FILE NAME: National Safety Council (NSC)

DATE: 1936

DOC#: NSC478

DOCUMENT DESCRIPTION: NSC Presentations [9] by Hunt, Templer, Stratton, Drinker, Newton, Lanza, Meller, Jones & Waters

9 conf presentations by Hunt, Templer, Stratton, Drinker, Newton, Lanza, Meller, Jones, Waters

TRANSACTIONS

25th National Safety Congress

NATIONAL SAFETY COUNCIL, INC.

ATLANTIC CITY, NEW JERSEY
OCTOBER 5 to OCTOBER 9, 1936

Ambassador, Chelsea, Ritz-Carlton Hotels
and Atlantic City Auditorium

Occupational Diseases

FRIDAY MORNING SESSION

October 9, 1936

The session was called to order by the Chairman, Dr. Hart E. Fisher, Vice-President for Health, National Safety Council, and Chief Surgeon, Chicago Rapid Transit Co., Chicago, who presided, introducing the speakers.

The Lesser Known Facts About Common Occupational Diseases

By DR. ROBERT B. HUNT

Medical Advisor, American Mutual Liability Insurance Co., Boston

Probably the leader in the parade of industrial diseases is an acute or chronic inflammation of the skin which we call dermatitis. This disease may present itself in any type of shop, factory or foundry. Any paste, powder, gas or liquid which comes in contact with the employee's skin, even the water supplied by the town in which he lives or works, may be the potential cause of such a skin disturbance.

The wide diversity of causes together with the varying susceptibility of different individuals makes the problem of control difficult.

Much investigation is under way to determine why one person may be susceptible to a certain substance while another is not. It has been proved many times that a poisonous substance formed within the body has been able to prolong the action started by some external influence. A printer developed a marked dermatitis from ink which persisted for two years. Finally food tests were made and showed that he was susceptible to lettuce, which, when removed from his diet cleared the skin. He returned to his usual occupation without a return of symptoms.

The poisoning of allergic substances is usually an accumulative process. It takes time to produce a manifestation of disease, but let any other substance cause the disease, and the irritating food may be of sufficient strength to magnify its action.

All cases of dermatitis cannot be cured by eliminating offending foods, but further investigation along these lines may give us a clue with which to lessen the loss of time from work and the discomfort now produced by industrial dermatitis.

Metals

Lead

The distribution of lead poisoning is quite extensive.

The skin of the body is a protective covering, and as long as it remains intact it does a good job except in the case of tetraethyl lead, which is used in blending gasoline and which is readily absorbed through the skin, having a tendency to create changes in the nervous system. The effect of other forms of lead, through that avenue of entrance, is practically nil, which explains the extremely low poisoning rate in typesetters, painters and others who continually come in contact with metallic lead.

Lead in any form, introduced through the mouth, acts rather slowly when compared with the inhalation of lead dust or fumes. However, no matter what the portal of entry may be, lead is acted upon by the body fluids and so converted that it may eventually be deposited within the bones.

Those bony safe deposit vaults may retain their lead contents for days or for years, and if the exposure is removed, may also free the employee of all signs

and symptoms of lead poisoning. But imagine the surprise of that supposedly cured person when years later, perhaps following some type of infectious disease or the excessive use of alcoholic beverages, he awakes to find that he suffers the aches and pains and paralyses of an acute lead poisoning. As the body fluids alter lead that it may be deposited, so may those fluids attempt to de-lead the body, and too rapid absorption may produce the original disease with all its discomforts.

One can readily see, then, that in some cases investigation of previous occupations is quite necessary to determine the original contact with lead.

Heating of molten lead causes a black scum of lead suboxide to form on its surface, and the heat from the metal disburses the fine powder into the air. Hence, in the process of smelting ores such as zinc, copper and silver, mixed with lead, we find a rather high lead poisoning rate.

Those engaged in the manufacture of lead wire and cables, batteries, glass, pottery and rubber industries, plumbers and users of dry colors offer their share of lead poisoning.

Probably the greatest source of lead poisoning may be found among those who sandpaper, scrape, chip or burn lead paint, for the dust and fumes caused by those activities are rather rapid in their action. Such workers may become incapacitated in a few days because the inhalation of lead dust causes the maximum amount of absorption into the blood stream in the minimum space of time.

Chromium

Chromium is a metal widely used as a foundation for colors, and dusts from its various salts may produce lesions of the skin and mucous membranes of the nose. Chromium plating by electrolysis may cause fumes which are similarly irritating. Although chromium poisoning does not usually cause death, the number of days of absence from work on account of incapacity which it causes is gradually increasing.

Other Metals

The most efficient portals of entry of foreign substances into the body are the nose and mouth. The smaller the dust (the size of smoke particles for example) the greater the speed of absorption by the blood. Fumes from hot metals carry not only poisons but numerous minute dust particles. This explains the incapacities occurring among those engaged in acetylene and electric cutting and welding. When men are so employed over a prolonged period of time, the constant inhalation of fumes and dust might produce symptoms of the metal upon which they work. In the shipbuilding trade, particularly in the construction of metal ships, we find occasional cases of metal-fume fever. "Brass chills" and "spelter shakes" from zinc are names applied by the lay people to such diseases. The terrific heat applied to some of our common metals and alloys by acetylene torches produces sufficient fumes to cause a temporary incapacity in 24 hours. Permanent disability from such causes is rare, however.

Diseases Due to Dust

Twenty-five per cent of all workers exposed to high concentrations of inorganic dust are expected to develop changes within their lungs due to that agency. We are at a loss to explain why the other seventy-five per cent are not so affected.

Mining, quarrying, foundry work, grinding, sandblasting, abrasive soap manufacturing, asbestos work, the making of emery and carborundum products and many other occupations offer opportunities for employees to inhale microscopic dust particles and create a foundation for possible future incapacity.

We are interested particularly in those men who work with sandstone, quartz, flint, granite, and sand, because they expose themselves to silica, and the chemical changes between that dust and the body fluids, in the presence of tuberculosis, may and usually do lead to a fatal ending.

It is safe to say, in light of our present knowledge, that the action of other inorganic dusts is much less virulent and incapacitating. That, however, does not allow us to lower the vigilant methods to improve dust control and protect employees, because all dusty occupations are potential trouble makers.

Although the actions of various dusts differ within the body, the exposure to asbestos fibres, present in the weaving and grinding of dry asbestos material, offers another type of dust which may cause fatalities among workers.

The organic dusts from cotton, silk, wool, tobacco, flour and similar substances are practically harmless. Such dusts rarely reach the lungs but may cause irritation of the windpipe and larger air tubes and result at the most in a mild bronchitis.

The factor which should be borne in mind, particularly when dealing with silicosis and asbestosis, relates to the progression of such disease. When changes occur within the lungs as a result of the presence of such dusts, nature forms scar tissue to heal such lesions but may fail to stop when the job is finished. As a result, the continuation of that healing process may lead to such structural changes within the lungs that partial or total incapacity may follow months or years after the employee has been removed from his dusty occupation.

Benzole-Benzene

Benzol is a distillate of coal tar used extensively in industry. It is an essential ingredient in the manufacture of explosives. It is an excellent solvent for grease, oils and cements, and because of that property it is important in many phases of the rubber and cleaning industries. In the manufacture of shoes benzol may be an ingredient of the dressing applied to the leather and of the cement which fastens the heels and soles. Not only in the shoe trade but in other branches of industry where employees work with gummy, sticky material, the workers soon learn of the solvent and cleansing action of this liquid and use it freely for that purpose upon themselves. The subsequent outbreak of skin afflictions may be the first indication of such unauthorized use.

Benzol is extremely poisonous, entering either through the nose or mouth or absorbed through the skin. Its action within the body is varied and may produce a multitude of signs and symptoms. The bone marrow becomes affected which in turn alters the character of the blood; hemorrhages are common; it may cause death.

The fumes from benzol are heavier than air and lie near the floor, which is an important point in the engineering problem of ventilation.

The members of the benzene group are absorbed through the skin, and more cases of poisoning are found when men perspire than when their bodies are cool. Probably the answer to that is that the fumes may solidify as they cool and the powder may settle on the skin. The sweat on the body may dissolve this dust so that it is more readily absorbed through the increased surface blood supply.

Chlorinated Hydrocarbons

This group of petroleum derivatives has been known to science for years but during the past decade its advance into the industrial field has been widely distributed and most important. Led by carbon tetrachloride and its chemically associated members, it has furnished industry with refrigerants for ice chests, excellent solvents for rubber, wax, oil and grease, thinners for lacquers and a very fine household necessity for the removal of spots from clothes. Hospitals have been using it more and more for the removal of adhesive plaster.

Due to the non-flammability of carbon tetrachloride, it is used in fire extinguishers. The rapid evaporation produces fumes which may smother a small blaze, but we must not forget that excessive heat of the actual fire may bring about combustion sufficient to produce such biproducts as hydrochloric acid and phosgene gas. Like its associated member, chloroform, it may produce sleep when inhaled by an individual, and only 1/350 of an ounce in a quart of air is necessary to produce such action. That thought must be remembered when a large quantity of those liquid products is spilled on the floor, perhaps accidentally. Action should be started at once before the liquid gasifies, and employees should be notified to keep their heads up to avoid the low ceiling of gas.

Chemists have developed and introduced to industry many new products, the basis of which is the chlorinated hydrocarbons. These derivatives of petro-

leum distillation are frequently combined with those from coal tar to form valuable chemical combinations. They have been placed on the market so rapidly that medical science has been unable to determine their physiological effect upon the health of man. We have known that some of these chemicals are capable of creating changes in the liver, and only recently in a city in Massachusetts one of these newer products caused the death of two employees and a battle to retain life among two others.

Carbon Monoxide

You remember the adage, "Where there is smoke, there is fire." We might add to that, "Where there is fire there is carbon monoxide."

This odorless but poisonous gas may occur in any industry or in any home, but the poorer the ventilation the better the chance of producing physical incapacity.

Since the advent of the motor car, whose exhaust pipe may pour forth as high as 6% of carbon monoxide, we are all exposed to that gas, particularly in crowded cities. The ordinary passenger car liberates about two cubic feet per minute, and one can readily estimate the physical damage that may be done if such a motor is allowed to run within the doors of a poorly ventilated garage or shop. Fortunately, serious cases of such poisoning are not common among those employed in public garages, but many of those employees are likely to complain of headache and faintness at the end of a day's work, especially in colder weather when doors and windows remain closed.

In the steel industry, where gas is used as the heating agency in the blast furnaces, care must be used to provide proper ventilation. Within the mines, workers are warned to allow enough time following blasts for the escape of this gas.

Being a colorless, odorless and tasteless gas, quick of action within the human body, the manifestation of the very first symptom may be too late to save a workman from partial or total incapacity or perhaps death.

Because the exposed person suffers first from motor paralysis, he may be unable to help himself or even to warn others of the danger. Even if removed from the poisonous gas at that period the damage actually done by the gas may result in permanent physical damage.

Infection

The skin is a protective covering of the body against infection and is extremely efficient as long as it remains intact, but allow it to be broken or punctured, introduce bacteria, and a battle ensues between the offensive agencies of infection and the defensive powers of the body. The winning of such a struggle may determine the presence or absence of incapacity. Infections are common throughout industry, but two types are particularly prominent — infection resulting from anthrax and infection among meat packers and fishermen.

Many of our fur, hair or wool-covered animals may contract anthrax. The germs of that disease defy the ordinary methods of sterilization and may linger on hides, bristles or hairs for long periods of time. Tanners, wool sorters, and hair or bristle workers may introduce the anthrax spore beneath their skin and undergo much physical suffering and sometimes death.

Infections are frequently found among meat and fish packers and those engaged in deep sea fishing. Although death rarely occurs, the loss of fingers, hands and nasty septic wounds are the result.

Punctured wounds, cuts, abrasions, burns and scratches are potential avenues of entrance for bacteria which would seem to be waiting everywhere at all times for such a break in the skin. Early medical treatment might often save later surgical interference, not to mention the accompanying discomfort, incapacity and perhaps the loss of an essential body part.

Summary

I feel that the time has come when an employer must demand of a manufacturer the answers to two questions:

1. How will your product affect my business?
2. How will your product affect the health of my employees?

That employer is entitled to honest answers based upon sufficient chemical and physiological examinations of the questionable product. That manufacturer

...held responsible for the ills ...ught by the use of his product and ...ilest he can guarantee its safety, it has ...o place in industry. Too many lives ...ave been lost or jeopardized by too ...ittle knowledge of a product's action ...pon those who handle it.

The incidence of lost time due to ill...ess and injury in industry has been ...reatly lessened by the many agencies ...orking along lines of safety. When industry has been made fool-proof by the substitution of non-toxic preparations for those now found to be harmful, and when each employee is imbued with the idea that constant thoughtfulness and care are most necessary for the maintenance of health and happiness, then, and not until that idealistic stage has been reached may vigilance and perseverance to maintain and preserve health, limb and life be lessened.

