the *moral* quality and it includes consideration of the individual's conduct on the job, his ability to fit in with the other members of the group, his reaction to discipline and his obedience to instructions.

2. *New Men.* The reception and treatment of a new man on the job very often determines his future with the company. He should be impressed with the importance of efficient performance, including safe workmanship. He should be carefully directed and observed especially during the early period of his employment. Before assignment to any task, his foreman should see that he is thoroughly trained in the correct method of performing the task; after which he should be guided until he becomes proficient. It is important that the new employee form correct habits of work under the immediate direction of his foreman or of an assigned experienced employee.

3. *Assigning Men.* Consideration shall be given by the foreman to the employee's particular fitness for the work to which he is assigned. A difficult job calls for an experienced man. A job on which there is greater than ordinary possibility of accident should be assigned to an experienced, dependable man. Several important items are to be considered before assigning men to difficult jobs. These include physical, as well as mental, and particular ability.

II. Training

1. *Training of Men.* Probably the most important responsibility of a foreman or supervisor is that of training. Workmen should be trained in the approved methods of performing the work and should be directed in order to see that these methods and no others are used.

2. *The Supervisor's Knowledge of the Job.* The supervisor or foreman being the director and trainer of men, it is necessary that he be more familiar than anyone with the job requirements. He must know the correct work methods otherwise how can he teach them. He must be taught how to supervise and how to teach.

III. Supervision

1. *Planning the Work.* Supervisors should appreciate the necessity for planning each job so as to insure its safe and efficient accomplishment. The job should be surveyed to ascertain the conditions to be met and to determine the methods to be used. If there are dangers involved, plans should be immediately and definitely made.

2. *Definite Instructions.* In situations involving more than ordinary accident possibilities, definite and exact instructions should be given regarding things to be done and methods to be used. Statements should be concise and understandable.

3. *Personal Supervision at Danger Points.* In crew operations, if the preliminary survey discloses greater than ordinary accident possibilities, the work should be planned so that the foreman will be present to direct it.

4. *Discipline.* This means training men to act in accordance with established rules. The supervisor is concerned with having his men conform to the rules of the company. The foreman is the company as far as his employees are concerned. He should speak with authority and insist that his instructions be fully and completely carried out.

5. *Inspection of Work.* Good work welcomes critical inspection. Frequent inspection of work in progress and of completed work is necessary to insure that standards are being met.

6. *Set Good Example.* The foreman who takes chances, who violates safety rules himself, or who overlooks infractions by his men, stands a poor chance of obtaining the cooperation of his workers in safety. If he is sincere in his safety endeavors and strictly follows and enforces the rules, he earns the respect of his men. A good example is necessary to obtain discipline.

The title asks the question "What does the safety man expect of management?" My answer is that he expects the management to take unto itself the responsibility for the safe performance of the work. That it does not blame men and machines for accidents to men or for production failures. He expects management to have a reasonable and sound philosophy concerning the safety of their personnel and to treat the safety work, not as a thing apart, but as part and parcel of sound operations. He expects the management to have a plan for the training of foremen and men; and to permit him, the safety man, to direct the methods and practices to be used in production; and to direct the supervision of work in order that failures will be kept at a minimum.

How does he get these things? He gets them by going after them. First, by setting himself straight as to the real relation of safety to operations—that accidents are operating failures, then by selling his management on these principles. This, it seems to me, can be advanced by the analysis of accidents that have happened, tracing their causes to management failure. Then he must inculcate in every management person an appreciation of this viewpoint that "the successful promotion of accident prevention work is largely a matter of executive interest, and unless management takes the lead and unless the employees generally recognize that management is leading, no plan of safety can hope to function."

If the safety man does his job well he may get his reward from the management or he may get it in heaven. If he fails, he can expect to catch hell in large, unadulterated doses.

ADJOURNMENT