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NATIONAL SAFETY COUNCIL, Inc.

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Foreword

THE Transactions of the Twenty-sixth National Safety Congress, 1937, are published by the National Safety Council in two volumes. This, the first, contains the general, the special subject, and the Industrial Section sessions. The second volume contains the sessions of the Child Education, Home Safety, Street and Highway Traffic, Commercial Vehicle and Transit Sections.

All industrial members of the Council automatically receive Volume I. Volume II is sent to members believed to be interested chiefly in the sessions it covers. Other Council members, however, may obtain it upon request.

Many members have found it worth while to distribute copies of the Transactions to supervisors, foremen, and others in an administrative or supervisory position who may make practical use of them for reference purposes. The following quantity prices are quoted on extra copies: 1 to 10 copies of the large volume (Volume I), $2 each; 11 copies or more, $1.75 each; copies of the smaller volume (Volume II), 75 cents each.

THE Transactions are published as a condensed record of the proceedings at the National Congress. The papers of each session or division of the Congress have been edited carefully to eliminate extraneous matter and to abbreviate the less essential portions because of space limitations. Thus the material herein presented is not a verbatim report of all the speeches presented at the Congress, but rather an abridged version made as compact as possible, yet without injury to the technical aspects of any address. The original manuscripts are on file in the Council's Bureau of Information, where they are available for additional reference. Where illustrations were sent by the speakers to the Council, these also are on file.

The National Safety Council at its Congresses seeks to eliminate from discussion matters which are not pertinent to the aim of the Congress or which are contrary to Council policies. It cannot accept responsibility for the views expressed either in the papers presented or in the discussions based upon the papers.

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Industrial Dusts

WEDNESDAY MORNING SESSION

October 13, 1937

The meeting was called to order by Chairman A. S. Regula, Executive Secretary, Industrial Relations Counselors, Inc., New York City, and Vice-President for Engineering, National Safety Council, who introduced the speakers.

What Industrial Dusts Are Harmful? Why?

By SENIOR SURGEON R. R. SAYERS

Chief, Division of Industrial Hygiene, U. S. Public Health Service

While dusts exist everywhere in the atmosphere, it has been recognized for centuries that workers in certain dusty occupations are less healthy than those not so exposed. The number of persons exposed in dusty occupations comprises one of the largest industrial groups. The occupational diseases of workers in dusty atmospheres have been found to be due to entrance of dust into the system by inhalation, by ingestion, by direct absorption through the skin, by irritation of the skin, or by a combination of the foregoing.

The suspensions of particulate matter in air have been broadly termed dusts, fumes, and smokes. Such a classification is necessarily arbitrary, since the line of demarcation between them is not very sharp, and the chief differentiation is based on the size of the particles. Investigations by the Public Health Service in dusty industries[1] revealed that about 70 per cent of the dust particles examined were between 1 and 3 microns in size, only about 20 per cent were less than 1 micron, and the median size was 1.3 microns. Industrial dusts are mainly less than 10 microns in size. However, fibrous dusts in the air, such as asbestos, have been found to contain particles as large as 200-400 microns in the greatest diameter.

While, generally speaking, according to Collis, dusts are more injurious as their chemical composition differs from that of the human body, or from the elements of which the body is normally composed,[2] it is difficult to establish a comprehensive definition for *toxic* dusts. Sollmann,[3] after analysis of various definitions for poison, felt that it is very difficult to give a definition which will not be ambiguous in some cases, but believed that the following covers most of the points which must be considered in classing a substance as such:

> "A poison is any substance which, acting directly through its inherent chemic properties, and by its ordinary action, is capable of destroying life, or of seriously endangering health, when it is applied to the body, externally, or in moderate doses (to 50 Gm.) internally."

Some dusts are known to be poisonous, while others, in the concentrations usually encountered, are comparatively harmless. However, it may be stated that *breathing* dust in high concentration is not desirable.

According to Fairhall, the damage arising from the inhalation of toxic dust may be either local or remote, and depends upon whether the material is a protoplasmic poison, whether it is caustic in reaction, or whether it is absorbed into the blood stream and carried to other centers which are in turn affected.[4]

It is now well established that exposure to certain kinds of dusts, such as those containing considerable quantities of free silica, has increased the morbidity and mortality rate from respiratory diseases; while metallic dusts, such as lead and its compounds,

have been associated with general systemic poisoning.[5] Dusts may be swallowed with saliva, water, or food, and direct poisoning has been traced to absorption by this method; other dusts may act as irritants and produce affections of the skin, irritate mucous membranes of nose, eyes and throat, often causing inflammatory diseases of these organs.[6]

Some inorganic dusts are able to penetrate the deep lung tissues and are sufficiently insoluble to be retained there. Some of these may be active in the human tissues, causing definite and permanent injury, while others are inert and may be retained for years, apparently without serious damage; some are gradually absorbed without causing pathological changes.[7]

All inhaled particles are soluble, at least to a small extent. If harmless, cell activity is stimulated so that phagocytes remove the dust. If the solute is toxic, the viability of the phagocyte is affected and an ineffective accumulation results. At the same time, further solute may diffuse into neighboring tissues, setting up an irritation and subsequent fibrosis. The nature as well as the solubility of the solute is an important factor, but of two substances of approximately equal toxicity, the more soluble form causes the greater damage. However, substances of such low solubility as silica may ultimately produce extensive injury.[4]

Kettle has stated that harmful dusts, if inhaled into the lungs, may activate a latent tuberculous infection; they may exaggerate an active tuberculous lesion or a coincident infection. If sufficient quantities of a harmless dust are inhaled, some of it remains in the lungs and causes a mild degree of fibrosis merely through mechanical irritation, but such fibrosis is never sufficient to interfere with the function of the lung.[8]

Some writers state that while the influence of nonpoisonous dusts on health is a debatable subject, abnormally high death rates from bronchitis and pneumonia are sometimes attributed to chronic exposure to nontoxic dusts. Large amounts of dust are occasionally found in supposedly normal lungs, at autopsy.[9]

According to Drinker, there are four different types of reaction produced in man by the inhalation of dust. The first and most important are the pneumoconioses, such as silicosis and asbestosis, which cause specific lung pathology and often are followed by pulmonary tuberculosis. The second type of reaction is caused by toxic dusts like lead, cadmium, and radium. A third type of malady follows the inhalation of finely divided metallic fume particles such as zinc oxide, and is known as metal fume fever. The fourth reaction, allergic in character, is caused by breathing organic dusts such as pollen and certain types of pulverized wood and flour. In all four cases the sole cause of the disability may be dust inhalation, but the reactions from toxic dusts result from swallowing as well as from inhalation.[10]

For various reasons it is difficult to set up an absolute classification for dusts. Opinion is rapidly changing regarding so-called inert or harmless dusts and further investigation may prove some of them to be injurious. Some dusts may have both a toxic and an irritant action; while on the other hand, the poisoning resulting from exposure to a dust may be the combined effect of more than one mode of entrance into the body. However, the following classification of dusts, according to physical characteristics and physiological effect, is used for convenience.

I. Organic Dusts

Organic dusts are those which contain carbon, and were originally supposed to come from organized substances derived from animal or plant life. Living dusts come under this classification, and are thought to be of the same order of size as industrial dusts, with which they are frequently associated. Bacteria are usually between 0.5 and 3 microns, except in a few cases, such as the anthrax bacillus, which ranges from 1 to 1.25 micron in breadth and 4.5 to 10 microns in length and 10 or 12 microns in diameter. However, it is possible that the larger and heavier varieties, like the larger and heavier dust particles, settle due to gravity, and do not remain suspended in the air.

Many thousands of organic substances, carbon-containing, are made synthetically by chemical processes, such as dyestuffs, explosives, etc.

1. *NONLIVING ORGANIC DUSTS.* As the name implies, these are comprised of nonviable particles, which may or may not be inherently toxic or irritant, but which nevertheless produce untoward effects in the human organism. "Allergic" dusts, or those to which only certain persons are or may

become hypersensitive, with resulting asthma, rhinitis, or other disturbances, are included in this classification.

a. *Toxic and/or Irritant.* Toxic or irritant dusts are all organic dusts which produce untoward symptoms, either systemic or local. Those producing local symptoms are usually described as irritant; those producing general or systemic symptoms are termed toxic. A dust may be both toxic and irritant.

In reported cases of injury or death following inhalation of dust from organic compounds, among the chief offenders are paranitraniline, the dinitrobenzenes, chlorodinitrobenzenes, trinitrophenol, and nitronaphthalene. Eye damage due to inflammation of the cornea has occurred among workers exposed to methyl violet dust. The dust from paraphenylene diamine derivatives is particularly irritating and dangerous, causing not only a severe form of dermatitis where the dust comes in contact with the skin, but also producing acute inflammation of the mucous membrane of the respiratory passages.[4] Toxic dusts may be generated during the handling of powdered dyes and in preliminary dyeing operations, particularly the hydro-extractor process, where particles are disseminated in all directions.[11] Coal tar and indigo dyes are substances most frequently used.

Cases of amblyopia have been reported from exposure to inhalation of tobacco dust.[12] It has been found that inhaled tobacco dust exerts a nicotine action on the organism fifteen times greater than that produced by the same quantity of smoked tobacco with an equal nicotine content.[13]

Severe dermatitis is experienced by many workers handling powder containing T.N.T., which is used in making high explosives. Picric acid, which is also used for this purpose, requires drying, and in this latter state has been found to produce a dermatitis. Pictic acid is also the oldest synthetic organic dyestuff.[14] Dermatitis occurs among handlers of silk with varying frequency. Salls determined that a rash occurring among workers in a silk factory was due to dust from silk cocoons imported from Africa.[15]

Persons engaged in the manufacture of quinine and quinine preparations suffer from skin phenomena, which occur for the most part on exposed parts of the body, and may be caused by ingestion or by quinine dust, or powder form of the preparation, erting a direct irritating effect on the sk Dermatitis due to other vegetable du such as vanilla, powdered arnica, py thrum, etc., have been reported.[16]

Dental lesions, of occupational ori have been reported among workers in sug The gingivitis caused by sugar dust is cl sified as purely mechanical, with lat developing caries. Digestive disorde respiratory conditions, and cutaneous co ditions (especially of the face) were a found.[17]

Dock workers, transporters of gra workers in grain and flour mills, etc. a exposed to dusts during their work. Du from cereals may contain many impuriti which may cause an irritating action on t respiratory passages, as well as inflamm tion of the skin. Digestive disturbanc dental defects, diminution in hearing, a conjunctivitis have been observed amo millers, and have been attributed to the dus to which such workers are exposed.[18]

b. *Allergic.* Many apparently innocuo substances may produce reactions in pe sons of peculiar personal susceptibility. Th term "allergy" is used to describe this co dition of hypersensitiveness or susceptibili and allergic phenomena most frequent manifest themselves in skin reactions. Ho ever, they may cause acute reactions els where in the body. When the respirato tract is involved we have such well know diseases as hay fever or asthma. The diseases may develop as a result of hype sensitiveness to such substances as polle from plants, horsehair, rabbit's fur, fu feathers, etc.

For instance, furriers, workers in clothin industries who are exposed to wool dus etc., may suffer from hay fever or asthma It is unnecessary for the offending dust t reach the depths of the lungs—giant pollet for example are reported to produce the effect after being caught in the upper re piratory passages. Should such an offendi substance be finely ground it could rea the alveoli and as a result probably a physiologic reactions would be accelerated.

In a survey of a plant where resin mixed, ground, and molded, it was foun that 80 per cent of the occupational derm titis there was due to hypersensitivity hexamethylenetetramine and formaldehyd contained in the dust to which the worke were exposed.[19] During the first processe

cotton spinning, cotton-strippers are exed to dust arising from cotton husks and ris, which produces a typical form of ima.[2]

Ordinary wood dust has been of interest e to its purely mechanical action, but ll greater care is required in handling rtain kinds, especially woods coming from road, because of the essential oils impregting them, which when freed in the dust y affect the health of the workers conned. Some of the woods capable of using skin lesions are Brazil wood, satinod, teakwood, cumaru or tonka wood, ck ebony wood, West Indian mahogany, panese tagayasan, coccoloba, chestnutwood, vewood, California sequoia, etc. All pers ns who handle these woods are not inred, only those particularly susceptible to e substances they contain becoming fected.[22]

2. LIVING ORGANIC DUSTS. These ntain particles capable of exhibiting the enomena of life[2] (especially the property reproduction or multiplication), such as cteria and fungi. They are usually found low concentrations and are associated th nonliving dusts in the air.

a. *Bacteria.* One of the most important nong these is the anthrax bacillus, which contained in the dust from skins, furs, ool, and animal hair, horns, hoofs, bones, c. This disease may occur in two forms: *taneous* (in which the organism affects e skin), and *pulmonary* (when it is inhaled, in the form of anthrax known as woolrters' disease).[12]

Cases of tetanus, reported in connection ith jute manufacture, were traced to the w material, the bacillus having been found the factory dust.[23] Diphtheria, tuberculosis, smallpox, typhoid, or other bacillusoduced diseases, may result from exposure infected dusts.