Pre-Employment Examination as an Aid to the Control of Industrial Diseases

By DR. W. C. TEMPLER
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We may well ask whether or not physical examination is of any value to the world at large, rather than limit the discussion to the control of industrial diseases. In the conservation of life and health much progress has been made in the eradication or control of such diseases as occur in epidemic form, as well as that type of disease which is not truly epidemic, but occurs in such frequency that general health programs are necessary. Much has been done to control such disabling illnesses as heart disease, arterio-sclerosis, kidney disease and diabetes; and something has been accomplished in the control of morbidity, which tends to, at least, make people happier through good health, even though an increased span of life is not gained.

Physical examination has played a large role in accomplishing these things, because it was through physical examination and physical observations that investigators were led to exert themselves to find a remedy for the cause of such conditions. Small-pox is no longer prevalent, due to such observations, which led to its control by vaccination. Malaria and yellow fever have been brought largely under control, and knowledge is now available in the control of venereal diseases if the proper physical examination and laboratory methods are used to arrive at a diagnosis. We are all familiar with the results obtained in decreasing the death rate due to tuberculosis. In fact, in the treatment of all epidemic-type diseases that have so far been eradicated, the examination of patients to determine the severity of symptoms and the improvement has been of foremost value.

Knowing that the average span of life has been increased eight years in the last quarter century and assuming that the above mentioned factors have had some bearing on it, could we decry the value of physical examinations for the general population?

If we know that examinations made by insurance companies and their associating examining institutions, the clinics run by the United States Public Health Service, and the great mass of physicians, who all carefully examine their clientele, have been of value in the control of disease, may we not assume that examinations in industry will help control the incidence and extent of industrial disease, particularly when the life expectancy of industrial workers is less than that of the general population?

In fact on April 14, 1936, at the National Conference on Silicosis and Similar Dust Diseases, called by the Secretary of Labor, Dr. R. R. Sayers of the United States Public Health Service said, "Preliminary and periodic physical and roentgenological examination should be made of all employees engaged in industrial processes where there is a potential if

not actual exposure to excessive concentrations of silica in the atmosphere."

Naturally in the early work of industry, only basic materials were used, ingredients had not arrived at a state of development and complexity, when intricate chemical compounds and other toxic materials were even known of, much less used. At the present time over 500 materials are listed which can, under certain conditions, cause industrial disease and the list is by no means complete, inasmuch as experimental work is being done by the personnel of practically every plant or industry to improve or enlarge its manufactured products by taking advantage of the great amount of knowledge science has given us.

Industrial examinations are of two kinds. First, the pre-employment examination, which consists of a very careful history, not only of the family, but also of the previous occupations with length of service in each, previous health and illnesses and present habits. Naturally such a history is of no value unless truthfully given and a reasonable amount of time must be taken to acquire details, which are often vague in a workman's mind or considered by him to be unimportant. The physical examination, of course, varies with the type of industry, and should be given with the knowledge of what the man's exact occupation is to be, and by a physician familiar with the industrial processes in which he is to be employed. In this way selected employment can be obtained for men who have some basic disqualification for one job, but which does not impair their ability for useful employment and the conserving of health in another.

The physical examination must be thorough. It should include all methods of determining a latent disability or one that is already present. Many examination forms are available from insurance companies or other health services, which have been designed entirely for industrial work. It has been the experience of men interested in this work, that all the special senses of the body must be tested as well as the measurement of motion in all joints. The cardio-vascular system is of great importance as is the respiratory and gastro-intestinal tract.

Re-examination and periodical checks, because of particular industrial hazards, must be correlated as to time spent in the hazard, although a period of one year is, perhaps, proper for persons who feel in good health and have no complaints or who are not working in toxic substances or with other materials which would under some conditions impair their health and usefulness.

The objectives of pre-employment and post-employment examinations are the same, that is: the establishment of a physical standard in which the employee can pursue his trade or labor, having no discomfort or ill effect due to industrial exposure to harmful products. Such products and materials are, as we have mentioned, of great number and variety. Attempts have been made to classify workmen as to age, sex, color and nationality. Whether or not any of these classifications are of value, it still remains that the primary effort is to have healthy workmen and the benefit is of as great value to the workman as to the industry. The benefits of individual and community good health are numerous and obvious and the benefits of good health to industry are equally important. The employee will be more productive, receive higher wages and be happier. The labor turn-over rate because of poor health will be lowered as will the costs of insurance. The working personnel will be more efficient and contented, and will dislike to be exposed to the overt acts of people who are epileptic, insane or who disregard communicable disease, and will use their endeavors to work safely among hazards they have been taught to respect.

The harmful exposure to each hazard is, of course, different, ranging from a few days as, for example, an acute poisoning from toxic gases, to that of 15 or 20 years in some of the less toxic dusts; therefore the period before re-examination for each class of employee will be different. However, individuals differ also and it is hard to state a definite period which may be satisfactory for each employee in a single class of hazard. Supervisors can often be of great value in sending employees out for physical examination whenever there is a change in attendance or work ability, or whenever they have been off on account of some illness such as those self-diagnosed as common cold, lagrippe, cough, sore throat or skin irritation. Such observations should be

consultant, where there is not a full-time physician, and they are of the greatest value in the early determination of a susceptibility to or the beginning of an industrial disease.

We are fortunate in having had a large amount of research work done on industrial diseases, until at the present time, materials from acetaldehyde to zinc are listed together with the processes in which they are used and the symptoms which they cause, and an estimate of the amount of exposure in nearly every case necessary to produce symptoms. It is really not too much of a problem for an interested physician to accumulate a supply of such knowledge, particularly when he knows the processes involved during the manufacturing procedure of his industry. It thus becomes relatively a routine matter of observation, together with examination for specific signs or symptoms at the time of the periodical re-examination, to obtain some degree of control of the hazard.

We cannot discuss the benefits of pre-employment examination and periodic re-examination without mentioning some of the objections to it. If a man has a disability, he naturally is anxious to keep it to himself, and in some cases we find that the workman is disinterested to a point that he would rather not know of a disability even though he has it. Certain special groups regard each man as entitled to employment whether he is physically fit or not, on the assumption that industry hires labor, not health, and that rejection because of physical disability causes a class of artisans to become prejudiced against and become charity cases. It is also alleged that the quality of medical service in industry is such that the results of examinations are misleading and of no value. Another objection is voiced by labor unions, it being claimed that pre-employment examinations are used to discriminate against labor union workers or members. Many labor leaders realize, however, that pre-employment examination and periodical check-ups are the only means of preventing disability from certain industrial hazards. Competent and honest medical service renders all these objections quite important; for if an endeavor is made to properly place employees, such a small percentage is finally rejected, and that percentage is so obviously unfit to work, that no fair-minded person can fail to see the justice of it.

These objections, however, are being noticed by legislative bodies, and in one State a law is in force which says: "It is hereby declared to be the policy of the legislature of this State, in enacting this article, to prohibit through every lawful means available, any requirement as a pre-requisite to employment which compels an applicant for employment in any occupation coming within the purview of this article to undergo a medical examination." This statement is in a paragraph labeled, "Prevention of Silicosis and Other Dust Diseases," and the logic of it is entirely non-understandable, even though at the present time there is no lawful means available to enforce the stated policy.

If physical examinations are of benefit to the population at large, they certainly must be to the industrial workers, who may be exposed to special hazards; periodical check-up examinations are necessary in any hazardous work or trade, in order to protect the workers as well as the industry; and the benefits to the workers of proper and fair-minded examinations, in all ordinary cases, outweigh the objections.

I have purposely omitted any reference to the economics of pre-employment and periodic re-examination, which apply either to the individual or the industry. However, one of the great public health problems of today is the question of the cost of medical care. If industry assumes some of this cost by periodical examination in connection with the prevention of industrial disease, it relieves the individual of this responsibility and allows more room in his budget for the care of his family. The benefits to industry, of course, are those of a better personnel and a lower rate of insurance. This rate, due to industrial disease hazards, is in many States very high and the logical conclusion is that the real remedy lies in the prevention of industrial disease by any method, one of which, I believe, is pre-employment and periodical examinations.

What Can the Engineer Do to Eliminate the Hazards of Occupational Diseases?

By REUEL C. STRATTON
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If I were asked, "Can the engineer prevent the majority of occupational disease cases" my answer would be, "yes." Obviously, with the exception of those diseases brought about through a sudden or accidental contact with a poisonous material or a virulent disease-producing organism, if the exposure were controlled by engineering technique, then there would be no occupational disease.

The engineer must rely upon the medical director to place individuals capable of working in hazardous occupations and to assist him in controlling these individuals through periodic physical examinations when the men are exposed to occupational disease hazards; but the engineer alone is responsible for reducing generation of harmful substances and for the control of employees' contact with processes using harmful materials.

The ascribing of many and new occupational diseases to industrial environment has produced a problem for him. The engineer generally works with materials which he can see, but the study of industrial disease control may require the handling of invisible materials. It is a common fault to focus attention upon one object to such an extent that others of equal importance may thereby be relegated to obscurity. Today safety engineers and industrial hygienists are concentrating their attention upon diseases caused by the inhalation of dust, but I do not believe the safety engineer is warranted in confining himself to the prevention of diseases caused by dust alone. His consideration should extend to include all materials produced in any manner that they may cause an effect upon a worker. The question of whether a material exists as a gas, a vapor, or a dust is but one of particle size and chemical make-up.

He must not forget that many such diseases are produced by exposure to vapors and gases as well as to dust, and that the control of these industrial diseases may be brought about by the application of certain fundamental principles common to all.

While the problem confronting individual safety engineers varies according to the industry, there are certain fundamentals common to all such problems which provide a workable basis from which an occupational disease prevention program may be developed. Once these fundamentals are set in motion toward a safe working environment, continuance is much the same whether the engineer is engaged with a large organization or with a small one. The fundamentals follow this sequence:

(1) An occupational disease inventory is required.

(2) A plan for correction of the exposures shown by the inventory requires development.

(3) A concentrated attack upon the major exposures first, following through until all are corrected or eliminated.

An inventory of all materials used in a plant will astound the average engineer. He will find many items about which he may have little or no knowledge. He may be confronted with items he had not recognized previously, even though he has been associated with the plant perhaps many years. When this inventory is complete, he should card index it, placing against the name of the material the health hazard associated with it both from a material and a process viewpoint. Such a card index should contain the component parts or constituency of compounds.

Process exposures should be studied in conjunction with hazardous materials. Assistance in compiling such data may be obtained in the bulletin "Occupational Hazards and Diagnostic Signs," prepared by Dublin and Vane of the Metropolitan Life Insurance Company, and in a publication of the United States Public Health Service, Public Health Bulletin No. 214, "The Potential Problems of Industrial Hygiene in a Typical Industrial Area in the United States."

In addition the engineer should obtain all available information upon the materials he is required to study. [illegible]

chemicals, solutions, dusts, degreasing agents, condensation products, paints, lacquers, dyes, abrasives, and other products too numerous to mention are being placed upon the market daily, and the average engineer's knowledge of their possible effects upon health is slight. Academic research determining the effect of these new materials upon humans is progressing slowly, and serious injuries may be sustained in industrial application long before the toxicologist is able to determine the properties of the material and the maximum permissible amount to which a worker may be exposed. In seeking this information it is essential to determine in so far as possible the maximum permissible amount of contaminants which may exist in a work place without causing an occupational disease.

Armed with this information, the engineer is in a position to locate properly in his own plant the process and the operation in which the exposure may exist. The engineer should study together with the plant physician the length of employment of exposed individuals and they should jointly determine the normal expectancy or average length of employment for the specific exposure. From such data may be developed a factor of safety, and the maximum allowable period of employment in certain areas may be assigned. Naturally this study should be focused upon the more hazardous locations first, and when these are corrected, attention turned toward minor conditions.

Housing. One of the most important considerations in attempting to control occupational disease is housing. Whenever practical, any hazardous manufacturing process should be separately housed and isolated; every effort should be made to arrest harmful substances—dust, vapors, or gases—at their source of generation. Buildings should be so constructed that accumulations of dust may be avoided.

When physical separation of departments is required, such physical divisions should be dust or vapor tight. Floors should be tight to prevent transfer of materials to floors or departments below. The engineer should give study to the complete enclosure of machinery or process units as individual units and, if so required, vent each one separately. The transfer of hazardous operations into the open air does not always eliminate the danger; in fact, it may increase the number of workers affected.

Process Revision. To reduce transportation of materials and exposure to harmful substances it is desirable to have all processes mechanically continuous and, if possible, enclosed. When this cannot be accomplished, suitable physical divisions should be provided. The engineer should consider the substitution of wet processes for dry processes, providing at the same time for the disposal of the moist collected material in a safe place. He should consider the substitution of automatic operations for hazardous hand work or machine work. A change of abrasive material will often reduce the quantity of dust produced.

I can cite an example of how a little thought can cure a hazardous machine operation with little or no expense:

A plant producing a finely pulverized material created large amounts of dust in bagging the material, using porous sacks. This high concentration of dust, not necessarily toxic, inconvenienced the workers. The cost of ventilating the department would have been prohibitive. By careful study the engineer determined that the fall of the material into the sacks forced the air out through the interstices of the material, carrying with it a quantity of the pulverized product. His problem, thus, was to provide a means whereby this air could be harmlessly expelled from the sack prior to filling. Study led him to suggest and apply the use of a collapsed paper bag which contained little or no free air. The problem was solved. Dust generation was practically eliminated by this simple change. Many hazardous processes in ordinary manufacturing operations may be cured in like manner if the engineer exercises his ingenuity.