Bacterial sensitization can be the cause of y of the allergic diseases, namely, asthma, rennial. hay fever, urticaria, angioneurotic lema, eczema, or migraine headaches.[24]

b. *Fungi.* Dusts containing the mycelia d spores of parasitic fungi give rise to noyance and discomfort. "Maltster's" itch om the dust alone has been reported. In rovence, reeds used for ceilings are stacked hile still wet and undergo fermentation; ey become covered with a white powder dry fungus of the Mucor family: Sporotrichum dermatodes), which is scattered when the bark is stripped off. This powder is irritating to the skin and mucous membranes. Mycelia and spores of moulds are commonly found to cause rashes: for instance, the black powder coming from macerated sugarcane stalks. Among basketmakers, the mycelium and spores, in the form of a white mould (hyphomycete) from the rhattan canes used, get shaken out when the canes are split, hammered, and cut, causing painful fissures to develop on the skin where they alight.[14]

A form of asthma or spasmodic cough, suffered by cotton weavers and known as aspergillosis, has been considered due to inhalation of spores of a mildew which sometimes occurs on the threads.[25] In a study of silicosis among miners, made by the Public Health Service, a number of cases of typical miliary calcification were encountered. Unstained smears of those cases examined were positive for fungus, two types of Aspergillus fungi being identified. All of the subjects but one were farmers, teamsters, feedmill workers, or residents of small agricultural towns where grain is marketed. Farmers are exposed to fungi in threshing wheat, baling hay, or handling various small grains.[25]

Some other fungus diseases such as actinomycosis and blastomycosis are associated with occupational exposure to dust. The former occurs among workers handling straw, hay, grass, vegetable débris contaminated with mould, etc. Actinomycosis is likely to affect people engaged in commercial handling, storing, and cleansing of grain (grain distilleries, flour mills, grain crushing, breweries, and malting houses, etc.).[26]

II. Inorganic Dusts

Inorganic compounds are of mineral origin, not requiring a living organism to produce them.[27] A number of dusts not usually classed as toxic may, under some conditions, produce untoward effects on the human organism. Classified under inorganic are toxic and/or irritant, fibrosis-producing, and nonfibrosis-producing dusts.

a. *Toxic and/or Irritant.* Toxic dusts are those which are inherently toxic when inhaled, ingested, or otherwise absorbed. Among those which produce systemic poisoning, some of which are also irritant, are the dusts from heavy metals and their salts, such as lead, mercury, arsenic, cadmium,

zinc, etc. Irritant dusts are injurious by reason of their strong irritative or corrosive properties.

As a rule, inhaled irritant substances immediately cause a reaction in the upper respiratory tract of such severity that they are prevented from reaching the lungs, although they may cause lung damage by extension of inflammation if the mucous membrane is corroded.[7] Lime, calcium oxide, and the di-chromates are examples of irritant dusts. An inorganic dust may possess both toxic and irritant properties, and the poisoning produced may be the combined effect of more than one mode of entrance into the body.

Of the directly poisonous dusts, the most widely prevalent are those of certain lead compounds, particularly the oxide, carbonate and the chromate. The dust is readily absorbed by the mucous membrane; some dust passes into the stomach and is dissolved by the gastric juice.[6]

According to Fairhall, perforated nasal septum is a common occurrence among workers with bi-chromate dusts.[4] In a study made by the U. S. Public Health Service it was found that continuous daily exposure to concentrations of chromic acid mist greater than 1 milligram in 10 cubic meters is likely to cause definite injury to the nasal tissues.[28] It is believed that a similar concentration of the dust would be equally toxic.

In the case of poisoning from some heavy metals, exposure may be to both dust and vapor. For instance, investigations have shown the safe limit of *total* exposure to lead oxide dust and fumes to be less than 1.5 mg. per 10 cubic meters of air, except for prolonged exposure.[29] In exposure to mercury dust and vapor, it was shown that the incidence of chronic mercurialism increases rapidly with increasing mercury concentration, after such concentration exceeds 2.0 mg. per 10 cubic meters.[30]

Alkalis and metallic oxides are common causes of dermatoses. Lye, potash and lime are known to cause irritation to plasterers, cement-makers, bricklayers, masons, stonecutters, modellers, and metal platers.[16] Ulceration and perforation of the nasal septum occur among workers exposed to the dust of soda ash; systemic poisoning also occurs from inhalation of calcium cyanimide dust.[21]

Cases of dermatitis, scleroderma and cancer are reported to have been caused by exposure to dust of arsenic compounds. Certain aluminum salts are skin irritants and aluminum dusts may contribute to the infection of skin and mucous membranes, through mechanical action.[16]

b. *Fibrosis-Producing Dusts.* The most important of these are the inorganic, slightly soluble dusts which cause fibrous changes in the lung tissues, some of which are serious, and some of which cause little or no disability.[7] So far as is known, no inorganic substances other than silicon derivatives cause more than a very moderate degree of fibrosis of the lung. Moreover, there seems to be no evidence that any other constituent of ordinary dusts can influence so unfavorably a pulmonary infection.[8]

Although other dusts, when inhaled in sufficient concentrations over a long period of time, have been shown capable of producing a pulmonary fibrosis, nevertheless, the pneumoconiosis characterized by nodular fibrosis has to date been shown clinically and experimentally to be associated only with the inhalation of dusts containing free silica.

Since this dust, to exert its harmful action, must enter the finer divisions of the lung, the particle size of the atmospheric dust may bear a definite relationship to the injurious effect produced. The silica must be present in the air in particles small enough to enter the finer air spaces and of such dimensions that the phagocytic cells may engulf them. The greater majority of particles found upon microscopic examination of the lung fall within the limits of from 1 to 3 microns.[31] Examples of siliceous dusts are granite, quartz, sand, pumice, slate, etc.

In a recent study among anthracite miners, the correlations between exposure to dust (which contained silica) and the evidence of constitutional changes left little doubt as to the etiological significance of the dust in the air breathed. Like correlations were found between the silica exposure and the extent of pulmonary changes.[32] When the inhaled dust consists of silica combined with bases, silicates, some degree of change in the pulmonary tissue may result. In this respect asbestos dust seems to be unique among silicates in the prevalence and severity of the disease it causes.[33]

The chief distinction between silicosis and conditions due to simple reactions caused by other dusts is the active proliferative

reaction in the tissues which results in progressive nodulation. Silicosis, when once established, strongly predisposes the lungs to infection, especially with the tubercle bacillus. Chronic interstitial pneumonia, chronic bronchitis, and emphysema are frequent complications of advanced degrees of silicosis.

The relation of the acute respiratory infections to the reaction due to dusts other than free silica has never been established, though a heightened incidence has often been shown statistically in workers in dusty trades. It is fairly certain that a dust damaged lung, whatever the cause, fares much worse if an acute infection does supervene upon it.[7]

In a study conducted by the U. S. Public Health Service among marble finishers in Vermont, it was found that marble dust when inhaled in the concentrations found in the examined plants produced a mild, bilateral, linear fibrosis in some cases, but no serious lung changes were noted and there was no disability due to the dust, even after years of exposure.[34]

c. *Nonfibrosis-Producing Dusts.* These are inert, that is, they do not cause fibrous tissue to be produced, but may become encapsulated or lie free in the tissues; or they are absorbed without production of fibrous tissue. Included among them are alundum, coal, corundum, emery, limestone, magnesite, marble, plaster of paris (gypsum), and polisher's rouge.

Dust Control

Engineering and medical control are the two most important factors in combating the industrial dust hazard, and are to a large extent complementary.

Engineering Control. As Lanza[35] has stated in a recent paper, "It is a basic principle in dealing with a dust hazard that the dust should be attacked at its point of origin and thus prevented from being disseminated into the atmosphere." After the dust has been spread throughout the air it is difficult to deal with it, and reliance must be placed on individual protection, which is never wholly satisfactory.

Lanza further cites various methods used in controlling dust. These will be reviewed but briefly, since a paper dealing with the subject of dust control in detail, will follow on this program.

Dust may be entrapped at its source by suction devices and thus removed and collected. Familiar examples are exhaust hoods in grinding operations, and the devices used in rock drilling.

Generally speaking, the exhaust ventilation method, where applicable, is to be preferred in controlling a dust hazard. Water may be used to entrap dust and prevent its dispersal, and under certain circumstances it may be of advantage to combine the use of water and the use of suction. Sometimes a dusty process can be completely enclosed in a sealed room or compartment. It must be remembered, however, that any mechanical device of this kind offers adequate protection only if it is properly designed, installed, and maintained.

A great deal of attention has been given the subject of individual protection from dust, and there are many types of respiratory protective devices now available. These are generally of two types: those which provide fresh air from an uncontaminated source and those which rely upon a filtering medium for removing dust from the air breathed. Where the use of such a device is indicated, only one of the types approved by the U. S. Bureau of Mines should be used. As a rule, it may be said that masks, respirators, or other such protective device should be used only where exposure to the dust is intermittent and brief, or where some unusual condition makes a more adequate dust control impracticable.[35]

Where bacteria or other living dusts in the air are associated with a process, sterilization methods such as increased temperature, ultraviolet radiation, and chemicals like chlorine or other bactericidal substances, may be of use. Pasteurization temperature (about 140° F.) will kill most organisms except those bearing spores. Steam disinfection is used for horsehair, and proves to be practicable if the temperature does not exceed 230° F. Wool fibres, however, lose their elasticity by steam disinfection, and the "Duckering" process now used in England includes soaking of the wool in a formaldehyde solution, and drying in a current of air at a temperature of 160° F.[12] There are few occupations in which there would be a sufficient concentration of dead bacteria to cause untoward effects in man.

In the case of dusts producing external irritation, auxiliary protective measures may include the use of protective clothing,

gloves, goggles and aprons; as well as protective salves, ointments, or other compounds to delay or diminish the irritant action. General rules for hygiene and good housekeeping should also be observed.

Medical Control. Equally important, and closely interrelated with the engineering phase, is medical control of occupational hazards. In addition to directing the proper placement of new workers, and guarding the health of all employees, medical control is a check on the efficacy of the engineering control methods already instituted, or a measure of the need for new protective devices.

It has been stated that "Industry has found that the best way to treat industrial injuries and illness is to prevent them,"[34] and medical control, through preemployment and periodic physical examinations, is one of the most important factors in such prevention.

The preemployment examination is made to determine the employee's physical and mental fitness for work. It serves to disclose the presence of any contagious disease, reveals any minor physical defects which might later become serious, or whether the examinee's condition precludes his employment in certain or in all types of work. It should be remembered that such preemployment examinations are not to be made for the purpose of eliminating an employee, but rather for allocating him to the type of work for which he is physically suited. A worker should be given employment unless totally unfit, or unless his disability, even though slight, would cause him to be a hazard to himself or his associates. Furthermore, the practice of preemployment examinations should be extended to include executives and officials of industrial organizations.

"The purpose of periodic physical examinations is to secure and maintain physical fitness and thereby lengthen work spans."[36] Reexamination of employees sometimes results in the discovery of defects and disabilities which were not observed at the time of employment. In such cases, an occupational adjustment should be made to provide continued employment, but remove the risk of permanent injury.

Reexamination of employees is required by law in certain occupations in which the handling of poisonous or otherwise deleterious substances may result in the contraction of disease.[37] Since some occupational diseases tend to clear up and recur, records o previous occupations should be included i the physical examinations. The frequenc of examinations should be determined b the medical director, unless otherwise spec fied by law. Those exposed to known occu pational disease hazards may have weekl or monthly examinations.[38]

"It should always be kept in mind that th basic principle of physical examinations i industry is to keep men on the job and no allow the physical examination to be merel a weeding out process."[35]

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The Engineer's Part in Eliminating Dust Hazards

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When one realizes that control of the dust hazard depends upon the combined contributions of the physician and the engineer, he appreciates that the solution requires scientific treatment. By scientific treatment I mean the technical analysis of the hazard to discover the causes which contribute to injury or ill health, and the development of control methods which obey physical law and physiology, and which will be directed at causes that admit of most immediate and economical treatment.

That goes for handling the dust hazard in a given plant. It goes double for acquiring knowledge to the end that the whole problem may reach ultimate solution. Right now our knowledge of the problem is in big chunks, loosely put together and largely empirical.

There are estimates only to judge the magnitude of the dust health problem, and it is so closely associated with other health problems that a clean-cut estimate of it alone is impossible. We do know that it is great in the aggregate, and for the individual plant it may be very bothersome and expensive.

What actually makes quartz dust cause silicosis is not known. It does, so the air breathed by workmen must not contain harmful quantities of respirable quartz dust. Inexpensive methods for making the air clean are still in the realm of dreams. Much work must be done to know more about silicosis and more how to make atmospheres safe *inexpensively*. As an accident prevention job, dust control lies almost entirely within the administrative responsibility. The control measures are capital expenditures of considerable size.

A plant with a dust hazard is sick, it needs an expert diagnosis and scientific treatment, which may include expensive major operations. Home remedies are seldom much good, and supervision and employee safety consciousness alone cannot accomplish anything. There may be observed in countless shops installations for exhausting dust which are derisively called "tin knocker" jobs in which the horsepower dissipated is out of all proportion to the air-borne dust moved. Tonnage efficiency of material moved may be the proper yardstick for pneumatic conveyors but if the material to be moved is air, contaminated with nearly weightless particles of dust, the entire health hazard can lie in the half of one per cent of material not moved.

I do not mean that unless a dust supression job was engineered it can be no good. There are many good installations that were never figured at all but grew like Topsy. The re-

sulting freedom from dustiness was so satisfactory that efficiency held little interest to the owner. This is exceptional, however, and I offer the opinion that dust suppression jobs should be engineered.

A dust-suppression installation is a safety device, designed and operated to provide protection against possible disease and provide a sense of security which must be absolute. Its safety is not rushing air and rattling chips but a minimal residual dustiness. There is no more pathetic defeat for a dust control job than to find faith in its effectiveness so low that workers must wear respirators to find the reasonable safety that was expected from the hoods, ducts and fans.

Diagnosis and Control

Let us examine some of the features by which we recognize this dust hazard problem, leaving out the socio-legal aspects.

In order to develop more fully the engineer's place in this dust control program, it seems desirable to separate as sharply as we can the diagnostic considerations from those which deal with control. In the first compartment we can place all the analytical components which describe the hazard and its exposure, the probability of its producing ill health and all the rest of the medical and industrial hygiene facts which make out a case against the existing dust. In the second compartment place the knowledge of physics and engineering necessary to plan the dust control program and so design it that when installed its performance follows prediction that the probability of industrial disease is reduced to insignificance.

The Industrial Hygienist

Our first feature of interest would naturally be the specific and relative toxicity of silica, silica-bearing and other dusts which make up the dust health hazard. Much might be said to advantage about the quality and quantity of hazard in many dusts. The acquiring of this knowledge has been, and must remain a medical problem. It involves gross and microscopic pathology and x-rays, and experimental animals. Engineers do not talk that language. Industrial hygienists do; they are a happy combination, half doctor and half engineer. Many of them are quite capable of handling the dust health hazard in all its phases of investigation and control. For the purpose of this discussion I throw their interest in with the doctors.

I want to go so far in my opinion as state that the engineer should not attempt define the quality of health hazard in a giv plant or industry, nor should he establi threshold limits of safe or permissible dus ness. This may be debatable, but I shall co tend that the engineer who writes the spec fications of hazard and dust tolerance is real an industrial hygienist, and is using a ver much broader knowledge than engineerin alone.

In the first case the quality of the healt hazard is an opinion arrived at after studyin all the environmental conditions including th general sanitation, occupational analysis an a scientific analysis of the dust exposure In the exploration of dust exposures, th nature of dusty operations must be viewe from physical, chemical and mechanica aspects, the determinations of dustiness mus be not only counted and classified by particu late sizes, but chemically and mineralogicall analyzed. The plant layout must be studie with respect to dust production and distribu tion, and the housekeeping and existing dus control equipment evaluated. The presence o specific hazards, such as toxic gases, abnor mal temperature and humidity conditions, etc. must be explored for their complicating effec upon the whole picture. This is distinctly a industrial hygiene job, and some of the mos critical data requires only medical viewpoint This is absolute in the case of tuberculosi study and the qualifying of men for employ ment.

So far, not one atom of engineering t suppress dust is involved. It is entirely anal ysis of hazard. The diagnosis must be tha the dustiness is hazardous to health or that i is safe. If it is hazardous, it must be brough down to a specified residue. If it isn't, leav it alone. On the second point, if the hygienist can not specify threshold limits graduate upward for relatively less hazardous dust let the engineer not worry about it. Th diagnosis is dust which is harmful and to much of it. The remedy is control of the dus The engineer designs controls which wi produce the lowest practical residual dust ness. He should not attempt to write his own specifications of threshold limits or permis sible dustiness. This may be an importan goal in the study of dust health hazards.

Safe Limits

At the present time the medical men an hygienists believe that quartz dust is sa

below five million particles. They seem willing to graduate upward to 20 million for medium silica and 50 million for low silica percentages. Five million particles is virtually dust free, and is very difficult and expensive to achieve and maintain. The declaration of safety of the installations must remain in the hands of the medical and hygiene groups in whose hands now lies the responsibility for determining the hazard.

We now enter the chapter of our discussion intended to demonstrate that dust control is an engineering job, that it must be given scentific treatment, not guess work, applying engineering methods which are based upon a knowledge of physical law, the behavior of dust, the performance of air-moving machinery, etc.

Prerequisite Knowledge

Let me recite briefly, a few of the things which, in my opinion, the engineer should know to do this job correctly. He must know how to make a survey. Surveys depend upon sampling, and sampling is not a catch-as-catch-can proposition. It involves the place, the time, the frequency, the amount in a sample, and the number of samples so that maximum, minimum and average data mean something, so that credibility can be given them.

For the type of sample involved he must know how to weigh or count respirable dust, as distinguished from large masses of non-respirable dust which complicate the picture. He must know how to observe the sources of dust floods as distinguished from conditions of normal dustiness. He must know the sources of dust and the principles involved in the dispersion of dust. He must determine how much dust enters the problem because it is part of the material, and what dust is created in the process by the fracturing of the material.

Any less survey cannot tell the engineer what his task of dust control is. To visualize that task intelligently he should know the physics of Brownian motion, laws of resistance to the motion of particles moving in air, both when the air is in turbulence and for stream-line motion. He should know terminal velocities, movements due to centrifugal motion; flocculation and the effects of air motion and the effects of humidification on it. He must know all about the difficulties of wetting and what is known about overcoming these difficulties. He should know the several electrical phenomena which bear upon dust behavior.

Those are all principles of physics which explain the behavior of dust and upon which engineering practice must be based. They must be understood and be taken into account. Dust control is not a matter only of general ventilation; the engineer must study the production as well as the dispersion. The problem should be analyzed to determine the applicability of segregation, enclosure, wetting, local exhaust and general ventilation.

In some instances, substitution of non-hazardous material, or non-dust-producing operations may have specific application, and they should be explored first. This implies plant engineering. I am convinced that many bad installations are bad because plant engineering was not used. In the designing of exhaust systems installed to capture the dust at the points of generation, the physical behavior of air moving toward hoods and in ducts must be known, and that knowledge used. Each system must consist of collection hoods, piping, air-cleaning plant and a source of suction. Before selecting a hood for a job the engineer must know dust dispersion by dynamic projection as well as dust dispersion by air currents, and design the hood accordingly.

Knowledge Needed

The aero-dynamic characteristics of suction hoods appear to be little known because little thought was given to them in designing thousands of hoods which can be found everywhere in industry. All the possibility for entrapping dust and much of the efficiency of the system lies in this factor. Air velocity, static suction, and rate of air flow are all related, and they must be known. It is essential to use high velocity of air in certain types of exhaust systems to entrap dust projected at high velocities as in the case of a granite surfacing machine, and low velocities must be used in others, as in the case of cleaning asbestos fibre of dust to prevent wasting material.

Quantity of air and its velocity must be determined, then the piping should be designed to take into account the behavior of air-flow through pipes at low and high velocities. Where the problem is complicated by the large sized particles which go along with the fine dust, how these behave must be taken into account. Pressure losses are very important elements in the design of an exhaust

system. Loss at the hoods, loss at the bends, and loss in the ducts must not be guessed at. Pipe design must take into account the gage of the metal and reinforcing to withstand pressures and erosion.

The selection of a fan and its motive power is a matter of calculation, not guess work. Power consumption in the system is calculable, fans follow certain laws, so the engineer must know the behavior of axial flow, propeller type, radial flow, paddle wheel and other fan performance.

More physics and engineering calculation goes into the air-cleaning apparatus. The selection of gravitation, inertial or filtration method depends upon what the dust is, the calculation for any methods requires knowledge of discharge through stacks, the determination of sizes of settling chambers; the behavior of cyclones. The use or non-use of a filter, and if so, what type, how it should perform, how big it should be, what kind of resistance and how much each kind offers, to say nothing of their proper location with relation to cleaning, accessibility, etc., are all items for accurate engineering determination.

Apparatus to check the behavior of installations must be known and used. Performance cannot be left to guess work. Supplying sufficient air to be exhausted is part of the problem. The same may be said of heating

Do I give the problent too severe a build up? I think not. Remember these two things

1. You are dealing with hazardous material so small in size and so little of it by weight that it is as invisible as the air that bears it.

2. Physical laws involved in the behavior of dust and air do not permit inexpensive methods of control. I am acquainted with budgets set up for this purpose which amount to more than a quarter of a million dollars and I know of many where 60 to 80 thousand dollars is involved.

The need for this much engineering is recognized by men who know. Already much has been done toward getting the knowledge into handbook shape. Perhaps the best job of this sort to date is "Fundamentals Relating to the Design and Operation of Exhaust Systems" developed under American Standards Association procedure.

The Doctor's Part in Controlling Dust Hazards

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Considerable confusion has existed in the past as to just what is the physician's function in the prevention of dust diseases, and just what is the engineer's. It is very obvious upon even casual thought that the two sciences must work hand in hand in their efforts to solve the problem.

The physician through his special training must be able to tell the engineer what dusts are dangerous and what are not. He must know how those dusts enter the body and the manner in which they do their harm. He must be trained in the examination of persons who are to be employed to work in dust, and to discover those who are already diseased, or are peculiarly susceptible to dust disease. He must be able to detect the first signs of disease in workers who are exposed to dust, and must be prepared to recognize the disease when it is fully developed.

It is not necessarily the physician's function to analyze dust. That is a task for the chemist and the petrographer. It is not the physician's function to count the particles of dust in a given industrial atmosphere. That in reality, is the function of the engineer. It is not the physician's function to devise ventilating equipment for the removal of dust, nor even to be more than an adviser as to the means that must be adopted to render the atmosphere safe.

The physician nevertheless must correlate with his medical knowledge and with his studies of the industrial worker the findings of the engineer. A diagnosis of silicosis, for example, requires not merely characteristic occupational history and characteristic phys-

cal findings, but the knowledge as well that the patient has been exposed to hazardous dusts in dangerous concentrations.

All dusts when inhaled in excessive quantities may be considered as harmful, but only a few can be regarded as dangerous. From the standpoint of their dangerous properties, they may be divided into three general groups.

1. Those which are dangerous because of their poisonous action, such as lead, arsenic, mercury, and similar substances.

2. Those which cause only irritation in the respiratory tract, resulting in such conditions as bronchitis or local inflammation; such substances as vegetable fibre, cork dust, flour, starch, and other relatively innocuous organic or inorganic materials.

3. Those which tend to produce fibrosis of the lungs, thereby predisposing to respiratory infections, especially tuberculosis, such dusts as asbestos, silica dioxide or magnesium silicate.

I shall confine my remarks chiefly to dusts occurring in the latter category.

It has been generally believed that the harmful effects of dusts inhaled into the lungs depended more upon their physical structure than upon their chemical. It was believed, for example, that silica dioxide, or quartz, was particularly harmful because of its crystalline structure, and the hardness and sharpness of its particles. This conception is now known to be faulty. The dusts which cause their damage by mechanical interference with function are the dusts which are relatively innocuous, whose symptoms are transitory, and which subside upon removal from exposure to the dust.

Chemical Effect Is Harmful

The disease of particular interest to us today, silicosis, owes its harmful effects very largely to a harmful chemical reaction occurring between silica dioxide and the body tissues. It so happens that silica dioxide is decidedly a tissue irritant to the body, regardless of the part of the body it invades, it causes local irritation, local destruction of tissue, and the replacement of that tissue by scars.

Thus, given a dust containing silica dioxide in sufficient concentration, in sizes small enough to permit its entrance to the ultimate air spaces in the lungs, we have a situation which offers danger to the worker.

We have no real knowledge as to true figures, but as a simple rule, we can adopt for practical purposes the thought that the human body can withstand successfully a concentration of dust containing 100 per cent silica dioxide in a particulate size less than 10 microns, in a concentration not in excess of 5,000,000 particles per cubic foot. If we decrease the percentage of silica dioxide present in the dust, we can correspondingly increase the concentration with comparative safety. We must, of course, take into account the portion of the worker's time spent in the dusty atmosphere.

To arrive at a rough conception of a safe atmosphere, we multiply the percentage of free silica in a given dust by the total number of particles per cubic foot. If the result is under 5,000,000 the condition may be considered relatively safe. If the result is over 5,000,000 the condition must be regarded as unsafe.

Bear in mind too that silicosis is essentially a disease of great chronicity. Except in a few exceptional instances it will require from seven to thirty years for a worker to develop advanced silicosis. It is evident too that coincident dusts may either retard the development of silicosis or hasten it. Recent research seems to indicate that the admixture of aluminum dust to a silicious dust will greatly inhibit the reaction of the latter; whereas a silicious dust combined with some alkaline coincident dusts may hasten the development of silicosis.

Much research is now under way in problems such as this. We have never learned how to cure silicosis, but we are learning rapidly how to prevent it. Our knowledge in this respect seems to be limited to the removal of dust from the breathing zone of the worker. Later discoveries may show us how to modify existing dusts with contaminant dusts that will render silica dioxide innocuous.