Ventilation. Proper ventilation is of paramount importance in the control of any occupational exposure. Most of the chief occupational diseases other than dermatitis arise through the inhalation or the ingestion of foreign material. If ventilating equipment can reduce the concentration of contaminating materials to a safe limit, the problem is solved. The engineer should study each process separately and ventilate each separately. It is seldom wise to rely upon general ven-

tilation. Instead, high velocity ventilating apparatus should be installed, functioning as closely to the point of generation of the harmful substance as is possible.

Individual machines should be so equipped if possible. Baffles may be introduced to prevent air stream disturbances or to increase the intake efficiency at the nozzle. Down-draft systems should be preferred for the collection of dust or gases of high specific gravity.

Even after the installation of exhaust systems, the engineer must study the type of maintenance required to keep them operating at peak efficiency. Nozzles should not be permitted to become covered nor moved out of proper position. Exhaust piping must be kept dust tight. Blower efficiencies must be constantly checked to insure that intake velocities are proper. The best ventilating system is a false protection if it does not function properly or if it is so poorly maintained that it falls below its designed rating. The engineer must exercise extreme care to provide a clean source of replacement air for the work place. He may find it necessary to install filtering and heating devices. The engineer must study the proper disposal of the collected or expelled material to be positive it will not drift back into the work place.

Employee Protection. While the primary engineering means of protection against possible occupational diseases should be mechanical correction, the engineer will find instances where even the best systems must be supplemented by individual protection. He must carefully study such exposures to provide the highest efficiency of protection, yet obtain a device easy for the operator to wear continuously. When the engineer has been successful in obtaining such a device, he must educate workers to use it.

Sanitation. Clean washing facilities and toilets should be provided. Lunch rooms should be not only clean but also well lighted and attractive and should be under the supervision of the plant physician.

Scientific Tests. Up to this point the engineer has deduced that an exposure exists, and from accumulated data has devised his means of prevention. However, the engineer interested in ascertaining not only exposure but also efficiency of control should realize control cannot be fully effective nor the efficiency of any protective device determined without scientific tests. Assumption, guesswork, unscientific procedure or apparatus have no place in an engineering program. The engineer must test each step unless it has been previously proved, carefully calculating in advance to avoid false protection.

He must be familiar with dust counting, air sampling, and chemical analysis technique, having such determinations made by established and proper methods. If such tests are beyond the scope of his ability or equipment and if the engineer considers such tests absolutely essential, then his executives should permit him to obtain experts qualified to make such surveys as his problem may require. The need for an accurate engineering approach to any control measure cannot be overemphasized.

Conclusion. Every engineer realizes control of any industrial disease exposure is divided, part of such control falling within the jurisdiction of the industrial physician and part within his own engineering province. Medical knowledge is invaluable in the detection of early symptoms and in the administration of suitable preventive treatment. The engineer should gladly obtain the services of an industrial physician to make a study of the plant, to assist in the classification of the hazardous operations and working locations. By such coordination he will speed control of the exposure.

Each individual occupational disease exposure must be studied, analyzed, and controlled individually. While general data may be available upon common exposures, the solution can be found only in individual treatment. Such exposures cannot be compared to ordinary safety engineering efforts. A circular saw is a circular saw wherever it may be operating, but industrial disease exposure varies within plants and certainly varies between different manufacturing establishments even though they may produce a like product or article.

ADJOURNMENT

Respiratory Protective Equipment for Use Against Dusts, Fumes and Gases

By PHILIP DRINKER
Boston, Mass.

There appears to be some confusion as to the distinction between dusts, fumes, vapors, mists, and gases, with the result that respiratory equipment for protection against them occasionally is wrongly applied. The respirator manufacturers have many examples of such misunderstandings and often are blamed for errors which result solely from confusion in nomenclature.

Dusts include all types of dry earthy particles small enough to be blown about by ordinary air currents. Dust suspensions may be generated as the result of a grinding, blasting, or comminuting process; or they may result from the handling of finely divided materials as in mixing processes, in sweeping, or the blowing about of wood flour, plant pollens, or common road dust. There is no chemical limitation implied by the term "dust" while the range in size of dust particles extends from the sub-microscopic to small sand grains. Such materials can be caught very effectively by the modern type of dust respirator.

Fumes embrace two definite kinds of atmospheric suspensions. It is unfortunate that such double-naming exists in the trade but one had best admit the fact. Thus, "lead fume" is a very old term used to describe the visible dark grey suspension which evolves from lead heated to high temperatures. The material in such suspensions is mostly tiny particles of lead (and lead oxide), much smaller in size than those of the average dust, with some lead in the gaseous state. When such a mixture is cooled down to the point where it can be breathed the contaminant is then the lead particles alone without any gaseous lead.

The word "fume" is also used to describe the mixture of gas and mist which may come from a bath of hot nitric acid, for example. None of the material in the suspension is dry—it is all in the form of a true mist (liquid droplets) or as a gas, yet it may have a thick brownish color. One buys fuming sulfuric acid (a liquid) from any chemical supply house and one can see large plants for recovering lead fume—a dry powder. Obviously, one does not want the same kind of respiratory equipment for two such different substances yet the customer often asks for a respirator to protect against fumes.

Lead fume happens to be very difficult to filter out so that the ordinary respirator which catches dust particles may be inadequate against lead fume. The acid fumes, containing both liquid particles and gas, require a filter to catch the droplets and a gas absorbant to catch the gaseous constituent. Therefore, it usually happens that the respirator manufacturer, in self protection, advises the customer to use an air-supplied or air-line respirator because he will then be adequately protected whether the fume is of solid particles, like lead, or a liquid and gas mixture. If the customer stated exactly what the suspension consisted of or told how it was generated he might be able to use less expensive equipment.

A vapor is a gas which can be converted into a liquid at ordinary temperatures and pressures. Thus, water vapor is a common constituent of the air and is contained in concentrations which vary with atmospheric conditions. Respiratory protective equipment is used against low concentrations of a great many vapors arising from common organic solvents such as benzol. Many such substances are absorbed by activated charcoal as in gas masks. There is a small cartridge type respirator in which the cartridge is filled with activated charcoal for absorbing a vapor such as benzol or with soda-lime for absorbing an acid gas such as carbon dioxide. Because these small cartridges contain comparatively little of the absorbant their use is limited to very low concentrations. They should not be used for emergency rescue work.

A mist consists of a suspension of liquid droplets together with the gas from which the droplets condensed. The commonest example is atmospheric fog.

Droplets of mist are necessarily microscopic in size or they would not remain in suspension. As soon as several droplets collide and form a large drop the liquid settles out. Therefore, it is possible to dispel a true mist very readily by simply stirring up the air—ventilation or dilution is unnecessary.

Mist droplets can be filtered out by ordinary dust respirators—that is, the visible portion of a fog is easily removed by filtration—but the gaseous constituent may pass through the filter. If the mist happens to be corrosive to fabrics the resultant effect upon a dust respirator is bad. Paint spraying generates a mist and a certain amount of vapor. Protection usually consists of an air-line respirator but it is not at all uncommon to use cartridge respirators containing activated charcoal and a filter.

A gas contains no solid or liquid particles under ordinary atmospheric conditions. The filter units of any of the common makes of respirators are ineffective against gases. Respiratory protective equipment which catches gases always consists in some chemical agent which either absorbs the gas or converts it into some other substance which can be absorbed. Because one can rarely be sure of the gas concentration to be encountered it is common practice in exploring man holes, for instance, to use devices supplied with air or oxygen in order that the wearer may be safe, regardless of the conditions he finds. The gas mask, however, and its outgrowth, the chemical cartridge respirator have a definite place in industry and are in wide use today.

The U. S. Bureau of Mines has helped in the manufacture and use of respiratory protective equipment greatly by its issuance of specifications for permissible equipment. Their present schedules do not include the air-supplied respirators such as those used in paint spraying or sand blasting but both the Bureau and the American Standards Association will issue such specifications presently.

Discussion following the address was based on these points:

1. What protection is provided against a dangerous accumulation of air pressure in the ordinary fresh air hose mask?

The helmet is not rigid. Air will leak out long before a dangerous pressure accumulates, or a safety link, provided in some types of hose mask, will blow out.

2. Would a protective mask approved for lead dusts filter out zinc oxide?

Yes. However, almost any type of mask will filter out zinc oxide, since these particles are easily trapped.

3. Will the simple face mask filter out ordinary smoke or will it absorb it?

It is impossible to answer such a question. There are as many types of ordinary masks as there are ordinary dusts. A mask must be purchased to fit a specific need. This is not difficult, however, since all types are available.

Glass Used for the Protection of the Eyes Against Injurious Radiation

By E. D. TILLYER

Southbridge, Mass.

The effect of excess visible light on the eye is immediately felt. If there is too much, anyone except the sun gazers immediately turns away, closes the eyes or seeks some kind of relief. There is a tendency to use too dark glasses in welding, inherited from the days when even the blackest glasses gave practically no protection from the insidious invisible radiations. A proper rule is, use a shade number which gives good, immediately comfortable vision and insist that this glass give protection against the invisible radiations.

The effects of the ultra-violet and the infra-red radiations are not as quickly noticed as the visible. We cannot say as we said for the visible, "get good immediately comfortable vision" because the first noticed effect of the ultra-violet oc-

Safety Exchange

General Round Table

THURSDAY AFTERNOON SESSION

October 8, 1936

The Safety Exchange Round Table, sponsored by the American Society of Safety Engineers—Engineering Section, National Safety Council, was designed to provide an opportunity for all Congress delegates to ask questions concerning their accident problems and to present information of interest and value to others in the audience.

Panel participants included Cyril Ainsworth, American Standards Association, New York City; J. I. Banash, Consulting Engineer, Chicago; H. N. Blakeslee, American Petroleum Institute, New York City; H. J. Griffith, Jones & Laughlin Steel Corp., Pittsburgh; C. B. Boulet, Wisconsin Public Service Corp., Milwaukee; Roy M. Godwin, Philadelphia Electric Co., Philadelphia; Wesley M. Graff, National Bureau of Casualty and Surety Underwriters, New York City; Dan Harrington, U. S. Bureau of Mines, Washington, D. C.; R. McA. Keown, Industrial Commission of Wisconsin, Madison.

T. E. Lightfoot, Koppers Coal Co., Pittsburgh; Dr. E. G. Meiter, Employers Mutuals, Milwaukee; W. S. Paine, Aetna Casualty and Surety Co., Hartford, Conn.; C. E. Ralston, Pittsburgh Plate Glass Co., Pittsburgh; D. L. Royer, Ocean Accident and Guarantee Corp., New York City; G. E. Sanford, General Electric Co., Schenectady, N. Y.; Reuel C. Stratton, Travelers Insurance Co., Hartford, Conn.; R. F. Thalner, Buick Motor Co., Flint, Mich.; and S. E. Whiting, Liberty Mutual Insurance Co., Boston.

Clyde W. Smith, general chairman of the sponsoring group and also director of the safety department, Standard Oil Co. (Indiana), Chicago, presided.

Chairman Smith: We will try to answer all the questions we can in the time we have.

One question submitted is:

"Assuming that the voltage is the same on both circuits, is a D. C. circuit more dangerous than an A. C. circuit from the hazard-to-life point-of-view?"

L. P. Ferris (Bell Telephone Laboratories): About ten years ago the Bell Telephone System entered into a cooperative investigation of electrical shock with the Department of Physiology of Columbia University. The object of this investigation was to obtain fundamental information that might serve as a basis for development of better protective measures and practices.

Last summer before the meeting of the American Institute of Electrical Engineers we gave the results of that investigation in a paper by Doctors Williams and King of Columbia; Mr. Spence and myself of the Laboratory.

I am glad to repeat these insofar as they apply to this question.

In our study we were primarily concerned with the effects of electrical currents on the heart. I say current because we found that the current is much more significant in its effects than the intensity of the voltage.

As we raise the value of a current, beginning at a low value and increasing it in steps, we come to a point where its effect on the heart is very dangerous.

have considered all the facts and my orders to you are that there shall not be any more accidents, and I mean it"—when the management takes that point of view, every employee understands. It then becomes a duty of the plant organization. The foreman is the man who is closest to the men and who should direct them intelligently. He is the man who explains everything to the men. Why should the men have to go to the bulletin board to find out what they should do?

T. E. Lightfoot (Koppers Coal Co., Pittsburgh): I don't think that you can disregard any of these various means of getting information to the men. Personal contact, of course, is the most important, and whether you have the gift of an orator or the gift for "button holing" a fellow and telling him what you know, it doesn't seem to make a great deal of difference. You can't ditch one in place of another.

Some men have to be "button holed" to get the information across, and others are moved by oratory, if you wish to call it that.

At the same time bulletin boards and means of that type have their place. It is a broad subject and it is a deep subject, and you have to tackle it according to the type of men you have to deal with.