Owing to its very great chronicity, it is only the rare case who actually develops disabling silicosis during his industrial lifetime. It is realized, of course, that exceptional instances take place, but the coincident ravages of age usually keep pace with the effects of dust, so that much of the disability usually attributed to silicosis is often, in fact, actually attributable to other diseases or incapacities which advancing years bring in their wake. To me the great peril of silicosis, the peril not only to the industrial

worker himself, but his family, co-workers and the public generally, is the accompanying susceptibility to tuberculosis.

Complicated by Tuberculosis

Silicosis per se does not kill. Tuberculosis as a complicating factor of silicosis rarely recovers despite treatment, and the individual so afflicted is not only totally disabled himself, but a definite menace to all with whom he comes in contact, particularly the fellow worker who may have silicosis. So perhaps the most important places in which the services of the physician in a dusty trade are necessary are—first, along lines of discovering and barring from exposure to a silicious dust those persons who may already have arrested tuberculosis; and secondly, discovering those persons already exposed to dust, possibly already silicotic, in whom tuberculous infections may have developed.

It is well recognized that no individual should be exposed to dust containing silica dioxide until he has undergone a thorough physical examination, including carefully made and interpreted x-ray films of his chest. It is likewise obvious to anyone familiar with silicosis that no person who is exposed to silicious dust should be denied the privilege of frequent physical examinations and x-rays of the chest, not entirely to discover the existence of possible silicosis, but to discover a coincident tuberculosis if such exists.

A man so diseased should, in protection to himself and to all with whom he comes in contact, be removed from industry. Let me emphasize the uselessness of a physical examination, unless it be accompanied by properly taken x-ray films, except in cases of gross tuberculosis.

It is the function of the physician, therefore, to conduct in a thorough and an intelligent manner the pre-employment examination of all persons who are to be engaged in a dusty trade. The purpose of this examination should be threefold. First, to discover and bar from employment in dust, any person who is suffering from tuberculosis in an active, a quiescent or an arrested state.

A possible exception might be made in individuals suffering from a so called healed primary complex, or a healed childhood infection. It is well known that exposure to silica dioxide is very likely to excite i activity a turberculous lesion which may quiescent or arrested, and once such a le is reactivated, the chances of recovery remote.

The second problem which confronts physician at the pre-employment physical amination is whether a given individual by reason of secondary physical defe more susceptible to the development of cosis than a normal. Is he suffering fr diseases of the nose or upper respirat tract, such as chronic sinusitis, disease of lungs or air passages, or obstructions wh produce mouth breathing?

We must remember that silica dioxide not dangerous until it reaches the lungs, a that the normal individual retains in nose and the upper air passages a la quantity of the dust inhaled from the atm phere. In instances where this nasal ret tion is disturbed, exposure to silica diox dust may be dangerous to that individ where it would not be to another.

It is believed that certain diseases of heart and circulation, of the kidneys, po bly syphilis, chronic coincident diseases the lungs, all may render a man more s ceptible to silicosis than normal. The phy cian at his pre-employment examination m follow certain established criteria in respect, and bar from exposure to danger dusts those persons who through exist disease may be more ready prey to silico or tuberculosis.

Re-Examination Needed

After the applicant for employment successfully passed his physical examina and is engaged in a dusty trade, the d of the physician is not yet ended. This wo man must be periodically re-examined, f to discover the early appearances of p monary fibrosis, but what is even more portant, to detect the early evidences complicating tuberculous infection.

A man should not be dismissed from ployment in a dusty trade merely becaus has evidences of non-disabling silico Workers in dusty trades, especially st cutters, moulders, pottery workers, similar craftsmen, are usually highly skill and it seems unfortunate from a social economic point of view to deny them ployment so long as they are physically to carry on, especially since the actual abling qualities of silicosis are in doubt

They should be denied employment in a dusty trade if that condition is found at pre-employment examination, but they should not be barred from continuing an employment in which they are already engaged. Of course, in such instances you, as engineers, must realize that you have failed, because if you had kept the breathing zone of the worker free from dangerous dusts, silicosis would not be present on physical examination.

In this work of preventing dust diseases in industry, it should be evident that the closest and most intelligent cooperation between the physician and the engineer is necessary. The physician must, through his knowledge and research, tell the engineer what dusts, or, for that matter, what other substances used in industry are harmful. He must tell the engineer how such dusts or other materials enter the body, how they leave the body and what they do in their passages through or their residence in the body.

Must Make Analyses

The engineer must in turn tell the physician of the harmful dusts and other substances surrounding his workers. He must make chemical and petrographic analyses of the dusts, and other indicated analyses of the atmosphere in the workshop. He must make dust counts and check his counts at regular intervals, conferring with the physician in an effort to discover whether, in the light of their joint knowledge, working conditions are dangerous. He must develop and install carefully designed ventilating equipment. He must arrange for modification of chemical and other industrial processes, where such modification is possible, and must bend his efforts toward removing from the danger zone of the worker the offending substance, whatever it may be.

Too many engineers construe this function loosely. They pass on to the physician as his responsibility certain functions which essentially are theirs; such functions as dust analyses, dust counts, and similar technical duties. All too often it is considered adequate merely to install a fan.

Ventilating devices in dusty work rooms must be constructed only after careful engineering study has given a knowledge of the physical properties of the air and of substances polluting it. It is possible to calculate to a very fine point the volume of air that must be removed from a given spot to remove the dust originating at that place, and the engineer must approach his task from just as scientific an angle as the physician approaches his.

There is no room in industry for haphazard methods on the part of either the physician or the engineer.

ADJOURNMENT

course, some similarity of procedure in directing the work of any man on any job; but different industries employ such different types of people, under such a wide variety of circumstances, and place such a divergence of requirements upon them that the problem of supervisory training in its more comprehensive aspects is peculiar to each type of industry.

The general treatises on leadership give the groundwork, but the subject matter for any supervisory training course for any particular industry lies within that industry. We must go out and see how our job is being supervised now; analyze the procedure of every foreman and supervisor; compare them and select the best; look upon supervision as a process in itself, and see how best to direct the work of the people. It is a long, tedious, and costly process, but one which, carried through to completion, will pay dividends in the end.

WEDNESDAY LUNCHEON SESSION

October 13, 1937

The Wednesday Luncheon session of the Cement and Quarry Sections was addressed by Isaiah Hale, Superintendent of Safety, Atchison, Topeka and Santa Fe Railroad, who spoke on "The Common Sense of Safety." The address was substantially the same as another address by Mr. Hale before the Steam Railroad Meeting. The complete paper will be found in the Steam Railroad section of this volume.

WEDNESDAY AFTERNOON SESSION

October 13, 1937

Work of the National Silicosis Conference

By R. CAMPBELL STARR

Assistant Safety Engineer, U. S. Department of Labor, Division of Labor Standards, Washington, D. C.

Silicosis is strictly an occupational disease. Medical science has not reported silica dust as affecting any individuals except those who, over relatively long periods of time, have worked in an atmosphere where the air which they breathe contained excessive concentrations of free silica.

The interest of the U. S. Department of Labor in a broad social and economic problem such as this has its origin in the Organic Act, effective March 4, 1913, which created the Department. This act, among other things, gives the Department of Labor the duty "to foster, promote, and develop the welfare of the wage earners of the United States, to improve their working conditions, and to advance their opportunities for profitable employment."

With this in mind, and believing that through joint effort of all concerned, much could be done to eliminate the hazard, the Secretary of Labor called together in Wash-

ington on February 26, 1936 a group of about 75 men representing leaders in industries having a silica problem, labor leaders, and outstanding representatives of the medical, legal, and engineering professions, as well as insurance carriers and State administrators.

After considering various phases of the silicosis problem, this group generally agreed that through a pooling of knowledge and a frank discussion through the conference method important advances could be made toward, first, overcoming the hysterical attitude on the part of employers, labor, and others; second, after careful investigation, to consolidate in one place all known data with regard to the preventive engineering methods; third, analysis and recommendations in connection with adequate standards of compensation for those workers disabled as a result of the disease.

As an outgrowth of this initial meeting, another group, similar in composition to the first conference, but expanded to include some 200 individuals, was invited to come to Washington on April 14, 1936 to outline ways and means of attacking the problem. After hearing silicosis discussed from the standpoint of the employer, labor, and the medical profession, by outstanding experts in the field, this large group endorsed the conference method as proposed, and as a result four main working committees were appointed by the Secretary of Labor with the advice and consent of the group to investigate and report upon the outstanding phases of the silicosis problem. These committees were:

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

A fifth committee, known as the Correlating Committee, was named. It was under the chairmanship of W. H. Cameron, Managing Director of the National Safety Council, and consisted of the chairman of the four technical committees just mentioned and two advisors, one on labor problems and one on mining matters.

These committee members served without compensation and gave freely of their time and effort in studying the problem from their respective viewpoints. After nine months of careful and searching study, these committees advised the Secretary of Labor that they were ready to report. Consequently, on February 3, 1937 the Second National Silicosis Conference was called in Washington. At this time summary committee reports were presented to the Secretary and considerable discussion was given them.

Shortly after this second national conference the Department published, as Bulletin No. 13 of the Division of Labor Standards, the summary reports of the four committees referred to above, together with an abstract version containing the principal findings and recommendations written in non-technical language.

The full reports of the committees, comprising several thousand typewritten pages, are now being edited and will go to the printer very shortly. It is expected that they will be issued in four separate volumes sometime during the fall or early winter.

Nature and Extent of Silicosis

Physicians generally agree that silicosis, in the layman's language, is a disease of the lungs, caused by breathing air containing silica dust, in which the normal lung tissue is replaced by fibrous or scar tissue.

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

Of the 49,000,000 workers in the United States, only 1,000,000, or 2 per cent, it is estimated, are in any way exposed to the hazard of silicosis. About half of this number, or 1 per cent of the total number of workers in the country, are exposed to a serious hazard, and approximately 110,000 of these have silicosis in some degree. Medical examination of men actually at work indicates that between 4,000 and 5,000 workers are seriously affected by the disease, in addition to

those already permanently detached from their employment by reason of disabling silicosis.

The status of the 1,000,000 workers exposed to the hazard of silicosis was analyzed thus by the committees making the survey:

A percentage of the 4,000 to 5,000 workers having silicosis are completely or partially disabled because of this disease and have their difficulties further complicated with tuberculosis.

The remainder of the 4,000 to 5,000 have silicosis and disability in some degree, but no tuberculosis.

Approximately 105,000 have silicosis, but no disability and no tuberculosis.

Approximately 900,000 are exposed to silica dust, but have not contracted the disease.

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

Silicosis Prevention

Silicosis can be prevented in three general ways: First, by preventing the creation of silica dust; second, by preventing the dispersion of dust into the atmosphere of a working area; and third, if it is impossible to apply the first two methods, by the use of personal protective equipment such as respirators, to prevent the inhalation of the dust.

In carrying out a prevention program, many agencies must cooperate. In the view of the committees studying the problem, the employer is called on to do most of the work and to spend most of the money. But his work and money will never accomplish the maximum results unless the worker is willing to cooperate and carry his share of the responsibility for helping to control dust and for using the personal protective equipment.

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

The reports of the conference committee on engineering control and medical control recommend specific procedures for attacking the problem through those two avenues of prevention. A partial list of these recommendations follows:

Survey the working conditions to determine the severity of the hazard and indicate what needs to be done to decrease it.

Secure information on best procedure.
Design plant for dust control.
Provide building ventilation.
Store dusty materials in dusttight bins.
Enclose material-handling equipment.
Isolate dusty processes.
Provide wet methods of operation.—

Water, oil, and other liquids may be used effectively—

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

2. To prevent the redispersion of dust that has settled on the floors, walls, and other surfaces such as in the granite industry and in foundries.

Design equipment to control dust.
Establish good maintenance and housekeeping procedure.
Provide respirators.
Instruct the workers.

Responsibility of Workers

The cooperation of the workers is necessary if the hazard of silicosis is to be reduced to the minimum. The worker should realize that the safe practices recommended and the equipment provided are designed to prevent injury to himself and to his fellow employees. The equipment should be used as directed and every effort should be made to maintain it in good working order. Furthermore, the worker is frequently in a position to observe faulty equipment and unsafe practices, and he should make it a point to report all such conditions to his supervisor.

Statutory Regulation

While the primary approach to the problem must be the prevention and diminution

of the hazard, the fact must be recognized that until silicosis has been wiped out, workers who now have the disease, as well as those who may contract it, must receive workmen's compensation just as do those workers who are injured in accidents.

Accordingly, the committees of the silicosis conference were unanimous in presenting the following recommendations:

Coverage for silicosis in the compensation acts of all States.

This coverage should be compulsory.

Because of competition between the same or similar industries in various States, the laws, rules, and regulations of the several States should be as uniform as practicable.

Should Be Insured

The employer should insure his obligation for compensation either through self-insurance subject to the posting of adequate funds, or with an authorized insurance institution.

Insurance should not be denied any employer, provided the State authorities certify that he complies with the State requirements as to proper safe working conditions, and pays the premiums involved.

Workers having active pulmonary tuberculosis and silicosis should be removed from employment. Such workers should be granted suitable compensation payments and medical care.

Workers disabled from silicosis (but with no tuberculosis) should ultimately be granted the same amount of compensation as those disabled by accidental injury.

Two years is a reasonable minimum limitation period for filing claims subsequent to the date of the last exposure.

Further Activities of the Department of Labor

In carrying out its duty as stated in the basic law, the U. S. Department of Labor has conceived that there is immediate need for the conversion of known facts in the medical and engineering fields working toward prevention, and in the legal, insurance and regulatory phases looking toward adequate workmen's compensation, into a practical, readily understood program which will adequately take care of the silicosis problem.

In its program of cooperation with the 48 States, the Department of Labor has included a section covering silicosis and similar dust diseases. This breaks down into three main sub-headings: (1) Assistance in the preparation of reasonable and adequate codes, rules, and regulations prescribing methods of prevention; (2) assistance in the establishment of equitable standards of workmen's compensation for those employees disabled as a result of the disease; (3) a general educational program among State officials, factory inspectors, etc. so that they will be equipped with adequate knowledge concerning the disease, its method of prevention, and its proper treatment under the workmen's compensation law.

Follows Two Lines

This application program, which is just now getting under way has been commenced along two principal lines: (1) The compiling of practical information concerning actual dust control installations in typical silica hazardous plants, together with approximations as to cost, not only of installation, but also of maintenance of dust control equipment in such plants; (2) a program of visual education supplementing the summary and full committee reports of the National Silicosis Conference. It is contemplated that in this field such media as film strips, lantern slides, posters, illustrated bulletins, etc. will be utilized. Further, in connection with the various exhibits of the department, shown at various large expositions, trade association meetings, labor and technical organization meetings, etc., it is contemplated that much factual information will be used, pointing toward ways and means of correcting the hazard and of establishing adequate standards of workmen's compensation.

Following the address by Mr. Starr a round table discussion of outstanding hazards in quarry operation took place. This concluded the Wednesday program.

Steam Railroad Meeting

WEDNESDAY AFTERNOON SESSION

October 13, 1937

The session was called to order by W. W. Wood, Baltimore and Ohio Railroad, Baltimore, Md., who presided, introducing the speakers and directing the discussion.

The Past, Present and Future of Railroad Safety

By J. M. SYMES

Vice President, Operations and Maintenance Department, Association of American Railroads, Washington, D. C.

No industry in the world requires more diversified study and more exacting application of safety principles than the steam railroad industry. Picture a quarter of a million miles of railroad line covering in a virtual network the vast expanse of the United States. Over this network are operated a billion train miles annually. Vast yard and terminal operations are necessary to make up the beginning of the journey of passengers and goods, and to break up at the end of that journey the 12 million trains that accumulate that billion miles. These trains carry 500 million passengers and one billion tons of freight annually. It requires more than one million railroad employees to run the trains, make them ready for road movement, supervise and safeguard their movement and maintain the equipment and roadbed, as well as perform the many other duties incidental to the production of railroad transportation.

Safety has in the past, is today, and always will be the first principle in railroad operations. But it is within the past fifteen years that greatest advances have been made in railroad safety. During that period we have seen a complete remodeling and modernization of railroad physical properties. Roadbeds have been strengthened; bridges, trestles and culverts rebuilt; tracks have been laid with heavier rail and with treated ties of greater service life and dependability; grades and curves have been eliminated or reduced; signal systems have been modernized and extended; other safety devices have been installed; new and more powerful locomotives, embracing all modern safety devices, have been purchased; new cars, both freight and passenger, have been installed. This capital improvement program has cost the railroads about eight billion dollars since 1923, and a large part, if not all, of that huge sum had a beneficial effect, directly or indirectly, on the safety of operations.

But the engineer's job is never done. As soon as new equipment, new rail, or other devices are installed the engineers go to work to develop more efficient and safer units. The railroads spend millions of dollars annually in research and laboratory work experimenting with engineering improvements. In all this work safety is of primary importance. An invention which might mean great economies to the railroads would not find its way to a single locomotive or car if its use in any way lessened the opportunity for safe operation. Conversely, any improvement, mechanical or otherwise, promoting safety of operation immediately commends itself to railroad officers and employees. The search for greater safety will continue so long as railroad transportation is used.

About a quarter of a century ago, the

THURSDAY AFTERNOON SESSION

October 14, 1937

Safety, An Executive Operating Problem

By R. C. WHITE

Assistant General Manager, Missouri Pacific R. R., St. Louis, Mo.

Safety is an obligation of management. Without the constructive leadership and day-to-day urge from the executive and operating heads, the movement would lapse into a perfuntory activity.

The safety movement is recognized by executive and operating officers as a medium for building up and maintaining that relationship, that fellowship, which broadens our views, enriches character, and brings the Golden Rule into practical application.

Management recognizes that our economic system must enable men to live on an increasingly high plane. It must enable them to fulfill their desires and satisfy their reasonable wants, and give them that feeling of security which is essential to happiness and efficiency.

Having made the decision that safety is an executive problem and responsibility—that accidents must stop—it is then essential that management promulgate, and follow through, a plan that will definitely fix this decision in the minds of all the individuals who collectively comprise the industry. The follow through must be such that department heads, superintendents, and every member of the supervisory force will appreciate the need for a constant, active interest in safety; will understand that passive interest will no more produce results than would the same interest in production. Supervisors must be made to feel that the prevention of accidents demands the same type of heads-up supervision that is given to the other problems affecting cost and service.

The executive must find a way to indicate directly that it is the responsibility of the department heads to carry out management's program, that authority is placed in each superintendent's hands to put accident prevention on the same basis as production.

A complete factual and descriptive report of each accident must be made. This must be followed by a thorough analysis to find the direct and underlying causes and the procedure necessary to prevent a recurrence.

Proof of its sincerity will depend primarily on whether management will make the first essential move in the program—that is, authorize the expenditure of money necessary to make the maintenance and operating plant a safe place to work.

Safety and Efficiency

Analysis of the underlying causes of industrial accidents and preventive measures to be applied has made it increasingly apparent that those factors which are producing accidents are very largely the same factors which tend to lower the quantity and quality of production. Expressed in another way, safety and efficiency are as inseparable as though one word.

In coupling safety with efficiency I have not minimized it as an executive problem, but have endeavored to indicate that its solution is an executive responsibility, both to his individual industry and to the employees that make it a going concern.

Rail transportation is a scientific business in which laboratory research, expert engineering, trained builders, and skilled workers share a part.

One of the main factors is a group of employees who are loyal—who appreciate that their railroad must give the kind of service that will stimulate and accelerate the development of the territory traversed.

The successful solution of our problem demands the type of aggressive individualism in executive leadership that will attract and command loyal, collective, cooperative effort on the part of all who produce rail transportation.

Our major concern is leadership—leader-

TRANSACTIONS

SILVER *Jubilee* SAFETY CONGRESS

CHICAGO
OCTOBER 10-14
1938

NATIONAL SAFETY COUNCIL, INC.

Foreword

THE Transactions of the Silver Jubilee Congress and Exposition of the National Safety Council, October 10-14, 1938, are published in two volumes. Volume I contains the general and subject sessions and the sessions of the various Industrial Sections. Volume II contains the Street and Highway Traffic, the Commercial Vehicle, the Transit, the Child Education, and the Home Safety sessions.

Volume I is distributed automatically to all industrial members of the Council. Volume II is sent to members who are believed to be interested chiefly in the sessions it contains. However, other Council members may obtain Volume II upon request.

Many members have found it of benefit to distribute copies of the Transactions volumes to both executives, foremen and supervisors, who have used the practical information they contain in safety programs and for general reference purposes. Extra copies of the Transactions may be obtained as follows: One to 10 copies of Vol. I, at $2 each; 11 or more copies, $1.75 each. Extra copies of Vol. II cost 75 cents each.

THE Transactions are a condensed record of the proceedings of the Silver Jubilee Congress. The papers and addresses have been edited to delete extraneous matter, abbreviate the less important portions, and emphasize what may be of particular usefulness and value in promoting effective safety organization and other accident prevention measures. These volumes, therefore, are a somewhat abridged version, compact, practical and of particular value to the student and executive interested in achieving more thorough accident prevention success. The original manuscripts are available for additional reference, if desired, in the files of the National Safety Council.

THE National Safety Council, at its Congresses, seeks to eliminate from discussion matters which are not pertinent to the aims of the Congress or which may be contrary to the Council's policies. It cannot accept responsibility, however, for all views expressed either in the papers which have been delivered or in the discussions based upon these papers.

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20 North Wacker Drive
Chicago

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S. E. Whiting, Liberty Mutual Insurance Company
A. W. Whitney, National Conservation Bureau
Charles E. Wilson, General Motors Corporation
F. B. Winslow, Safety Div., Birmingham Chamber of Commerce
W. E. Worth, International Harvester Company
Arthur H. Young, Past President
E. J. Zauft, Safety Bureau, Duluth Chamber of Commerce

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Occupational Disease

THURSDAY MORNING SESSION

October 13, 1938

The session for the discussion of outstanding problems in the field of occupational disease was called to order by the Hon. P. J. Angsten, Chairman, the Illinois Industrial Commission, Chicago, who presided. The Chairman emphasized the importance of the selected subjects to be presented by eminent speakers, and promptly introduced the first scheduled speaker.

The Trend of Occupational Disease Legislation

By HENRY D. SAYER

Manager of the Casualty Department, Association of Casualty and Surety Executives

Let us consider the differences between the accidental injury and the occupational disease. For these distinctions are important and must constantly be borne in mind when we consider either legislation on the subject of disease, or engineering methods of prevention or control.

Generally speaking, accidents occur at a specific moment in point of time, and, from the standpoint of fixing liability under any policy of insurance, it is in the future; that is to say, at the moment of the acceptance of liability under any insurance contract the accident for which liability may be assumed has not yet happened. That frequently is not so with the occupational disease. Insurance by its very nature can only assume liabilities that have yet to arise—not those that have already accrued.

Again, speaking generally, the industrial accident is something that can be seen—even though unforeseen. It may be visualized and described in words, setting forth specifically the time, place and manner of happening. It can then be determined, after the happening of the event, whether it was preventable or inevitable; blame, if any, can be assessed; the worker involved, or his foreman or superintendent, can be shown the fault, and effective measures can be taken to guard against a like future happening.

But some will say, truly, not all accidents happen in the manner described; that not always are they held to occur only at a specific moment or under circumstances where they can be visualized and described. By administrative and court decisions, it is true in some jurisdictions that the definition of "accident" has been greatly broadened. We find the entrance of disease germs into the human system without visible trauma, with resulting sickness or death, and even the specific time and place not definitely known, except that it is shown to have probably occurred in the employment, being held to be an accident.

(Hiers vs. Hull, 178 App. Div. 350, 164 N.Y. 767, an anthrax case; Vennen vs. New Dell Lumber Co., 161 Wis. 370, a typhoid case; and others.)

Poisoning of the body through the effects of a deleterious or toxic substance used in the employment, the dangers of which were unknown to the worker, the employer having been negligent in safeguarding properly the use of such substance, has been held to be the result of an industrial accident.

(Victory Sparkler & Specialty Co. vs. Francks, 147 Maryland, 368; and the very recent case of Black vs. Creston Auto Co., Iowa Supreme Court, August 5, 1938, 281, N.W. 189.)

And where negligence of the employer has been shown, an injury to health, even though not occurring through a happening at a given time and place, but by repeated

sures over months of time, has been to be an accident.

(Neely vs. Carolina Asbestos Co., 206, North Carolina 568, an asbestosis case.)

ese and other cases I might cite are exceptions and not the general rule what constitutes an accidental injury. ink we may fairly assume that the ts of administrators of the law and courts have been directly inspired by belief in the necessity of finding a ly for an industrial ill for which no remedy had been provided by specific age of the statute. May we consider as straws in the wind, showing a l toward industrial disease liability? ay observed that the tendency of the ts is to construe the term "accident" more limited manner in those states e there is specific provision in the law ring occupational diseases. Thus, we clear instances of what has been d "judicial legislation," that is, the s broadening the meaning of the law over situations not clearly included n the terms of the law by the duly con- ed legislative authorities.

t us now consider what we mean or in- by the term "occupational disease." we find a more difficult field—difficult the standpoint of administration and al interpretation; and difficult from tandpoint of the doctor and the en- .

at is disease? We think we know, and st to laymen the term conjures up minds something of a rather defi- ture. When we pause to consider it, rse, infinite qualifications of the term to us, and we are confronted with conditions that fall into the zone of -such as, for example, whether her- a disease. At any rate, we say it is ormal condition, and let it go at

when we come to add to the doubt- n "disease" the even more indefinite ccupational" or "industrial," we find es in an area of highlight sur- l by a vast and increasing zone of shading off into Erebian night. w then shall we define the term tional disease"?

diseases stand out in our minds as nd definitely occupational. As to have no great difficulty, either legislatively or administratively. These include the well-known metallic and chemical poisons that are so definite and characteristic a part of some industrial processes. Were the diseases arising from the use of these substances the only occupational diseases with which we need concern ourselves, the legislative difficulty would be largely removed, and we could safely entrust the problem to the doctor and the engineer.