Many in this audience have entirely different types of men to deal with, but I wouldn't put up one method against the other. Our thought is, "use them all—where they apply."

Chairman Ainsworth: "What should the safety engineer do to control dust in industry?"

Dr. E. G. Meiter (Employers Mutuals, Milwaukee): One of the first things that a safety engineer can do to prevent dust in industry is to institute a good housekeeping program and a program of orderliness in the plant.

That requires a continued program and is not to be carried out at fever heat for a week or two and then forgotten.

Chairman Ainsworth: "Should all scaffolds, regardless of their use, have guard rails?"

Chas. W. Hanko (Pittsburgh Steel Co., Monessen, Pa.): The experience that I have had would make me say "yes". Some few years ago we had a platform used as a scaffold some two feet from the ground. A fellow working on this platform accidently fell backward and hit a piece of iron. He broke his neck and died within ten or fifteen minutes. That is why I would say all scaffolds should have guard rails.

Chairman Ainsworth: "When should brakemen ride or when should they not ride on switch engines used in yards to move cars?"

Mr. Hanko: No, as far as the yard crew is concerned; they don't have any right in the engines. That is why we have foot boards on the wings. Only the firemen and the engineers are permitted in the cabs.

Chairman Ainsworth: "Is there any efficient way to safeguard a guillotine paper cutter?"

Mr. Royer: I have had this problem a number of times, and I don't know the answer to it. Practical printers and paper cutters will assure you that if you have a reliable non-repeat clutch, so that the knife will not descend when the workman's hand is under it, and then if you pull down your holding bar or a similar mechanism with your foot, you can't have amputation. The high speed jobs, where the bar and the knife descend under power, are protected by two-handed devices, and I should say that they are reasonably safe.

The guillotine paper cutter that causes me to worry is the old timer. The clutches may repeat and they are not equipped with two-handed devices, and I certainly wouldn't like to put my hands under the knife. I was hoping that some practical paper cutter or printer in the audience might say what he thought about it.

Walter A. Gleason (Hammermill Paper Co., Erie, Pa.): That depends on whether it is a mechanical device or is electrically operated. Of course, we know that with the old mechanicism there was an additional device that had to be released with one hand. On the electrical or the more modern devices these are buttons and connected in series so that the operator must manipulate two different points.

Mr. Royer: Is it true that you cannot have an injury when the holding bar is down on the stock? The printers say that is impossible. Do you know whether

Chemical Section

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chemical workers, handed down from the age when chemical leaks and drips were frequent.

6. The chemical operator should realize that the control features on all chemical equipment are there not only for operating purposes, but, in most cases, for safety; and in the event that any pressure or vacuum gage, thermometer, or what not indicates abnormal change or a bad condition, he should take steps immediately to rectify the condition as specified by his superior, usually by reporting the condition promptly. However, there are emergencies when he must safeguard the situation before reporting. It is taken for granted that these emergency conditions are provided for in his training. It is impossible to do more than generalize on this without the danger of misunderstanding.

7. While "a little knowledge is a dangerous thing," the more the worker knows about the reasons for following prescribed methods, the better worker he is. He should acquaint himself with the reasons, and, if possible, be familiar with the simple chemistry and physics of his job, and not be afraid to ask questions; but he should never experiment without the advice of proper authority.

Chemical control should not be treated lightly. Any changes to be made in the chemical process should take place only after the careful consideration and direction of those competent to make such changes.

8. When leaving his work, or outlining his duties to another at the termination of his shift, the chemical worker should fully familiarize his successor with the condition of the equipment and the status of the chemicals in process. This should be in writing in a log book of operations. By no means should he leave any questionable condition whereby his fellow worker may meet with a mishap. It is his full responsibility to live up to this and to consider it as sacred as anything in life. The slightest deviation from this practice, whether deliberate or otherwise, has meant disaster to chemical workers and monetary loss to plant owners.

9. The chemical plant is no place for monkey business or horseplay. It must be remembered that the practical joker in chemical work may be a potential killer.

I have known chemical workers deliberately to plug condensers in order to see if their fellow workers could quickly discover and locate the trouble. Such methods should not be resorted to, even with only water in the equipment.

10. The chemical worker should thoroughly appreciate the fact that safety is sacred, that the safest method is generally the best method, and that the best method always embraces the safest way.

WEDNESDAY MORNING SESSION

October 7, 1936

Employers' Added Liability Under New Occupational Disease Laws in New York

By J. W. NEWTON

Compensation and Claims Departments, Eastman Kodak Co., Rochester, N. Y.

The New York State Workmen's Compensation Law, adopted in 1914, covered only accidental injuries arising out of and in the course of employment, and such diseases or infections as might naturally and unavoidably result therefrom.

Occupational diseases are not accidental injuries and were, therefore, not included in the coverage of the Workmen's Compensation Law.

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diseases, arising out of and in the course of certain designated employments or processes. From time to time the law was amended, increasing the occupations or processes covered and increasing the number of diseases covered to 27 as the law stood at the end of 1934. It is a fair statement to say that every disease known to medical science, which could be directly traceable to, or was definitely known to arise out of, a process of employment was included in the Workmen's Compensation Act, with the exception of silicosis and similar dust diseases.

The annual cost for occupational diseases under that law to the employers of the state was comparatively small, there being added to premiums in most cases one per cent per hundred dollars of payroll, and in a few industries, where the hazard was greater, a cost varying but not in excess of $1.00 per hundred dollars of payroll. The total average cost in the State of New York was not over 1 per cent of the total premium.

A few years ago the medical profession in this country became particularly interested in the causes of the disability and death of employees engaged in occupations having a silica dust hazard, particularly granite and foundry workers.

A serious problem was presented to many industries in the state by the fact that another piece of legislation, the so-called "all-inclusive" occupational disease bill was actually put on the statute books and took effect September 1, 1935.

Under this law some of the problems were: Would the term "occupational disease" be construed by the courts to include any disease which might arise during the employee's employment? Would an occupational disease under the law include the common cold, pneumonia, scarlet fever, or any communicable disease? How would the courts of this state interpret the law? If the law were interpreted to include as occupational diseases, only diseases peculiar and incident to the nature of an occupation or process in which the hazards of such diseases actually exist, then it was thought the cost of occupational disease coverage should not increase by virtue of this all-inclusive law to any considerable extent over the present cost, except for silicosis and similar dust diseases.

On May 21, 1935, Industrial Commissioner Andrews issued a statement relative to the probable effect and cost of the all-inclusive occupational disease bill which became effective September 1, 1935. In this statement, the Commissioner said that the experience in New York State and in states having an all-inclusive occupational disease law, indicated that the new amendment would add less than 2 per cent and perhaps less than 1 per cent to the insurance cost of workmen's compensation insurance in New York State.

It is my understanding, however, that the Commissioner did not mean to include in this estimate of 1 per cent and 2 per cent, the cost of silicosis and other dust diseases, but that the Commissioner referred to diseases brought under the act, other than dust diseases.

But whatever he meant the amendment has not been in operation long enough for an accurate accounting to be made as to the actual increase in cost of occupational disease compensation.

When employers examined this amendment making all occupational diseases compensatable, the first feeling was one of alarm, and the insurance companies, apprehensive almost to the point of panic, added to this alarm by cancelling coverage on certain plants, and notifying others that their premiums would be drastically increased. When, however, the new silicosis and dust disease law (which will be described in a moment) was enacted after a great number of conferences among employers, insurance companies, the Department of Labor, and employees, the general alarm greatly subsided. Another important cause of the subsidence of this alarm was the pronouncement of the Industrial Commissioner that it was not proposed to bring under the occupational disease classification every illness or disease suffered by an employee.

To be compensatable, he said in effect, a disease must be shown to be a real occupational disease of a type peculiar to and caused by the occupation in which the worker was engaged. If the Commissioner's interpretation is sustained by the courts there may be some justification for this occupational disease amendment since an occupational disease so defined is generally the result of conditions imposed on him by his employer, conditions over which he has no control and

from which he cannot escape, except by leaving his job. The employer, therefore, it may be agreed, should be solely responsible for most of such occupational diseases and in all justice should accept the responsibility for injuries sustained. The more one studies this occupational disease amendment, in the light of the Commissioner's pronouncement, the more difficult it becomes to find any real occupational disease that has been added to compensatability under the Workmen's Compensation Law other than silicosis and other dust diseases. Before this amendment there were in the statute 27 named diseases coupled with descriptions of processes, and it seems probable that the only real occupational diseases added by the amendment are silicosis and other dust diseases. Undoubtedly in time, because of newly discovered processes and hazards in industry there will be additional occupational diseases discovered that are not represented in the twenty-seven scheduled diseases, and these new diseases will automatically be brought under the law by the amendment covering all occupational diseases.

Following the adoption of this all-inclusive amendment a new silicosis and dust disease bill was introduced in the State Legislature in 1936, and was finally enacted June 6, 1936. This bill was introduced primarily at the behest of the employers of the State because they felt strongly that the inclusion of silicosis and other dust diseases in the all-inclusive amendment placed an undue burden upon industries particularly subjected to the dust hazard. The reasoning was that the difficulties attendant upon the correct diagnosis of these dust diseases would open the way for numerous doubtful claims unless some extra requirements were placed upon physical examinations, and special limitations put upon the amount of compensation payable for the various stages of these diseases. The bill as finally enacted is known as Article 4a of the Workmen's Compensation Law, and section 222a of the Labor Law.

The first paragraph of the Act is a declaration of policy and reads as follows: "It is hereby declared to be the policy of the legislature of this state, in enacting this article to prohibit through every lawful means available, any requirement as a prerequisite to employment which compels an applicant for employment in any occupation coming within the preview of this article to undergo a medical examination." This measure was included over the strong objections of many employers in the state who felt that any such provision was a step backward in the use of medical science in industry and if followed out would be in the long run a detriment to employee and employer alike. The declaration remained in the bill in spite of these objections.

The Act itself provides that no compensation is payable for partial disability due to silicosis or other dust diseases.

For temporary or permanent total disability or for death from silicosis or other dust disease, if disablement or death occur during the first calendar month in which this act became effective, $500 is payable; if disablement or death occur in the second month $550 and for each month thereafter the payment shall increase at the rate of $50 per month, but in no event shall payment exceed an aggregate of $3,000.

Medical treatment and care are provided for a period of 90 days from date of disablement and may be extended for an additional period of 90 days upon order of the Board.

The liability prescribed is in lieu of any other liability whatever.

If death occurs and there are dependents, the benefits will be the difference between what has been paid and $3,000 but never more than $3,000. If there be no dependents, payments cease, nothing to be paid into special funds as in the case of accidental death from other compensatable causes.

If, for example, total disability commenced in August, 1936, that is, three months after the law became effective, a payment of $650 would be made, and then compensation at two-thirds of wages as long as the disability lasts, but not in excess of $3,000.

Where the last exposure was between September 1, 1935 and the date this law became effective, a claim is barred unless filed within 180 days from the day this law became effective.

An employer shall be liable for compensation when disability results within one year after the last exposure, and in case of death is liable if death result

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within five years following continuous disability.

The employer in whose employment the employee was last exposed shall be liable for compensation. There is no splitting of compensation between two or more employees.

Now, I am supposed to say something in regard to the effect of these two new laws on the chemical industry. Let us take a look at the statute as it stood before the all-inclusive amendment became effective, and we will find that the chemical industry is well taken care of. In the occupational disease section are included poisoning and other deleterious effects resulting from contact with lead, zinc, mercury, phosphorus, arsenic, wood alcohol, benzol and its derivatives, carbon bisulphide, and any sulphide, nitrous fumes, nickel carbonyl, solvents for cellulose nitrate and acetate, formaldehyde and its preparations, chromic acid, tar, pitch, mineral oil, paraffin or any compound of these substances, methyl chloride sulphuric, hydro-chloric and hydro-fluoric acids, petroleum products and their fumes, dermatitis from handling acids, alkalies and oils. Out of 27 processes described 18 belong in the chemical industry.

In my opinion, based upon the fact that practically every known occupational disease in the chemical field was specifically covered in the New York law prior to the adoption of the two amendments which I have described, and assuming that Commissioner Andrews' definition of "occupational disease" under the "all inclusive" amendment is sustained by the courts, there will not be any great increase in compensation costs to chemical manufacturers on account of these two amendments, other than in those industries which are definitely subject to a dust hazard. Theoretically, I think this is true, but in closing I want to point out that there is no assurance whatever that the referees who conduct the hearings or the courts will strictly and uniformly apply Mr. Andrews' conception, since there is no definition of "occupational disease" in the statute. Judging by tendencies in the past, there will be a strong and sustained effort made to have the phrase interpreted more liberally in the interest of the claimants, and if that succeeds, this "all-inclusive" amendment may open the door to all sorts of claims which have no true relation to the legitimate burdens of industry. In such event the industries may be forced into the role of health insurers for their employees, and the feature of the employers of New York State as to the tremendous expense to be placed upon industries, chemical and otherwise by this statute, would be realized.