But we have seen that the legislative problem is not so simple. Nor is it simple administratively. We find ourselves floundering in a veritable morass, either because of the inherent difficulties of the situation, or because we have not or cannot agree on our objective. If all parties would recognize the difficulties and the limitations on what industry can do, or can fairly be expected to do, we could much more confidently face the future. If we could agree that provision for "occupational diseases" is not synonymous with general health and life insurance for industrial workers at industry's expense, then I am sure we could get somewhere very definitely.

But has there not been too much loose thinking on the subject? We are met with a curious situation. We find the advocates of so-called "all-inclusive" statutory coverage deliberately seeking indefiniteness. This is unlike them, for when they know what their objective is, and are willing to disclose it, they have not refrained from pressing their advantage with definite and specific purpose, and with exact language to accomplish that purpose. That, at any rate, is correct legislative procedure.

But in this field, even where the liability of the employer is made inescapable, the constant suggestion is put forth that it is futile for the legislature to attempt a definition or delimitation of occupational diseases, and, therefore, words of the most general character should be employed, leaving to the courts the interpretation of the law as they see fit. I submit that it is not the function of the courts to make up the legislative mind; that is the function and the right and the duty of the legislature. Nor should the legislature seek to avoid and evade responsibility by transferring to courts and commissions the determination of questions of liability which the legislature finds too difficult for it to determine for itself.

To effect coverage under the compensation law, therefore, by any such general and vague language as the term "any and all occupational diseases," or by adding to the definition of "accidental injury" the phrase "and shall include occupational diseases," is to create an uncertain liability—one that may require endless and perhaps disappointing litigation—before the meaning of the law is established; and will most certainly be a disservice to workers and employers.

An excellent rule—a cardinal rule—in statutory drafting, is to use words of definite, certain and understandable meaning, used in their common acceptance, rather than to resort to vague, uncertain and meaningless words, or words the meaning of which may have the effect of distorting the objective that is sought. Controversy is bred by uncertainty of language, and controversy leads to litigation in courts. Litigation is expensive for all parties; it causes delay; and it frequently causes bitter disappointment. It breeds rancor. It may even breed disrespect for the law and for orderly process of government.

Why then should there be this continuing demand for the all-inclusive coverage? Is it with the vague hope that satisfaction may result in some cases of misfortune to workers who fall victims of the disease that besets us all and lurks in waiting for us in our play, in our homes, yes, and even in our sleep, as well as in our employment? Perhaps not—yet if that were the design, a more simple way of succeeding in it could not otherwise be contrived.

Are we to understand that *any* disease of the most common and ordinary risk of life may become an occupational disease if its source or supposed source had its origin in an incident of the employment or a condition there present, or if claim was made that a pre-existing disease had been aggravated by such condition? That is a large order. It would mean that industry would become liable for any ordinary disease of life, provided that disease could be, with a show of plausibility, related to a condition or incident of the employment. Such diseases are almost too numerous to enumerate.

But we know that claims have been made for tuberculosis and heart disease, the two most numerous diseases and the cause of more deaths than any two other diseases. Add to these pneumonia, asthma, arthritis, rheumatism, and a host of others; and we discern in this the beginning of a system of health insurance of the most costly type—a system moreover that would discriminate bitterly against the many millions who contract such diseases in perhaps actually the same way, but who have no employment at all against which to assess liability. Should not the man who falls victim to a disease of ordinary life while searching for a job be just as much the concern of the state as the man who becomes disabled from the same disease and who is so fortunate as to have a job?

Let us be realistic about this thing called health!

Ill health is a deviation from the normal. But what is "normal?" How great a deviation is abnormal? Disease is of many and varying degrees. To what extent does the mind affect the working status? Or what part in the situation is played by "will power"? These are not fanciful questions, they are encountered and will obtrude themselves continually in determination of compensation for disease where we depart from the known and characteristic occupational diseases.

From these remarks perhaps some will say we are opposed to coverage of occupational diseases under compensation laws. Not so! The stock casualty companies represented in the Association have not opposed and do not oppose the principle of compensation for occupational diseases, if thereby is meant compensation for those diseases that arise from a "trade risk," or from conditions that are normally and usually present in the particular employment, as distinguished from those ordinary human ills that beset all of us. Our view of it is that the policy of coverage under the law is a matter of local concern, to be determined by local legislatures in the light of local demand and with due regard to local opinion of both labor and industry.

No employer in this age can reasonably object to fair compensation for disease arising from such occupational risks, any more than he can object to reasonable compensation for disabilities due to accidental injuries.

This conception of industry's obligation is, however, quite different from the conception of a public obligation to care for

ıd compensate for all sickness and death ıder a form of health and life insurance. he latter obligation, if it be a valid one, the obligation of the state and the nation ıot the obligation of industry alone.

The reasonable, the intelligent, the sane ay for industry to discharge its obligation its workers for conditions of health is provide for the greatest reasonable re- ırements for industrial hygiene, and to ovide compensation only for those con- tions that arise from specific named dis- ses that are truly occupational, charac- istic of, and peculiar to the processes in ich the worker is engaged.

ıdustry will, I am sure, meet the chal- ge of the occupational disease problem, it is presented under a law that pre- ıbes the liability of industry in under- ındable terms. In the early days, the ıeral rule was to include occupational seases in the compensation law by specify- the particular diseases or the particu- conditions leading to diseases that are ıed to be occupational and compensable. is we call a "schedule" law. It is the ın in which compensation for occupa- ıal diseases is covered in all of the ıntries of Europe and of South Amer-

It is so simple; it is so sensible; it is easily administered, that the wonder is t the acceptance of the principle is not versal.

f we will keep ever before us the prin- e that a disease, to be deemed occupa- a', must be "characteristic of and pe- ır to" the occupation, there should be great difficulty in arriving at a proper ıtory setup for the coverage of all true pational diseases. Metallic poisonings characteristic of occupations in which metals are used. The diseases charac- ic of chemicals, of acids, of alkalies, s and fumes, are characteristic of and iar to those occupations in which the oyees are so exposed. The diseases of espiratory system, due to the inhala- of dusts, are the natural accompani- and the characteristic effect of work h dusts.

en such clear and specific language is ble, why should we be asked to use , broad terms, the use of which may tute the giving of a blank check by ry? If the purpose is not to charge ry with diseases which are not char- acteristically the obligation of industry, why continually insist upon the use of language which is susceptible of misinterpretation? Be well assured, if legislatures do not perform their duty and lay down clear definitions of liability, industrial boards and commissions cannot in the presence of the widows, orphans, and industrial cripples, be expected to exercise greater courage than the legislatures. The law in the hands of such an administrative body will be scanned, and I fear scanned in vain, for limiting words or language to stay the hand of industry's self-constituted almoner.

The legislative trend, I am happy to report, in recent years has been toward the definite, rather than the indefinite. Despite tremendous pressure, no legislature has, in the past three years, adopted a blind, "all-inclusive" occupational disease law, except New York, of which I shall speak more in detail presently. Michigan, Rhode Island, Pennsylvania, Delaware, North Carolina, and Washington, among the states most recently enacting occupational diseases laws, have adopted the "schedule" or specific method of coverage. Two years ago, Ohio amended its scheduled occupational disease law by adding dust diseases to its existing schedule. In two other states, namely, Illinois and Indiana, occupational disease laws have been enacted in general terms. However, in identical language, these two states have undertaken to limit and define occupational diseases and have attempted therein to safeguard industry against liability for the diseases of ordinary life.

Although doubtless familiar to many, the definition in the laws of those two states will bear repetition, as indicating the extreme of difficulty in attempting to exactly define an occupational disease.

"Sec. 6. In this Act the term 'Occupational Disease' means a disease arising out of and in the course of the employment. Ordinary diseases of life to which the general public is exposed outside of the employment shall not be compensable, except where the said diseases follow as an incident of an occupational disease as defined in this section.

"A disease shall be deemed to arise out of the employment, only if there is apparent to the rational mind upon consideration of all the circumstances, a direct causal connection between the conditions under which

the work is performed and the occupational disease, and which can be seen to have followed as a natural incident of the work as a result of the exposure occasioned by the nature of the employment and which can be fairly traced to the employment as the proximate cause, and which does not come from a hazard to which workmen would have been equally exposed outside of the employment. The disease must be incidental to the character of the business and not independent of the relation of employer and employee. The disease need not to have been foreseen or expected but after its contraction it must appear to have had its origin in a risk connected with the employment and to have flowed from that source as a rational consequence."

Under this definition no industrial manager can, with any assurance, be informed what his obligation is to his workman, and assuredly no workman suffering from disease can surely know whether he is entitled to compensation under that law. Of course, as is to be expected, litigation over the interpretation of this definition is already in progress in both of these states. And situations will arise constantly in the future where the facts will be such that only litigation in the courts will determine the liability of industry, or the right of the worker to be compensated.

The claims actually filed with the Industrial Commission of Illinois already include undulant fever (a disease said to be commonly communicated by milk and meat products), tularemia, rheumatic fever, arthritis, rheumatic heart, heart disease, amebic dysentery, varicose veins, flat feet, athlete's foot, cerebral hemorrhage alleged to be due to overwork, syringomyelia, and nerve disorder. I have not mentioned the claims for characteristic occupational diseases, such as silicosis, carbon monoxide poisoning, and the various other toxic conditions which clearly come under the Act.

I have referred to the fact that New York, alone, has in recent years enacted a law covering occupational diseases in general terms. New York was the first state, I believe, to enact an outright compensation law for occupational diseases. It did so in 1920. The law was a schedule type law. (It so happens that I had the privilege of being one of those who collaborated in the drafting of that law.) We were dealing with a new subject. We examined the existing laws in other countries and adopted the form that seemed best adapted to our conditions, namely, the English law on occupational diseases. The schedule was, from time to time, enlarged as new industrial processes developed new diseases. By 1929, the schedule had been enlarged to include every disease that was a potential hazard to the workers in New York State, with the single exception of the dust diseases of the lungs. In order surely and certainly to bring such conditions within the purview of the law, there was enacted an additional item in the schedule, reading "any and all occupational diseases." The schedule was not repealed, and the administrative provisions in the law with respect to the schedule were continued. One of the first questions that arose under this new law was whether the new classification superseded the schedule and the limitations set forth therein, or whether it was an addition to the schedule and applied only to those conditions not previously included therein.

The legislature, having evaded the duty of defining the term "occupational disease," the Industrial Board, which administers the law, adopted a definition. That definition is well worth repeating: that the Board deems a disease to be occupational only when it is "characteristic of and peculiar to the trade, employment, or occupation" in which a worker was engaged. This definition was adopted almost verbatim in the Rhode Island and Michigan Laws. The Appellate Division of the Supreme Court, however, declined to follow it, and by a vote of three to two, held that *any* disease that arises out of a condition incidental to the employment must be deemed to be an occupational disease.

(Bishop vs. Comer & Pollock, 251 Appellate Division, 492; Goldberg vs. 954 Marcy Corporation, 251 Appellate Division, 904.)

The Goldberg case was appealed to the Court of Appeals—the court of last resort in New York. So completely do the facts in the Goldberg case bear out what I have said about indefinite liabilities under an all-inclusive law, that they will bear repetition. Shirley Goldberg was employed to sell tickets in a moving picture theater. Her booth was on the sidewalk. It was kept heated, in cold weather, by a small electric heater, operated from [illegible]

ooth. She contracted what she described s blotches or a rash on her legs. The lotches or rash she claimed were due to he alternate heating and chilling of her gs when she switched on or off the heater. hey did not constitute a disability. How-ver, on complaint to her employer, she was ld to see her doctor. While on her way o see her doctor, on her own time, she ipped on the sidewalk and fell, fracturing n ankle. Although the day was cold and e testified there was ice and snow on the lewalk, the claimant alleged that she fell dely due to weakness resulting from ese blotches, and the Industrial Board found; and found that the cause of the ll was an occupational disease, character-tic of and peculiar to her employment.

The Court of Appeals, in an opinion that ristles with logic and sound sense, struck is free-for-all system from the language the New York Act. They unanimously fused to concede that this was an occu-ational disease. To make every disease at arose out of and in the course of em-loyment compensable as an occupational isease, they said, would be to make the mpensation law "the equivalent of life d health insurance." The court further id that to be "occupational," the disease ust be one which "results from the na-re of the employment"; and that by na-re of the employment is meant—conditions which all employees of a class are subject d which attach to the occupation—"a zard which distinguishes it from the usual n of occupations, and is in excess of the zard attending employment in general."

Goldberg vs. 934 Marcy Corporation, decided anuary 11, 1938, and reported in 276, N. Y. 13 12 N.E. 2nd. 311.)