Gas Detectors for Determination of Flammability, Oxygen Deficiency and Toxicity in Rooms and Vessels

By

E. W. GILLILAND

Chief Chemist, Mine Safety Appliances Co., Pittsburgh, Pa.

WILLIAM P. YANT

Director of Research, Mine Safety Appliances Co., Pittsburgh, Pa.

Interest in public and industrial safety from explosions and occupational injuries and diseases from gases and vapors has stimulated the development of gas detectors, indicators, and analyzing equipment that are suitable for use at the site of the industrial situations in which the gases and vapors occur. The ordinary laboratory procedures are usually cumbersome, delicate, operable only in the hands of trained technicians, and require considerable time for making determinations.

A suitable device for most field situations must be readily portable, rugged, easily maintained in condition for use, reliable, operable by the personnel at hand to give results and the desired information, with the accuracy and sensitivity required for the situation under investigation. For many uses, it is required that results be obtained quickly in order to avoid delays that would prolong hazardous work and increase costs and to detect rapid changes in atmospheric contami-

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John Russell, Jr., Public Service Electric & Gas Co., Newark, N. J.

Officers Elected for 1936-37

General Chairman—W. A. Snow, Associated General Contractors of America, Inc., Washington, D. C.

Vice-Chairman for Heavy Construction—R. J. Reigeluth, C. W. Blakeslee & Sons, New Haven, Conn.

Vice-Chairman for Highway Construction—F. I. Rowe, W. L. Johnson Construction Co., Hicksville, Ohio.

Vice-Chairman for U. S. Engineer Department—Major Elliott Vandevanter, C. of E., Office of the Chief of Engineers, Washington, D. C.

Vice-Chairman for Building Construction—Chester W. Wright, Wright & Kremers, Inc., Niagara Falls, N. Y.

Secretary—Robert McKinley, General Accident Fire & Life Assurance Corp., Detroit, Mich.

terially improve accident records in the construction industry is that which other industries have been using for so long. Briefly, a program based on adequate accident records, consistent inspection and maintenance of plant, a complete medical program and the principle of supervisory responsibility, cannot help but succeed.

Dust Diseases As They Affect the Construction Industry

By A. J. LANZA, M. D.

Assistant Medical Director, Metropolitan Life Insurance Company, New York City

With a possible single exception, there is but one dust disease and one dust causing that disease with which the construction industry is concerned. The disease is silicosis and the dust causing it is dust containing free silica (SiO_2). Dusts containing silica in combined form have not been shown to cause disability or disease, with the exception of asbestos, which is a silicate.

The outstanding facts with regard to silicosis have often been detailed and will be only briefly summarized here. The dust must be in a fine state of subdivision to reach the lungs. The particles which do the damage are less than ten microns in diameter. In this country, the amount of dust in the air at any location is determined by the standard method elaborated by the United States Bureau of Mines and the United States Public Health Service, using the impinger, the results being expressed in millions of particles per cubic foot. In order to estimate the hazard, we must know the number of particles and the percentage of silica, because a dust containing 100 per cent pure silica would be more harmful than one containing 50 per cent silica.

When we know the amount of dust—in terms of averages—the amount of silica, and the extent of exposure, we are in a position to evaluate the seriousness of the hazard. We know that silicosis is a chronic disease, taking usually years to develop, and as we see it in American industries, causing little or no disability unless there is superimposed upon it an infection. This infection is most often tuberculosis, to which the individual with silica damaged lungs is very susceptible. The more severe the silica damage, the more apt tuberculosis is to develop.

We do not as yet have permissable or safe standards of dustiness. There is such an extremely wide variation of industrial processes and environmental factors that any elaborate system of standards would be impracticable; but a simple workable standard is highly desirable. There is a rough standard, which is based largely on the work of the Public Health Service, of ten million particles of dust per cubic foot. This is a convenient target to shoot at when dust control measures are undertaken in an industrial plant. That is not to say, however, that a threshold of ten million particles of a highly siliceous dust is safe. This standard was based on exposure to granite dust, containing about 35 per cent pure silica.

The construction section of this Congress embraces many types of industry and a multitude of processes. It is not practicable, therefore, to present a complete scheme of all the hazards in these industries. We can, however, attain our object in a sufficiently satisfactory manner by considering first, materials, and second, the processes in which these materials are used. The construction industry uses enormous amounts of certain well known materials. Lime, gypsum, cement, sand, occur to everyone's mind when you mention construction. Many of these substances are used in processes which involve considerable amounts of dust, wherein lies the possibility of a health hazard.

There is no silicosis without silica—free silica. So right off, the manufacturer or industrial company has the first clear-cut index of the potential harmfulness of the dust which may be causing concern [illegible] or his employees. Doc-

e contain free silica in appreciable amounts?

What is an appreciable amount? Probably in excess of 5 per cent. At least, that is well on the conservative side. Non-silicious dusts may be a nuisance or an annoyance to employees or to neighboring communities, but they are not concerned with silicosis. If the employer does not know whether a dust to which his employees are exposed contains silica—that is the first thing for him to determine. Should he find that the dust does contain free silica, in a determined percentage, then the next step is to ascertain the amount of such dust present in the air where his employees work.

We are frequently asked whether dust arising from gypsum, cement, lime, marble, talc, rock wool, mineral wool and many other substances, may cause silicosis. We say to the inquirer, "You know the materials you are working with. Do they contain free silica?" He may reply, "No," or "Only a trace." The conclusion then is obvious. There is no silicosis hazard.

The type of process in which the dust is generated is of great practical importance. If the process is conducted in a confined place, with poor ventilation, it is apparent that the hazard is much more dangerous than if it were in the open air, because in the confined place, the workman gets a much bigger dose of silica.

Recently I saw some X-ray films of brick masons. These masons handled only fire bricks—made from a highly silicious material — and they were employed in lining kilns and furnaces. Their films showed well developed silicosis. Their job consisted in breaking up the worn-out lining in furnaces and building new ones. They were continuously exposed to a highly silicious dust in a very close, confined place. The same material could probably be handled in other types of construction work with little or no hazard.

The mention of close and confined places brings to mind tunnels, about which there has recently been much agitation. Without going into details concerning this subject, the lesson to be learned is clear. The digging of a tunnel is not a permanent undertaking in any locality but the work should be safeguarded as in more permanently established industries. Where a tunnel is being constructed in a highly silicious rock, the dust hazard looms very large. It is similar to hard rock mining and everything conspires to make the control of dust difficult. It is interesting to note that tunnel work in various parts of the world has been followed by similar experiences.

The report of the Director General of Public Health for New South Wales in Australia, 1924, details an investigation concerning ventilation and sandstone dust present in the air of certain sewer tunnels in Sidney. Apparently there was an excessive amount of silicosis and tuberculosis among these tunnel workers.

A report of the South African Institute for Medical Research, April, 1935, details a severe silicosis hazard among sewer tunnel workers in South Africa.

We are justified in concluding that tunnel work calls for extraordinary precautions for safety and health with a supervision of the health of tunnel workers comparable to that followed in other industries. Grinding or pulverizing sand, gravel, and other highly silicious materials are processes that need very careful control and supervision.

The control of the dust hazard is an engineering problem and in the main depends on an effort to entrap the dust at its point of origin by using water, or suction exhaust systems, or both. Once the dust is in the air, reliance is placed upon further use of water, and on dilution of the silica dust by increased ventilation and on protecting the individual by a suitable mask or respirator. The United States Bureau of Mines now certifies respirators that are safe for silica dust. The use of respirators should be restricted to exposures which are intermittent or temporary.

Where ventilation equipment designed to remove dust from the air is installed, its efficiency should be checked from time to time by dust counts, using the standard impinger method. As with other protective devices, there is always danger that this sort of apparatus becomes greatly impaired or useless because of failure to maintain it properly.

I mentioned an exception to the statement that only free silica dust will produce disease of the lungs. This exception is asbestos, a magnesium silicate.

The inhalation of asbestos dust produces a condition of the lungs similar to silicosis. The pathology is quite different and the appearance on X-ray films is distinct from silicosis. Asbestosis apparently does not predispose to tuberculosis and in this country has not been shown to cause much disability, though a few deaths have been recorded. In the manufacture of construction material, asbestos is usually combined with other substances which, by reducing the amount of asbestos in the dust, tend to mitigate the hazard.

A matter of great concern to the employer is what disposition to make of cases of silicosis among his employees. If active tuberculosis is present, it is to the interest of the individual and his fellow workmen that he be removed from his occupation and given proper care. If infection is not present, there will be little or no disability and the employer should protect the individual from further exposure through methods suitable to the situation involved.

The important item to remember is the nature of the material and the process in which it is employed. Consideration of these two items will enable the employer to ascertain whether a silica hazard is present and to act accordingly. Again let me emphasize that where workmen are exposed to a highly silicious dust in confined places, the situation is extremely serious and calls for energetic and comprehensive measures of control and continued medical supervision of the men. Dust samples should be taken frequently and the men should be examined frequently so that serious disease will not occur.

Physical Examinations of Construction Employees on Public Works Programs

By L. M. DEARDORF

Superintendent of Construction, W. L. Johnson Construction Company, Hicksville, O.

If there ever was a time when employees on Public Works projects should be given physical examinations before permitting their names on the payroll, it is now.

Any contractor who secures a Public Works project with the Highways, PWA, the U. S. Engineers, or any of the other department of the Federal Government is required, as a part of the labor regulations, to submit a requisition for his employees to the National Reemployment Service. The National Reemployment Service is dominated by the WPA organization to the extent that all semi-skilled and common labor are furnished only from relief lists. In the majority of cases those unfortunate individuals who are still on relief are there only by reason of a mental or physical deficiency. They have done very little work during the past five or six years and are pretty thoroughly demoralized mentally; physically they have permitted their bodies to be run down about like an old paver that has been standing alongside the road for a corresponding period of years.

Our procedure in carrying out physical examinations for our employees is as follows: The contract having been awarded, and the superintendent assigned to the project, one of his first important preliminary instructions is to talk to the doctors in the vicinity of the project and explain to them the problem which we face in securing competent physically-able workmen. If the M. D. shows any sympathy in our problems and troubles, we negotiate for mass examination of the employees. The price paid for the examination is from $1.00 to $2.50.

The findings have been very interesting on the various projects as the following facts will testify.

to think, inability to draw a personal lesson from the experience of others, overconfidence and a desire to make good on the job. These can only be overcome by careful and systematic handling on the part of the supervisor. His is the responsibility of putting over to the worker the value and advantages resulting from a close observance of rigid safety inspections.

Systematic Organized Safety Effort

There should be little need to make a plea for more concerted action along this line. As safety men, we know how easily the small employer could be put out of business as the result of even a few accident losses. The larger employer, as well, cannot afford to overlook the situation—his losses, through waste of time, money and materials, will seriously affect his profits and hold his company up to the public as a very inefficient organization. The ever increasing cost of compensation insurance will undoubtedly be a factor in forcing more consideration for well organized safety work. Personally, I emphasize the side of humanity above the dollar and am satisfied from long experience that where humanity rules, the profits will be satisfactory. Where a real safety program is followed, without doubt efficiency and economy of the highest order will also prevail.

The Present Status of Control of Dust and Fumes in Industry

By H. B. MELLER

Managing Director, Air Hygiene Foundation of America, Inc.; Head, Air Pollution Investigation, Mellon Institute of Industrial Research, Pittsburgh, Pa.

The problem divides itself naturally into medical, preventive engineering and legislative phases, and includes consideration of the responsibilities of employer and employee to each other and to the public.

It is axiomatic that, in case of physical disorder, impairment of function or disability, the more thoroughly the cause and course of action are known, the more certainly can possible remedies be applied or preventive measures taken.

In the diseases or affections under consideration, there are facts upon which preventive methods are based, and upon which further studies now in course or contemplated are, at least in part, predicated.

During the development of the present state of knowledge of the influence of some air contaminants on health, naturally many theories were advanced that later scientific work has modified or displaced. However, not always has the correction been as widely and thoroughly disseminated as was the original theory; this condition, perhaps, has led to some confusion in the minds of many who have not followed too closely the evolution of knowledge in this field.

Clarsification of Dusts

There are available different published classifications of dusts. Included in such classifications are dusts, the exposure to inhalation of which are, or are likely to be, occupational. Those that are inherently toxic when inhaled or otherwise absorbed and which cause systemic poisoning, include lead, arsenic, mercury, manganese. Examples of dusts which have the ability to penetrate the deep lung tissues and to be retained there are quartz, flint, chert, asbestos, talc, coal, iron, clay, slate, and other types of rock dust.

Attention here will be centered upon this last group and upon pneumoconiosis, the general term used to designate lung conditions caused by dust. Silicosis, which is caused by the inhalation of free silica, has been prominent recently in the public press, sometimes in a way that made misunderstanding possible, if not probable.

Aside from silica, many of the insoluble mineral dusts may bring about slight changes in the lung tissues, which may be demonstrated on the roentgenogram if there is silica in the dust that is inhaled. As far as is known today, most of them are relatively or entirely harmless.

Ability of Dusts to Cause Injury

It has been established that the potentiality of siliceous dusts to cause lung damage is, with few exceptions, dependent upon their content of free silica (SiO_2). The development of silicosis depends, therefore, upon the concentration of dust containing free silica in the air breathed. In other words, the total amount of free silica breathed and retained seems to be the primary factor; the length of time necessary for a sufficient accumulation is important, but less so than the total load.

Silica occurs also in chemical combination in silicates. Some of these compounds have been proved to be relatively harmless to health, some are still in the realm of doubt, and one—asbestos—may cause the industrial disease called asbestosis, which is the result of lung damage similar to, but not identical with nor as serious as, that produced by free silica.

Importance of Particle Size. The size of dust particles in the air which an individual may breathe is important. Not often are particles larger than 10 or 12 microns found in the deep lungs, except in the case of asbestos dust, where fibers as long as 200 microns have worked their way down lengthwise.

Uncomplicated Silicosis. Silicosis, uncomplicated by an infection, is more of an impairment than a disability. It is not seriously disabling until it reaches an advanced stage, and does not of itself greatly shorten the life of a silicotic.

Silico-Tuberculosis. When a silicotic dies, the immediate cause of death is usually some type of intervening lung infection. It is not known just why the presence of silica in the lungs increases susceptibility to tuberculosis, but when an adult with silicosis is exposed to tuberculosis, an active infection may occur, regardless of the previous state of health. It is thought probable that silica dust can reactivate healed tuberculous lung lesions of the adult type: how long after such lesions have healed the reactivation is possible is not certain. Exposure of silicotics to tuberculosis or of tuberculous individuals to silica dust is serious and should be avoided.

After silicosis has become well established in the lungs, medical science has not found a way to arrest the progress of the silicotic process toward the stage of disablement except through limiting or preventing further exposure to silica dust. Nor has medical science found a way to prevent tuberculosis from being superimposed upon silicosis, except through control of contact. The course of silico-tuberculosis is chronic and is very difficult to influence by treatment, according to phthisiologists.

Medical Control. As a basis for intelligent determination of the physical fitness of a man for a job in a dusty trade, physical examination, with stereoscopic roentgenograms of the chest, is necessary. Along with this study goes, naturally, the preparation of an occupational history with detail as to the exact nature of previous work and of exposure to industrial dust—not a valueless recording of occupations as "laborer," "machinist," etc. Dr. Sayers, of the U. S. Public Health Service, has developed a method of securing information for a proper occupational history; among others, Cummings, of Saranac Laboratory, also has worked out a useful history blank.

Standards have been developed for the diagnosis of silicosis. There is also a suitable technic for taking roentgenograms of the chest in order to bring out the characteristic lung changes.

From the considerable amount of work that has been done, it is possible to forecast with a reasonable degree of accuracy the silicosis potentiality of various dusts.

Periodic physical examinations, including roentgenograms, are essential if employers are to be enabled accurately to learn the effect of individual exposure and intelligently to transfer affected workmen to lower dust concentrations before serious injury has been done, or to work out a system of rotation where indicated as desirable in order that exposure may be intermittent. Such examinations are helpful also in showing the efficiency of engineering control methods.

The ability to place responsibility in case of claim for injury is no small part of the value of such initial and periodic examinations.

Asbestosis. Clinical experience has shown that the inhalation of a sufficient amount of asbestos dust causes a serious type of fibrosis, which is not accompanied

by an unduly high incidence of tuberculosis.

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

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

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

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

Preventive Engineering

It would be needless repetition to discuss in a technical way the engineering phases of dust control. All interested are referred to "Industrial Dust," by Drinker and Hatch, which deals comprehensively with the subject; U. S. Bureau of Mines Information Circulars 6840 and 6848, by Harrington and Davenport, a review of literature on "Prevention of Dust Diseases"; U. S. Public Health Service Bulletin 217, by Bloomfield and DallaValle, on "The Determination and Control of Industrial Dust"; Report Z9 of the American Standards Association; and to the U. S. Bureau of Mines for a list of approved protective devices.

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

Methods of Determining Dust

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

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

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

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

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

Dust Elimination

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

bility for potential efficiency is upon the manufacturer.

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

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

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

Permissible Dustiness

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

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

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

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

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

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

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

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

Workmen's Compensation Acts

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

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

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

commissioner in 40 states; in six states the acts are administered by the local courts.

Again from the report: "The guiding principle in the early acts was the awarding of compensation for accidental injury, meaning thereby traumatic injury." (Traumatic means of or pertaining to a wound or wounds.) "In those years, the importance of disability due to occupational disease was not generally recognized. It however became increasingly apparent that 'injury' might be suffered gradually, and that the result of such gradual breaking down of the strength and resistance of the employee was more serious in many instances than traumatic injury. Courts therefore, in some states, wrestled with the problem of construing 'injury' so as to include disease and bring disease within the compensation acts."

In one state a diseased condition is compensable under the act if caused by the negligence of the employer. Occupational disease is compensable, to some extent, in 16 states and the District of Columbia; in five of these states silicosis is not included among the compensable diseases; in one state silicosis is the only occupational disease made compensable.

There is a legal obligation on the part of the employer to provide a safe place to work, and usually the matter of ventilation is featured. The mining laws approach uniformity as to air quantity and as to equipment for mechanical ventilation.

The right, at common law, to recover for occupational disease due to negligence of the employer, is important. In three states it has been held by the courts that the right never did exist; in three states the right is extremely doubtful; in 12 states it probably exists, although there is some doubt; in 12 other states, the right seems well settled, but is limited in eight of this group; in the remaining states and the District of Columbia, no court decisions can be found which decide the question as to whether or not such common law right exists. It should again be noted that occupational disease is compensable in three states in this last group.

"With the adoption of Occupational Disease Acts, new medical problems arise and more adequate provision is required for medical examination and treatment. This is especially true with respect to dust diseases, which call for diagnosis by skilled specialists experienced in that field."

Examination Before Employment

1. Under Compensation Acts: The New Mexico Act contains a provision requiring the workman, at the time of his employment, or thereafter at the request of the employer, to submit himself to an examination.

The New York Act of 1936, covering silicosis and other dust diseases, provides, in the opening paragraph:

"It is hereby declared to be the policy of the legislature of this state, in enacting this article, to prohibit through every lawful means available, any requirement as a prerequisite to employment which compels an applicant for employment in any occupation coming within the purview of this article to undergo a medical examination."

The North Carolina Act, effective March 26, 1935, contains a provision requiring examination both prior to employment and from time to time during employment.

In the compensation acts of no other states were found provisions with respect to examination prior to the time of employment.

2. Under Other Statutes: Five states (Louisiana, Maine, New Jersey, New York and Pennsylvania) have statutes requiring physical examination before an employee is permitted to work under compressed air or in caissons.

Examination During Employment

The five states mentioned in the preceding paragraph require periodic examinations during the course of employment under compressed air or in caissons.

Missouri statutes provide for examination, as often as once a month, by a competent licensed and reputable physician, of all employees who come into direct contact with certain poisonous agencies or injurious processes.

Three states (New Jersey, Ohio and Pennsylvania) require employers to cause to be examined at least once a month employees engaged in any work or process exposing them to lead dust, lead fumes or lead solutions.

Examination After Claim for Disability Arises

No two state acts contain identical provisions, but in all (including the District of Columbia) that have compensation acts, there is provision for physical examination after claim for disability arises.

In five states (Kentucky, Massachusetts, New York, North Carolina, and West Virginia), definite recognition has been given to the importance of some sort of medical board composed of specially qualified physicians and surgeons, and charged with the duty of diagnosing occupational disease and of advising the administrative board or commission with respect thereto. The laws of these five states are quite different and should be studied separately for details, but in each occupational disease, including silicosis, is compensable.

The importance of roentgenograms in any thorough physical examination for pneumoconiosis is well-known. This importance is recognized in the Acts of New Jersey, New York, North Carolina, and West Virginia.

Medical Treatment

In the 17 states (including Maryland) in which occupational disease is, to some extent, compensable, the acts usually entitle the claimant to a limited amount of medical, surgical, and hospital care, measured in money cost or length of time covered by treatment.

These points were raised in the discussion following the addresses:

1. How much time is required for completing a training course?

Mr. Davison said that the training course in their plant ordinarily covered a period of one and one-half years, but that some students completed it sooner. The time required depends upon the individual.

2. Is it advisable to limit the number of students per teacher?

Ten students per instructor is a good ratio.

3. Which gases present the greatest harzards in welding?

Silicon gases are the most harmful. The risk, however, has largely been overcome by manufacturers of welding supplies.

THURSDAY MORNING SESSION

October 8, 1936

Metals Section Safety Contest

Two hundred and two units were registered in the 1936 Contest of the Metals Section. During the Contest period 267,792 employees worked 541,788,579 man-hours with an average frequency rate of 8.030, a decrease of 4 per cent from the 1935 rate of 8.334. Ninety-five units completed the Contest with a frequency rate below the average, and 8 per cent of the units finished with perfect records. Nineteen plaques and eight certificates were awarded in the Contest.

The plaques were presented by John B. Gibson, Publicity Director, Hawthorne works, Western Electric Company, Chicago, and Vice President for Community Safety Councils, National Safety Council, as follows:

Steel Mills Division, Group A—Continental Steel Corporation, Kokomo Division, Kokomo, Indiana, 1,143,806 man-hours, 12 injuries.

Quarry Section

Officers 1935-36

General Chairman—ALEXANDER FOSTER, JR., Warner Co., Philadelphia, Pa.
Vice-Chairman—RUSSELL RAREY, The Marble Cliff Quarries Co., Columbus, Ohio.
Secretary and News Letter Editor—N. B. SIPE, J. E. Baker Co., York, Pa.
Program Committee Chairman—H. F. YOTTER, The General Crushed Stone Co., Easton, Pa.
Publicity Committee Chairman—J. R. BOYD, National Crushed Stone Assn., Washington, D. C.
Statistics Committee Chairman—W. W. ADAMS, U. S. Bureau of Mines, Washington, D. C.
Members at Large—
V. P. AHEARN, National Sand and Gravel Assn., Washington, D. C.
WILLIAM H. BAKER, J. E. Baker Co., York, Pa.
O. M. GRAVES, The General Crushed Stone Co., Easton, Pa.
A. L. WORTHEN, The Connecticut Quarries Co., New Haven, Conn.

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O. M. GRAVES, The General Crushed Stone Co., Easton, Pa.
S. WALTER STAUFFER, National Lime Association, Washington, D. C.
A. L. WORTHEN, The New Haven Trap Rock Co., New Haven, Conn.

WEDNESDAY MORNING SESSION

October 7, 1936

The first session was called to order by General Chairman Alexander Foster, Jr., Warner Company, Philadelphia, Pa., who presided, welcoming the delegates and outlining the activities of the Section during the year.

Hazards in and about the plant are discussed and corrections recommended. A short study of first aid is covered at each meeting. If time permits, some interesting article from the National Safety News is briefly covered or some new safety device is placed on display for consideration.

The personnel and safety department issues a monthly "Foremen's Bulletin" which is distributed to all plants. Each issue contains an editorial; a first aid instruction page; a Voice of Safety experience page, containing illustrated safety devices that foremen have sent in, relating to some accident problems and how they were solved. This is followed by several pages showing competitive standing of foremen according to severity rates. The last few pages cover a summary of all lost-time and reported accidents during the previous month.

Employer-Employee Relations

If an employee is happy with his work, his comrades, and general surroundings, he is proud of his company. He has been given a chance to help develop the safety program. Perhaps the company's house organ has honored him for a noteworthy suggestion. Maybe he was in a group picture of no-accident workers. These are subjects of conversation when he is out with his friends. He is not only proud but interested in his surroundings. He is part of the organization, and that feeling of responsibility encourages co-operation.

Good Housekeeping

Every safety program contains a few thoughts on this topic, but it is one practice that is seldom seriously considered. It is so hard to use valuable time to clean up yard and plant. We have learned differently. About a half hour each day is spent in keeping our plant ship-shape. Our walkways are kept free from sand and gravel, lines, worn plates and screens. The spaces between the railroad tracks are cleaned so that the brakemen and firemen will run no risk of injury from falls while shifting cars. The decks of our tugs, scows, and dredges are kept free of material and lines are properly coiled and placed to prevent one from stumbling. Where no other protection can be given, hand rails are placed on tugs and barges to prevent men from falling overboard. The plant is thoroughly illuminated for night operation. Floors, steps, and other walkway surfaces are kept free of oil, water, ice, and snow. Materials are piled so that they will not easily fall or be displaced by vibration.

THURSDAY MORNING SESSION

October 8, 1936

Silicosis: An Occupational Disease Hazard

By ROY R. JONES, M. D.*

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Silicosis is, in the strict sense of the term, an occupational disease. It has not been reported as affecting any individuals except those workers who, for a long period of time, have worked in an atmosphere where the air they breathed

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contained an excessive concentration of free silica.

Frequently, reports have appeared in the literature listing the chief occupations which are considered hazardous because of their silica exposure. These no doubt are true statements, but they cannot be taken to mean that all workers employed in these trades or industries are harmfully exposed. In some cases few of the employees in the cited industries are at work with processes contributing to a silica hazard. In other instances, although all the processes are dusty and potentially dangerous, effective control measures are in operation and no real hazard present. Perhaps it would be more proper to state that the following occupations are the "most potentially hazardous" from the viewpoint of silica exposure.