Thus, after more than two years of at uncertainty as to the meaning of the , the Court of Appeals has eliminated m the New York Statute the diseases ordinary life which are only incidental speculatively related to the occupation.

ust a word about hernia as an occupa-al disease. Never heretofore regarded an occupational disease, but quite gen-ly recognized under certain circum-ces as an accidental injury—the Occu-onal Disease Law of Michigan, enacted year, specifically included hernia in schedule of diseases. Not all herniae, ever, are so included, but only those dy of recent origin, as to which dis-ability follows immediately, and in which prompt report to the employer is made. This is not far different from the rule in regard to hernia as an accident. But in New York, during the past year, it has become somewhat the fashion to regard almost every hernia as either an accident or an occupational disease.

This followed on a decision of the Court of Appeals, sustaining an award for hernia as an occupational disease wherein the Industrial Board specifically found that no accident had occurred. In the case presented, the worker was required, in the course of his employment, at frequent intervals, to rotate his body on the hips. This man was employed in a glass factory. He gathered molten glass on the end of a punny, which he, in turn, swung about and placed in a mold. The weight was not excessive, being only a matter of a few pounds. In affirming this award, the Court of Appeals said:

"The finding, supported by evidence, is that the continuous gathering and lifting of glass from a furnace involved a constant twisting and straining of the body. This process, from gradual stretching, resulted in a hernia which is a disease (Matter of Alpert vs. Powers 223 N. Y. 97, 101.) There is medical testimony that claimant's occupation would produce this disease and there are judicial decisions in other jurisdictions holding that hernia is an occupational disease (Marathon Paper Mills Co. vs. Ind. Comm. 203 Wis. 17; Travelers Ins. Co. vs. Locke 56 Fed. (2nd) 443, 444)."

(Foster vs. Gillender Brothers Inc., 278 N. Y. 348 16 N. E. 2nd 360.)

Perhaps the most controversial question involved in occupational disease legislation is the treatment of liabilities for dust diseases of the lungs. In no class of cases is the marked difference between accidents arising at a given time and place and occupational diseases more pronounced. In this category of cases, we find silicosis, anthraco-silicosis, and asbestosis, all of them forms of pneumonoconiosis. While these diseases in some of their forms are among the most ancient, their ravages having been recognized generations ago, little has been known until recent years of their causation, of their pathology, and of their complications with other diseases. A vast fund of knowledge of these diseases has been gathered in the past ten years, and intensive

studies of their etiology and pathology are still going forward.

One fact stands out clearly, and that is, that these diseases do not progress to the point of disability until after many years of exposure to dust. The length of time, varying from five to twenty-five or more years, is dependent in large measure upon the concentration of dust, the composition of the dust, the time actually exposed during working hours, and the individual susceptibility or resistance of the worker. Another fact that stands out is that the fibrosis of the lungs, once acquired, is permanent and incurable, and, in uncomplicated cases is not susceptible to medical treatment.

Many thousands of workers today, under no law but the common law, have been employed in employments exposing them to more or less heavy concentrations of dust for many years. In the event of the enactment of an occupational disease law including those diseases, industry will find itself, at the stroke of a pen, liable for conditions already acquired through long years of employment, and which may become disabling at any moment. In this situation, the best guaranty against disablement is continuous and steady employment. Many a man, actually able to work and earn good wages, while he has a job, will be able to demonstrate by x-ray and clinical examination the presence of a marked degree of silicosis, when his job stops because of depression or otherwise.

Hence arises the question of the so-called "accrued liabilities." This term which has come into common use is perhaps not an exact term, in that "liability" does not occur until disablement, and the liability is only "accrued" at that time. What we have in mind when we discuss accrued liabilities is the condition of fibrosis of the lungs which has accrued and has been acquired over a period of years. This condition, being permanent, remains with the worker, whatever and wherever may be his employment. Perhaps a more exact expression would be "potential liabilities," and yet they are more than potential; the condition giving rise to them is actually existent.

Industry tells us quite truly that it cannot now pay full compensation out of current income to all of the men employed in industry who may have in the past incurred some degree of fibrosis of the lungs. But if industry cannot assume these liabilities, how much less justification is there to call upon insurance, out of the premiums of next year, to pay for disablements acquired over the past fifteen years, and for which it received no premium?

In this difficult situation, it has been found necessary in many states, if employment is to be continuous and uninterrupted, and if men are eventually to be compensated for the fibrosis acquired due to future exposures, to absolve, to a great extent, industry from the obligation of compensation for past exposures, and to base compensation upon the extent of exposure after the enactment of an occupational disease law. Thus, there has come into acceptance in several states the principle of graduated compensation benefits for dust diseases, limited to future exposures, and eliminating in large measure the exposures of the past.

Under this system compensation for disability or death occurring during the first month under the new law would be only a nominal amount (it has been set as low as $500 to start with). A person disabled during the second or third month after the enactment of an occupational disease law will have been exposed, to a small extent at least, under that law. The exposure is perhaps in itself insufficient to actually result in any harm. But the maximum benefits will be increased, month by month by small increments, until in the course of two or three years the full limit chargeable to industry in the particular state will have been reached. This system is not so complicated as it might seem.

The effect of it is rather to postpone the going into effect of a dust disease law for a matter of two or three years, and experience under this law has demonstrated that few claims arise where the compensation benefits are so limited, the workers preferring to stay at work as long as they can. It may be said that it works harshly in the case of the person who becomes really totally disabled in the early months of law. When measured by the liability with which the employer may fairly be charged, it does not, in fact, work a hardship, and when compared with the existing system in states not now under occu-

ational disease laws, it not only is not hardship but is, in fact, a great boon.

The principle of limited and graduated ability of the employer for dust diseases as been recognized by enactments in New ork, Michigan, Pennsylvania and Ohio. n unusual provision has been adopted in ie state of Washington, providing under ieir schedule form of law that the cost f compensation for occupational diseases iall be divided equally between the employer and his workers, and deductions iall be made from the employees' wages s contributions toward the insurance remiums involved.

But what, you may say, has all this to o with the safety engineer?

It has much. The safety engineer can o longer regard himself as doing his ob if he seeks only ways and means to iminate the industrial accident. The industrial hygienist must become the colleague f the industrial engineer. Medical science ust give intensive thought and study to etermining the effects upon the human stem of various industrial processes, and xposure to various materials therein. All xposures cannot be eliminated and still ive industry perform its functions. Most nportant, therefore, is the medical deterination of what are safe limits in exosures—the so-called "threshold limits." he engineer cries aloud today for expert edical guidance on this subject. Armed ith such medical opinion and advice, the sk of the engineer then is to devise pracical ways and means for attaining condions where such threshold limits apply.

Every industry presents a problem or ries of problems in itself. No two inistries are exactly alike. What is tolerle in one may be intolerable in another. hat is good practice in one industry ay be totally inapplicable for practical asons in another. The task of the enieer then is to find how right principles ay be made applicable.

Industry today, more than at any time its history, must bear the burden of sponsibility for the health as well as for e safety of the industrial worker, and if s health and his safety are adequately feguarded his happiness and the happiness those about him will be increased. Therere, it is of prime importance in the field safety that intensive and increasing interest must be given to industrial health.

The care for the health of the worker must not be confined to the guarding against those conditions that are mentioned specifically in the law. The engineer's responsibility is a broader responsibility than is the legal liability for compensation. There can be no doubt that the enumeration in the law of specific conditions for which liability is absolute will be of great advantage to the industrial engineer in seeking to enforce proper health standards. It is far easier for him to obtain approval of his recommendations, if he can point out to management that the use of benzol or some benzol derivative is specifically mentioned, and point to the specific paragraph in the law that cites the liability of the employer for that condition. No argument is needed to convince management of its obligation in such a case.

The same is true with regard to all of the metallic poisonings and all of the other wide range of chemical exposures. Psychologically there is great power in the printed word, and even the most backward management may be made to respond when the clear mandate is set forth in the law. Not so easy will it be, under a general, vague, and all-inclusive occupational disease statute, to convince management that it has specific duties with regard to the elimination of health hazards. Thus, we see there is another and potent argument for the schedule law, rather than the all-inclusive law.

There is perhaps yet another and even more compelling reason for applying the rule of sanity and common justice to legislative mandate in the complex field of occupational disease. Shall employment be limited to those who are physically perfect? All humans are not examples of physical perfection, nor can we by legislative fiat reverse the laws of nature which immutably decree that we shall grow older with the passing years.

We have seen and discussed the dangers inherent in the all-inclusive theory of stretching the law to cover every sort and condition of disease, and to try to make them employment-related. When that stretching is complete, when administrators of the law find it easy and possible to burden industry with the responsibility of health insurance under the guise of an occupational disease statute what of those

who, wanting employment or seeking to retain it, are not physically perfect yet certainly are not disabled?

Much is heard today of the dread forty-year-line for employment. Whatever the facts may be as to that, is it not possible—if not probable—that industry, in desperation and against its desire, will be forced eventually to accept only those among whom the health hazards are least uncertain—the physically perfect, the young and the strong? We may well pause to consider the devastation such a situation would produce.

In the interest of all workers, the young and the old, the perfect and the imperfect, let us not embark upon legislative policies that can lead only to enlarging the field of unemployment, and to closing the door of industrial opportunity to those skilled and faithful workers who, having passed the meridian of life, are subject to those natural infirmities and ills of the flesh to which all men, in time, must bow.

Handicaps in the Diagnosis of Occupational Diseases

By CAREY P. McCORD, M.D.

Detroit, Mich.

It is a popular medical belief that occupational diseases are far more difficult to recognize and precisely to class as such than any other type of disease state. So firmly is this idea rooted in the minds of some physicians that they argue that occupational diseases never should be made compensable because of extraordinary diagnostic difficulties.

Lately, Kettering has said, "The doctors tell us there are certain diseases that are incurable. Do you know what an incurable disease is? It is one that the doctors don't know anything about. The disease has no objection to being cured at all."

This may be paraphrased by saying: There are no undiagnosable occupational diseases. The only ones that appear undiagnosable are the ones the physicians have not learned how to diagnose. No occupational disease has ever offered any resistance of its own to being diagnosed. The disease is perfectly willing to be diagnosed.

At least one-half of all occupational diseases are almost self-diagnosing, particularly when arising in groups; the remaining half present no greater difficulties than attend the diagnosis of some other classes of diseases. To maintain that occupational diseases are beyond the diagnostic skill of the physician is pure defeatism. With equal propriety, it might be suggested that all neurology be abandoned because the majority of conditions arising in this field may not be diagnosed with ease.

While it may be said that there are no undiagnosable occupational diseases, it must be recognized that many remain undiagnosed, or more often misdiagnosed. The prime reason for this is that the usual physician sees only small numbers of any one type of occupational disease. Taking Ohio as a typical industrial state, the total number of occupational diseases, compensable and otherwise, reported to the State Department of Health during the year 193[illegible] was 1,066. On the other hand, there are in this state 9,200 physicians. Thus, only one occupational disease arose for every 5.5 doctors in the state.

Here then is the foremost handicap to the recognition and diagnosis of occupational diseases and at the same time a back-handed compliment to industry. Industry, because of its prevention achievements, has so limited the number of occupational diseases that day by day the physician is ordinarily not spurred to the possibility that any worker who seeks his professional guidance may have a disease of occupational origin. Here, too, is the fundamental reason why more medical schools do not develop training departments in the field or organize special hospital services for the care of occupational disease patients.

While there are reasons for rejoicing that there are comparatively so few occupational diseases, we should recognize that there are specific situations which introduce diagnostic difficulties. A number of these are now presented, as separate entities.

Definition and Terminology

Much confusion is caused by lack of uniformity and clarity in definition. Scarcely any two states in their statutes accept the same definition of an occupational disease. In a few states, hernia is by law specified as an occupational disease. However, in the majority of states it is, when related to industry as a cause, classed as a traumatic injury. In a few states, the definition of an occupational disease provided by statute is such that certain items later appearing on the schedules themselves do not conform to the definition furnished.

Well meaning legislators might enact a law declaring that two and two make seven, but the mathematical facts still might remain otherwise. So with legislation involving occupational disease diagnosis, there may be demands for legal acceptance of certain conditions as occupational diseases, when elementary medical facts point otherwise. One group of physicians may reserve the term "injury" for exclusive use in connection with trauma, while another with propriety may assert that occupational diseases of many natures represent "injury" to the same extent implied by the term "traumatism."

Let us consider, for example, the occurrence of an accidental injury on the one hand and a clear-cut occurrence of an occupational disease on the other, both caused from one and the same substance, but under different circumstances. It might come about in a given factory that a workman entered a tank car, lately emptied of benzol, and in the absence of suitable protective and precautionary measures might, within ten minutes, become asphyxiated as a result of breathing benzol vapors. Manifestly, such an occurrence as this would be accepted as an accidental injury and no compensation board would ever raise a question that such was not the case.

On the other hand, this same benzol, as from this tank car, might be utilized in this same factory in some productive operation, giving rise to benzol vapors. Day after day, another workman might inhale some of these vapors. In due course, this workman's exposure might produce the usual and characteristic features of that occupational disease known as benzol poisoning. Here again it is most unlikely that any physician or compensation board would entertain any uncertainty that this condition represents a characteristic occupational disease.