Abrasive-powder makers
Abrasive-soap makers
Blasters (sand)
Brickmakers
Coal miners
Core makers
Foundry workers
Glass makers
Glass mixers
Granite quarriers
Hard-rock miners
Metal grinders
Pottery makers
Pneumatic rock drillers
Polishers
Sanders
Stone finishers
Slate quarriers
Slate finishers
Sand pulverizers
Tunnelers
Vitreous enamelers

In a survey carried out in a typical industrial area,[1] it was found that about 9 per cent of the workers were employed in occupations where a potential silicosis hazard is known to exist. Lanza and Vane[2] estimated, in 1934, that about 500,000 men were then working under conditions which were harmful to their health from the viewpoint of silica inhalation, but such a statement does not mean that this number of men are doomed to die from the effects of such exposure. Many of these workers may in the near future be working under different conditions, either because they sought employment elsewhere, or because the existing hazards will have been controlled.

Occupational diseases are reportable by law in but a few states. As a result, accurate information regarding the incidence of silicosis is not available. Based upon the data furnished by field studies and census reports, various estimates have been made as to the number of workers potentially and actually exposed to a silica hazard. Less than 25 per cent of the employees in the zinc and lead mines in the Tri-State Area,[3] and of the workers in the hard coal mines of Pennsylvania,[4] were found to have developed silicosis in any form. In Massachusetts, according to a report of a Special Commission,[5] less than 23 per cent of representative granite workers examined and less than 12 per cent of representative foundry workers had silicosis in any form.

Causes of Silicosis

The mere contact with silica dust does not, of course, result in silicosis. The development of silicosis in an individual is dependent upon: the concentration of dust in the air he breathes; the amount of free silica in the dust; the size of the silica particles; and the length of time the worker is exposed to the dusty atmosphere. Some contributing forces are the presence of other irritating dusts and active pulmonary infection. The lung with impaired lymphatic drainage resulting from previous infection can less readily eliminate the silica particles inhaled, and thus predisposes to a more extensive accumulation of silica in the lung. In the final analysis, only dust containing

[1] Public Health Bulletin No. 210. The potential problems of industrial hygiene in a typical industrial area in the United States.
[2] Lanza, A. J., Vane, Robert J. The prevalence of silicosis in the general population and its effect upon the incidence of tuberculosis. American Review of Tuberculosis. Jan., 1934. Silicosis and Tuberculosis among
[3] Sayers, R. R., Meriwether, F. V., Lanza, A. J., Adams, W. W. Silicosis in zinc miners and millers in Oklahoma, Kansas, and Missouri. U. S. Bureau of Mines of the Department of Commerce, Technical Paper, 511, 1928.
[4] Public Health Bulletin No. 221. Anthracosilicosis among hard coal miners. Commonwealth of
[5] Report to the General Court of the Special Industrial Disease Commission, Massachusetts, House No. 1350, Feb., 1934.

free silica has been shown clinically and experimentally to be capable in itself of producing the nodular fibrosis characteristic of silicosis.

Our knowledge regarding the harm which may be expected from working in specific dust concentrations is rather limited. The question of mixed dusts has provoked considerable discussion. In field research and experimental studies to date, however, it has been found that the injury produced has closely paralleled the percentage of free silica present in the dust. In a general way, the greater the silica content, the greater is the damage. Obviously, the inhalation of any dust in sufficient concentrations might exceed the ability of the lung to eliminate it. Fifty million particles of dust per cubic foot of air seems to be a rather excessive concentration. However, workers in the anthracite mining operations who were exposed to air which contained concentrations up to that amount, the silica content of which ranged up to 5 per cent, experienced no more respiratory trouble than industrial workers generally. Moreover, these anthracite workers did not develop silicosis despite prolonged exposure to such concentrations. In the haulageways of the anthracite mines, where the silica content amounted to about 13 per cent, a corresponding safe limit for workers appeared to be between 10 and 15 million particles of dust per cubic foot. For the rock workers in these mines, where the silica in the dust ran as high as 35 to 43 per cent, a relatively safe concentration of dust was judged to be about 10 million particles per cubic foot. This latter finding compares with the 10 to 20 million particles per cubic foot which was shown to be a reasonable safe maximum concentration for workers in granite, where silica constituted about 25 per cent of the dust inhaled.

Only the very fine dust particles can gain entrance to the alveoli of the lung (small terminal air sacs), but these particles that do get into these tiny air sacs can be eliminated only by means of the tissue cells (dust cells) carrying them away via the lymphatic circulation. Particles of silica longer than 10 microns in their longest dimension (a micron is 1/25,000 of an inch) cannot gain entrance to these small divisions of the lung, and those which may be present in the air inhaled are arrested along the upper respiratory tract and upon the mucous membrane lining the trachea and larger bronchi. From these areas they are eliminated along with the mucous secretion. However, research studies[4] have shown that about 60 per cent of industrial dust is made up of much smaller particles, with an average diameter of between 1 and 3 microns. In fact, only about 7 per cent of industrial dust particles are of an average diameter greater than 3 microns. Thus, a large proportion of industrial dust is of a size which can penetrate to the finer divisions of the lung.

The irritating and toxic effect of these fine silica particles retained in the lungs is first to produce an inflammation in the tissues where they accumulate. Following this inflammatory reaction, young fibrous tissue cells, which harden as they mature, gradually replace the delicate lung tissue, forming a scar. This dense scar tissue is functionless as far as aiding in respiration is concerned, and not only decreases the lungs' ability to obtain oxygen to pass into the blood but also, what is more important, lessens the natural resistance of the lung tissue to infection.

The length of exposure to silica-containing atmosphere necessary for the development of silicosis is very indefinite. It would vary with the concentrations of silica to which an individual is exposed. Signs indicating the presence of silicosis might appear more quickly if the worker has previously suffered from extensive pulmonary infection, or if the pulmonary infection develops during the period of employment. Where the exposure is excessive, typical silicosis has occasionally developed in such brief periods as 1½ to 3 years. However, except where infection has hastened the process, in the majority of cases silicosis is seldom established in less than 10 to 15 years, and rarely develops to the point where measurable disabling effects are noted until after 15 to [illegible] years' exposure.

[4] Public Health Bulletin No. 217. The determination and control of industrial dust.

Clinical Signs and Diagnosis

The diagnosis of silicosis may sometimes be most difficult. There are no signs or symptoms exhibited by the individual with silicosis which may not also be found upon examination of persons suffering from other respiratory diseases. Early in the development of silicosis, unless the condition is complicated by pulmonary infection there is little, if anything, in the affected individual's general appearance to suggest the disease. The cardinal symptom is shortness of breath. At the beginning, this may be apparent only following exercise, but as fibrosis of the lung increases, shortness of breath is more marked and eventually may become manifest upon the least exertion. When silicosis is definitely established, the individual usually breathes in a manner characteristic of those whose lungs have lost elasticity. Normally, the time required to inhale is longer than that required to exhale. The pulmonary fibrosis developed in the person with silicosis will not permit the lung to collapse as readily as the normal lung. The time required for breathing out may be two or three times greater than that required for inhalation. In the advanced silicotic, this phenomenon may be as marked as in the case of chronic asthma.

Commonly, the silicotic individual complains of a dry cough, more marked in the morning and following exercise. The sputum may sometimes be blood-tinged, especially following severe coughing attacks. Excessive coughing, with the raising of muco-purulent sputum, usually indicates infection. When the person with silicosis develops an extensive complicating pulmonary infection, he will usually show constitutional evidence of the infection. Digestive ailments, loss of weight and strength, fever, and severe chest pain are commonly experienced. Particularly when these signs persist, they may generally be considered indicative of serious complicating pulmonary infection.

The lung changes shown by means of the X-ray are the most specific findings of the disease, but these, too, are similar to the film changes produced by other pulmonary lesions. No diagnosis of silicosis should be considered established in the living individual without an X-ray study being made.

Considerable discussion has been created by the question of the manner in which silicosis contributes to disability, and the methods used for determining the degree of disability. Detailed studies made upon large representative groups of workers have shown that in a majority of cases, a condition accurately diagnosed as silicosis may exist and yet there is no measurable decreased capacity for work. Therefore, it is important to remember that a diagnosis of silicosis does not always mean that the individual is disabled. Individuals with silicosis have been shown to be more susceptible to pulmonary infection; and for that reason, simple silicosis may be considered as contributing to disability which is primarily the result of a pulmonary infection.

The fact that X-ray findings are so important has led to the erroneous conclusion by some that a positive diagnosis may be made by examination of the films alone. Such is not the case. Careful consideration of all the evidence available is essential, before an authoritative ante-mortem diagnosis may be established. A complete occupational record should be obtained. The medical history and the individual's complaints are of limited but definite value in all cases. The progress of the pulmonary changes serves to indicate the role played by infection. Since silicosis predisposes to pulmonary infection, particularly tuberculosis, every effort should be made to determine if the infection is tuberculosis. In many instances, this will call for more than simple microscopic examination of the sputum. Guinea pig inoculation with the formalin-treated sputum will frequently show tubercle bacilli that are not readily demonstrated otherwise. Some cases may require repeated examination in order to rule out the more common pulmonary ailments as causes of the pathological changes observed.

Prevention of Silicosis

The responsibility for the control of the silicosis hazard in a plant rests directly upon the employer. This differs sharply from the distribution of responsibility in the field of industrial accidents. In the case of accidents, the employee must share some of the responsibility.

Silicosis, on the other hand, does not develop from a temporary or single exposure, and proper supervision of workers offers the management ample opportunity to deal summarily with the careless offender before serious damage can result. Effective control may be stated primarily to depend upon the management's attitude toward a sound comprehensive program of prevention, based upon our present knowledge of the disease.

The prevention of silicosis is dependent upon the application of cooperative medical and engineering methods. Silicosis itself seldom advances to a degree which becomes disabling, unless the condition is complicated by pulmonary infection. Adequate medical supervision requires that provision be made for:

1. Medical staff with special training. It is not enough that the physicians be basically well-qualified in their profession. They must also be familiar with industry to such a degree that they know what health hazards are commonly associated with specific industries. Moreover, they must know the fundamentals of engineering control applicable to these hazards, so that they may cooperate effectively with the engineering staff.

2. An organized program, including detailed pre-employment physical examinations; careful periodic physical examinations, and adequate control and study of respiratory illnesses affecting employees; and an effective system of recording and reporting industrial accidents and occupational diseases.

Pre-employment physicial examinations should be made for the purpose of placing workers in positions for which they are physically fit to carry on with safety to themselves and their fellow-workers. No convincing evidence is available to show that a non-disabling silicosis affecting a worker will progress more rapidly if the individual remains at work under conditions reasonably controlled, than if he is given another type of work. Therefore, those without evidence of active pulmonary infection may be safely employed in any capacity, provided the conditions under which they are working are reasonably controlled. We have proof that individuals with active tuberculosis will have their condition aggravated by silica exposure, and that individuals with silicosis are particularly susceptible to pulmonary tuberculosis. When management fails to take the necessary precautions to guard against the placing of men with tuberculosis in a dusty environment, they increase the problem of controlling tuberculosis among the population as a whole. Since any pulmonary infection may be such an important contributing factor in disabling silicosis, the relationship of the medical personnel to the employee should be such that he is assured immediate advice and early treatment, if necessary, for respiratory infections which may develop during the period of employment.

Physical examinations made at regular intervals afford an opportunity for early detection of any harmful effects due to working environment. Where they are found, plant conditions may be corrected before serious injury results. The frequency with which these examinations should be made will depend upon the physical condition of the men and the nature of the process in which they are engaged. For this reason, it is highly important that the medical personnel be familiar with the condition of the men upon entering employment, and with their later physical condition. They must also know the physical requirements of the occupation, the particular health hazards associated with it, and the practical means for rendering conditions of employment safe.

There are many ways in which mechanical or engineering methods can be adapted to insure clean air in the workroom. Where possible, dusty operations should be isolated from other plant activities, thereby exposing as few workers as possible to even a potential silicosis hazard. Local exhausts, removing dust at its source and preventing its dissemination into the workroom atmosphere, are practical for many operations. To accomplish this, in some instances, may require complete enclosing of the process. When local exhaust or enclosed processes are not effective or practical, air filtering systems or simple general workroom ventilation, removing the dusty air and replacing it with clean air, may serve to keep the quarters safe.

Attention should be given to the methods of cleaning the workrooms. Much

unnecessary dust is created by careless sweeping procedures. Either wetting down before sweeping, or the use of moist sweeping or vacuum cleaning methods, lessens this source of atmospheric contamination.

In some operations, water sprays and other wetting-down methods serve to keep the dusty particles out of the breathing zone of the worker. These methods are particularly adapted to blasting and loading operations. In mining and tunnel work, where blasting may be the chief source of atmospheric contamination, regulating the time for doing such work is strongly recommended. This work should be done betwen shifts or after regular working hours. In either case, sufficient time for the air to clear should be allowed. Wet drilling or the use of drills with dust traps attached are practical in most drilling operations.

It is sometimes impossible to operate certain processes in such a way that the worker can avoid exposure to a dusty environment. Under such conditions, respiratory protection of an approved type must be provided. The type of equipment to be furnished will depend upon the duration of exposure and the concentration and type of dust to which the individual is exposed. For short periods of such exposure, or for emergency use, a simple filter type of respirator may be satisfactory. For continuous employment in unsafe atmospheres, the employee should be equipped with a positive pressure helmet or an airline respirator.

All mechanical or engineering devices used as a means of prevention should receive periodic inspection to insure that they are properly maintained and work efficiently. That dust which is collected at its point of origin, and dust removed from the general atmosphere of the workroom, should be so disposed of that there is no chance of its again being circulated in the workroom.

Substitution of Product

Frequently, an effort has been made to eliminate the silica hazard by relying upon substitute materials which contain no silica. While this may in rare instances be both necessary and practical, in many it has proven a measure of but little value; furthermore, it can seldom be considered a complete solution of the problem. We have seen the results of similar attempts in the use of toxic solvents. Aside from the fact that the substitute may be less efficient, often its use is associated with a health hazard equally difficult to control. Effective and practical control methods have been developed to insure the safe operation of most processes requiring the handling of siliceous materials. It is a far wiser policy to depend upon proper control measures and continue being a material whose toxic qualities, in controllable limits, are well understood, than it is to omit the adoption of control measures and rely upon a product concerning which much less is known. It must be remembered that occupational diseases develop slowly, often only after years of exposure, and the fact that a substitute material proves safe for a few years is no guarantee that it is altogether harmless.

What the Employer Should Know About Silicosis

By THEODORE C. WATERS

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Prior to the adoption of the workmen's compensation acts by our several state legislatures, an employee injured in the course of his employment could only recover from his employer for those injuries which could be attributed to the negligence of his employer.

While liable for his own negligence, the employer was not liable for the dangers of the employment, a risk that was assumed by the employee. The contributory negligence of the employee and the negligence of his fellow servants were similarly available to the employer. Thereby [illegible] industrial disputes [illegible] this

legal status, employees resorted to actions at common law to obtain compensation for injuries based upon the alleged negligence of the employer.

The main purpose of the authors of the workmen's compensation acts enacted by our several state legislatures was to make the remedy granted thereby the exclusive remedy for injuries suffered by employees during the course of their employment. These acts stripped the employer of his common law defenses, including:

1. Failure to prove the employer's negligence.

2. Assumption of risk by the employer.

3. Contributory negligence of the employee and negligence of his fellow servants.

In other words, the compensation acts made the employers insurers of the safety of their employees against accidental injuries. On the other hand, the compensation acts deprived the employee of his right of common law action for accidental injuries sustained by him in the course of his employment. We must bear in mind, however, that the workmen's compensation acts did not purport to cover occupational disease injuries, but solely accidental injuries, that is, those injuries which occurred at a specific place, at a certain time, and which could be ascertained and determined coincidentally with the infliction of the injury.

Forty-six states and the District of Columbia have enacted workmen's compensation acts; Arkansas and Mississippi alone not having such acts at the present time. Compensation acts which exclude compensation for occupational diseases, either expressly or by judicial interpretation, have been enacted in thirty-two states. Fourteen states and the District of Columbia have (a) Workmen's compensation acts which include compensation for occupational diseases, either expressly or by judicial interpretation, or (b) specific occupational disease acts.

With respect to those courts holding that the workmen's compensation acts do not provide an exclusive remedy to an employee, whereby the employee retains his common law right of action for injuries sustained by him in the course of his employment, such ruling is based substantially upon the reason that since workmens' compensation acts were designed primarily to compensate for traumatic injuries, they replace the employer's common law liability solely for those injuries sustained by accidental means.

Therefore, with respect to those personal injuries sustained by other means, as for example, silicosis, since it is not compensable under the compensation acts, the employee still retains his common law right of action therefor, based upon the negligence of his employer. With respect to those courts holding that the Workmen's Compensation acts do provide exclusive remedy, such ruling is based primarily upon the language of the act and the further ruling that an employee had no common law right of action for occupational disease injury.

Legal Basis for Recovery

The usual form of declaration contains allegations that the defendant manufacturer caused the plaintiff to work in an atmosphere where silica dust existed; that the defendant knew or should have known that certain materials used by the defendant employer contained harmful or dangerous agencies of silica which were destructive to life and health in the human body; that the defendant was guilty of negligence in failing to warn the plaintiff of the danger and in failing to provide the plaintiff with a safe place in which to work or safe appliances with which to work; that thereby the silica became introduced into the plaintiff's lungs and body, causing him permanent injury.

The defense pleadings set up the defense of assumption of risk by the plaintiff, the plaintiff's contributory negligence, the negligence of the plaintiff's fellow servants and a general denial of the allegations of negligence as charged by the plaintiff.

It is needless for me to emphasize the seriousness of this type of litigation. Class is arrayed against class. The local press in those places where the causes are tried will carry sensational headlines with respect to the trial, describing the terror of the disease and emphasizing each complaint against the manufacturer. Suits are filed, accordingly, but by the dozens. The whole community wherein the in-

dustrial plant is located becomes aroused, with the attendant industrial chaos, and by the time trial day arrives, every citizen of the community is so prejudiced against the defendant that it is almost impossible to procure an impartial trial.

Need for Compensation Legislation

The ultimate solution of the problem of compensation for silicosis must be found in some type of legislation that will remove this dispute from the field of common law suits. In the same way that workmen's compensation acts eliminated such actions for accidental injuries, some legislation must be devised to eliminate such actions for occupational disease injuries.

The honest employer desires to provide compensation for those injuries occurring to his employees as a result of the industrial processes in which the employee is engaged and which are peculiar thereto. The honest employee similarly desires compensation only when he has suffered actual injury.

To attempt any detailed discussion of the subject of silicosis in industry and preventive and compensatory legislation therefor would consume far more time than is available. However, there are certain basic principles relating to the subject to which I desire to call your attention.

In the first place, the nation-wide publicity that has been given to this problem has served a fortunate purpose in molding public opinion to eliminate such diseases from industry so far as engineering control thereof is capable of doing so. You and I, as citizens, recognize the fact that industry should provide for its employees a safe place in which to work, and accept this obligation imposed upon us by law.

In the second place, the problem itself is one that calls for the cooperative effort of both capital and labor. There are certain industrial processes wherein the hazard of silicosis exists, and today there are available mechanical improvements to eliminate or control this hazard. Upon capital rests the burden of the installation of such mechanical equipment as will minimize the hazard in so far as is possible. An affirmative duty of constant care is imposed upon industry to perfect its mechanical improvements for control. However, for their part, those who labor must be educated in the ways and means of protection, to carry out the principles of good housekeeping that employers and responsible State agencies may suggest, and utilize such protective appliances that may be offered for their protection.

If employers and employees alike recognize and discharge these duties, effective results should be obtained in minimizing the hazard and controlling diseases arising therefrom. Again, with respect to compensatory legislation, occupational disease compensation should not be permitted to become health insurance and upon industry should be imposed only those costs which compensate injuries that are peculiar to the particular industries in which the employees are engaged.

Form of Silicosis Compensation Acts

For many who have given but superficial thought to this problem, it has been somewhat easy to say that compensation for silicosis injuries should take similar form to that for accidental injuries. The vice of such thought is in our failure to recognize the essential differences between the two types of injuries, to wit—that accidents occur at a specific time, at a specific place, in a specific way, under a specific employer, while silicosis and other occupational disease injuries are the result of the accumulation of injurious substances over an extended period of time in different forms or types of employment and even under different employers.

Therefore, the practical administration of the thought to compensate silicosis injuries in a manner similar to accidental injuries has not proved satisfactory and some other solution must be found.

We have seen that in considerng the national development of compensation acts, their original design was to cover only accidental injuries; in form and in methods of administration they were not designed to cover occupational diseases. It may be true that certain occupational diseases have characteristics strikingly similar to traumatic injuries, such as anthrax and lead poisoning, where the disease develops immediately after exposure and the develop[illegible] of the disease is

rapid and become disabling, fatal or cured within a limited period of time.

On the other hand, there are certain forms of occupational diseases, for example, silicosis, where the injuries sustained represent the accumulation of injurious substances over an extended period of time and disablement may follow exposure to hazards under successive employers. Therefore, in considering legislation for occupational diseases, we must recognize the fact that the problem with which we propose to deal is, of necessity, different from the accidental injury problem and that the administrative provisions of such legislation must be designed especially to handle this particular problem.

I am not a professional critic of Workmen's Compensation Laws in effect in this country, but one thing is certain, none of them is perfect. Some of their provisions are perhaps unjust, either to the employer or the employee and, certainly, in the administration of these provisions, the human element therein may give rise to certain inequities. However, these acts were the result of the need of transferring the disputes arising between employer and employee to some State agency whereby they might be settled, other than that provided by our courts of law. From my own observation of silicosis litigation, I believe that from the standpoint of the employer, the employee, and the public, some agency other than our courts of law should be established to determine the liability of employers for occupational disease injuries sustained by their employees.

I have mentioned the possible inequities that have existed under our compensation acts and in the administration of their provisions. However, I believe today it is fair to state that any attempt to effect the repeal of those compensation acts would meet with the combined resistance of employer and employee alike. Neither interest would desire to transfer back to our courts administering common law, the question of the legal liability of employers for accidental injuries sustained by employees in the course of their employment.

Therefore, in view of the past administration of our compensation laws, unsatisfactory to certain interests as they may have been, it is not unreasonable to hope that intelligent occupational disease legislation may similarly meet with the approval of employer and employee alike. Furthermore, it is reasonable to hope that such legislation may eliminate the possibility of expensive litigation that may arise and serve the social needs of all parties interested in this problem.

The statutes providing compensation for silicosis injuries that have been heretofore adopted in several of the states vary both as to form and as to provisions for their administration. In my judgment, uniformity of legislation is not only impossible of achievement, but distinctly inadvisable. Industrial conditions vary greatly in the different sections of the country and what may be the answer to the problem in the state of New York may be entirely separate and distinct from the answer to the problem in California. Any legislation proposed to be adopted must be suitable to the particular working conditions in the particular State in which it is to be applicable. A frank recognition of this fact will eliminate unnecessary contention with respect to such proposed legislation.

Again, some of our friends who purport to speak for labor have been advocates of the so-called "all-inclusive" occupational disease acts. In my judgment, the "all-inclusive" occupational disease acts tend inevitably to health insurance and enable the Department charged with the administration thereof to award compensation to all the human ills that may occur to employees in the course of their employment.

Another phase of the problem of silicosis compensation legislation is that of accrued liability. In most instances where silicosis is found to exist, the employees have accumulated the injurious substances that cause their condition during the term of their employment before such proposed legislation could become effective. With respect to that liability, I believe it is inequitable to saddle the expense thereof upon industry at one given time and some method should be found for apportioning this accrued liability.

Another most important element to be considered in the drafting of silicosis compensation legislation should be a provision for the appointment of a competent

medical board. Neither lawyers nor laymen are in the position to pass upon medical questions nor to determine the existence of occupational diseases in industry nor the disabling effect thereof. The determination of such injuries must be taken from lay juries and from commissions incompetent to determine such medical questions.

Necessity of Prevention

I wish to emphasize what to me seems to be the most important aspect of this problem, namely, prevention. From the standpoint of those who labor, they should be far more interested in the maintenance of their health in their particular employment than in compensation for injuries to that health. From the standpoint of employers, the cost of prevention of occupational disease injuries will be but a small fraction of the ultimate cost of compensation for such injuries.

With respect to silicosis, through agencies such as your own, the United States Public Health Service and other state and industrial organizations in which industry may have confidence, there is available, to you as employers, scientific information as to methods of eliminating most of the silica hazard that exists in your particular industries. If, for none other than selfish reasons, you, as employers, should make use of this information. The initial cost may seem great, but it will many times repay the cost of compensation for silicosis injuries.

I do not believe that modern society will countenance the continued failure of many industries to utilize such available methods of engineering control as will tend to minimize the hazard and I hope that in your industrial processes each of you here assembled will renew your interest and activities with respect to your own important departments of industrial hygiene.

Labor, for its part, must discharge its duties with full appreciation of the hazards that are present in the particular industries wherein its members are engaged. There must be no half-hearted use of protective appliances with which labor may be supplied. Similarly, there must be no half-hearted enforcement of factory rules and regulations with respect to the use of such appliances. Again, there must be a cooperative observance of rules and regulations that may be laid down by safety engineers or state officials with respect to health conditions in your plants.

The problem of health must become a major consideration by all interests involved and I honestly believe that with full cooperation by employer and employee alike, industry may be well on its way to elimination of this hazard and may relegate the problem of compensation for such injuries to such statutory provisions as the state may see fit to adopt, reasonable in their provisions, but unnecessary to enforce because of the previous elimination of the hazard.

The Thursday morning session was brought to a close with a general round table discussion on "The Work of the Quarry Section."

ADJOURNMENT