Between these extremes, there is some point at which difficulties would arise in distinguishing occupational diseases from accidental injuries. This same situation applies to many other substances and many other occupational diseases. There is perhaps no warrant for any attempt at a hard and fast demarcation in terms of time, indicating where an accidental injury exposure leaves off and an occupational disease exposure begins.

However, there may be some justification for the practice of many physicians, who hold that if the exposure leading to damage is less than one work period, the ensuing injury should be recognized as an accident. Conversely, if the exposure period extends for more than one work period, then the resulting damage may with propriety be accepted as an occupational disease. In general, it may be claimed that one of the disturbing handicaps to uniformity, clarity, and precision in connection with occupational disease diagnoses stands in relation to awkward legal situations, inadequate definitions, unsuited classifications and such.

Fallacious Medical Histories

As a result of careful training, every physician is disposed to attach significance to the history statements given by a patient or members of his family with regard to any disease. The less a physician may know about the possible etiologic facts in any situation, the more consideration he is likely to give to history statements. It is human nature to associate all of our ills with some particular happening or series of happenings. A cold may be associated with a particular period of sitting in a draft. A gastro-intestinal upset is prone to be associated with some particular alcoholic bout or food engorgement.

In the case of industrial workers, there is an especial proneness to associate any bodily ailment with some aspect of work. Inasmuch as almost every workman hopes, openly or secretly, that any and all diseases from which he may suffer may be laid at the door of his employer, he is most likely to stress and emphasize the high probability that this condition unfailingly was produced by the chemicals, gases, vapors, dusts, etc. that attend his work oper-

ations. This does not necessarily represent dishonesty or cupidity on the part of the patient and only may involve those human frailties shared by all of us.

No less, the history statement may unduly influence the physician in his diagnosis, may lead to misdiagnosing, may pave the way for unwarranted claims or law suits without any evil intent on the part of the physician. It is most unfortunate that the physician is all too often unable to appraise the worth of work history statements provided by a patient. Let us, for the moment, assume that a specialist in ear diseases is visited by a patient on account of deafness. In connection with the history, the physician may record that this patient is a drop forge operator. The physician may go ahead and make many careful examinations, looking for the cause of the deafness, from infection, from syphilis, from heredity, etc. If, however, he had obtained a complete work history, and was in position to evaluate this work history, he might come at once to know that this drop forge operator is perhaps exposed to as much noise and concussion as ever arises in ordinary industrial work and that the deafness present clearly is an occupational disease, resulting from sustained noise exposure.

It may be asserted that well meaning physicians, without any evil intent, through their misunderstanding of patients' descriptions of work operations have become responsible for a high percentage of the large number of unwarranted suits that have flooded the country in recent years. In short, one of the handicaps to the proper diagnosis of occupational diseases is to be found in the attaching of undue significance to the patient's statements as to work conditions, when the physician himself is unable to appraise their reliability and merit. Some physicians need to make themselves more remote to the fallacy that just because a workman is employed in a dangerous trade, inevitably any ailment must necessarily be the result of work exposure. There still may be a few persons who may believe that lead poisoning may arise from work in making lead pencils.

Time as a Handicap in Diagnosis

Too often the physician well qualified in the field of occupational diseases, does not see the patient or claimant whose condition is to be appraised until long after that time within which the disease might have been diagnosed with precision. Without any purpose of condemning or finding fault, the fact must be faced that in many instances the decision of a patient to blame his ailment on work causes was not made within that period when some or all of the characteristic manifestations were present.

Then, at some later time, a physician qualified in occupational disease work may be called upon to examine the claimant or to reach a decision based upon the examination of inadequate records of another physician who himself did not carry out any examinations with particular reference to that occupational disease for which a claim later has been filed. This is asking too much of the diagnostic ability of any good physician.

On the witness stand, the charlatan always makes the better impression on a jury, because he is unhampered by the caution and reserve that guide the upright witness. Being positive is often merely a matter of being wrong in a loud voice. The point is that the time to make a diagnosis of an occupational disease is that period during which the disease exists. Otherwise, the most accomplished physician may be placed in an unfortunate position in the reaching of his decisions.

Insufficient Training and Experience

An outstanding drawback to the proper diagnosis of occupational diseases may be found in inadequate training in medical schools for this aspect of medical work. This is not a thrust at the doctor, nor may any complaint be made against medical education today. It may not be expected that medical schools will markedly enlarge an already over-crowded curriculum to provide extensive instructions with reference to occupational diseases when the number of cases yearly is so small as to provide only one for every five or six physicians. Realizing his own shortcomings in this field, a good general practitioner may honestly shun this type of work, but this step on his part may eventuate in even more undesirable situations.

The patient, instead of being referred to a better qualified physician in this field is given no advices, whereupon he grav-

ıtes toward an inferior physician, less con-rned with the lack of qualifications. The ·tent to which lack of qualifications in oc-upational disease work may go is reflected the fact that recently a duly licensed ysician in the State of Michigan reported testinal peristalsis" as a diagnosis of an ccupational disease.

While the unwillingness of a physician to ·cept responsibility for pathologic states ıth which he is not conversant is com-endable, there still remains a duty to di-·t his patient into channels wherein ade-uate services may be procured.

Industrial Terminology

One of the most annoying handicaps in stablishing the exact etiology of a possible ccupational disease resides in the wide-·read practice of industry in using code ·mbols in the designation of its substances. n inquiry, the patient may state to his ysician that his work consists of filling ntainers with "B-72." But, inquires the ysician, "What is B-72?" The patient ntinues, "B-72 is a mixture of M-20 with -40 and L-97." Completely the physician left in the dark, but if the truth were own it might be shown that this patient as engaged in the filling of cans with a rnish remover, which consists of a mix-re of wood alcohol, benzol and a syn-etic wax.

Such situations may become so confus-; that it may be almost impossible for physician to obtain proper information to work exposures. Medical, safety, so-l service or insurance departments all y have difficulty in obtaining full in-rmation as to actual chemicals and mix-es of chemicals designated in production ·ations only by code numbers.

The Absence of Records

'he majority of industrial plants fail maintain sufficient medical and work ords to serve the physician properly in nection with occupational disease work. a given instance an afflicted workman give as his occupation some innocu-job as "elevator operator." He may re-aber that the job before that was as ruck driver." There his memory may His work record may show no items transfer within the factory of his employment and no record of any pre-s employments. Although the x-ray of the chest of this workman may strongly suggest the possibility of silicosis, nowhere on the work record may it be shown that for a period of seven years at some much earlier time this workman was employed as a laborer in a pottery.

In this same connection it should be emphasized that one of the many handicaps to the physician in making an accurate diagnosis is to be found in the widespread practice of hospitals, of clinics, insurance records, etc., in merely naming the trade of a workman rather than describing his exact occupation. It is quite insufficient for medical purposes for a record merely to show, for example, that the patient was employed as an "automobile worker." Under this heading, there are perhaps not less than 200 different and dissimilar types of employment leading to different exposures; such for example as to silica in the foundry, cyanide in the heat treating room, chromium in the plating department, lead in body finishing, and on and on.

Lack of Library Facilities

With some temerity the statement is made that regardless of many book publications in the field of industrial hygiene and occupational diseases, special magazines, and articles appearing in general medical magazine publications, there is, at this time, no condensed, informative material on occupational diseases well suited to the needs of the family practitioner.

It is of course impossible and undesirable that any attempt should be made to reduce all of the lore of occupational diseases to some thin book to which the practitioner may refer and with certainty obtain all the guidance needed in the treatment and management of occupational diseases. Granting all this, there still is occasion to assert that a real need now exists for a book publication on occupational diseases designed for services to the neighborhood physician who in the aggregate sees far more occupational disease cases than the small number of specialists in this field.

Attitude Toward Industrial Medicine

In times long ago, when mine workings, sawmills, and railroad construction camps were established in remote sections of the country, far removed from the usual sources of medical services, it became necessary that the management bring into these iso-

lated work places a physician who might carry out all manner of medical services. These physicians set the broken arms of injured miners; delivered the babies of the miners' wives; treated the miners' children for measles and mumps and otherwise attempted to meet the medical needs of these detached communities. Usually the companies contributed to the income of these physicians and every family and every single man was taxed a stipulated sum each month in order to cover the physician's salary. Thus arose the term "Contract Physician." This perhaps did not always represent the best of medicine and not in all instances were these contract physicians of the highest type.

Later some of these communities became larger towns, or cities, and other physicians sought to gain a livelihood, only to find that the contract physician was in the saddle. This gave rise to complaint and out of this "Pandora's box" have come innumerable evils that even to this day attend the highest type of industrial medical supervision under the most ethical and commendable circumstances. It has become a tradition on the part of many of the medical profession to blame almost any manner of their economic difficulties upon industrial physicians. So real is this disaffection that some organized medical groups have sought to legislate against almost any form of industrial medical practice and in some instances to deny membership in medical societies to industrial physicans. As a result, industrial physicians in some respects have been branded with a scarlet letter.

This queer situation, strange to say, may serve as a handicap in the diagnosis of occupational diseases, since some of the best physicians, and particularly the more timid ones, fear lest they may become besmirched by cooperating in this type of medical endeavor and to some extent shun any close affiliation that might lead to lifted eyebrows by those regarded as the leaders of the profession.

Now that the American Medical Association is somewhat alert to this situation and has organized a Council on Industrial Health, including some members with industrial medical experience, it is to be hoped that after all the industrial physician may become respectable.

New Chemicals

A further deterrent to accurate diagnosis of occupational diseases is linked up with an almost endless flow of new chemicals into industry's processes. Year by year, a far greater number of new chemicals are introduced than the number of investigations referable to their toxicity. It is often true that nowhere in the entire literature concerned with industrial toxicology may any word be found aiding the physician in determining if a given chemical might be responsible for a series of objective and subjective symptoms in any patient. One of the most desirable changes needed in connection with worker health protection is the requirement that no new substance be introduced into industry on a production basis until it shall have been established to the extent possible, through animal experimentation, that such a substance is without dangerous potentialities.

Significance of Handicaps in Diagnosis

A recital of the type just presented might be continued almost indefinitely, but perhaps without profit. The entire situation may be summarized by stating that whereas occupational diseases themselves are probably as diagnosable as any other difficult class of diseases, just about every stumbling block that may be produced is laid at the door of the physician sincerely seeking to acquire sufficient evidence upon which to make exact diagnostic decision. The greater number of these stumbling blocks represent no willful desire to hamper the physician, but instead arise from the results of peculiar circumstances that in some measure separate industrial diseases from the general run of afflictions.

As a consequence, large numbers of unwarranted diagnoses of occupational diseases have been made and are being made. Scores of suits have been instituted and some have been won by claimants whose claims possess no whit of merit, chiefly because well meaning physicians unhappily implanted the seed of possibility that his disease might have been caused by work and that the responsibility might be laid at the door of the employer. While the results may have appeared to work an injustice and monetary loss upon the employer, in the long run the interests of the worker himself are not served by these

spurious claims predicated upon improper medical advices. The usual trial of an occupational disease case is a travesty. The bombastic statements of some physicians, unattended by any iota of fact, bring into disrepute the entire medical profession and take away its time honored traditions of integrity and skill.

A further significance in the misdiagnosis of occupational diseases on the part of physicians is to be found in unwarranted hardships imposed upon employers. Recently a physician made a diagnosis of silicosis in two workmen in a given department. As a result, widespread apprehensions arose among the remaining workers, strikes were threatened, talk developed as to demands for high wages because of unusual exposures and the expectancy or a short work life. The employer was compelled to spend some $85,000 in the installation of an elaborate dust control system.

As a matter of fact, these two workmen did not suffer from silicosis, were not in any wise disabled, had never been exposed to silica; no silica or any other harmful dusts were created. There was no need for the expensive installation made and contrariwise other departments did present practical exposures for which this $85,000 might have been spent to better advantage in procurement of needed protection.

The Road to Betterment

This entire discussion would be without any value if present day practices and situations only were condemned. More accurate diagnoses as to occupational diseases are badly needed. These better diagnoses will come in proportion to the extent that the changes now listed are brought to actuality.

(a) The general level of knowledge of occupational diseases on the part of the medical profession should be increased through the introduction into medical college training of a practical amount of instruction on industrial hygiene and occupational diseases furnished by men who have had first hand experience in this field and are not wholly dependent upon textbook lore. However, it is emphasized that in undergraduate medical training this form of instruction necessarily must be sharply limited because of a crowded curriculum, but conversely more extensive instruction is badly needed under postgraduate auspices.

(b) In every industrial community, or at least in every industrial state, there should be available for cooperation with the general medical profession a number of much experienced and highly skilled occupational disease consultants, who, through limiting their professional activities to this one aspect of medicine, may become highly proficient in the solution of occupational disease enigmas.

(c) In every state and in some of the larger industrial cities, there should be maintained public institutions devoted to industrial hygiene and occupational diseases whose technical services may be available to the physician in charge of patients who may be suffering from occupational diseases, and these public bureaus should serve as fact finding bodies, equally interested in the worker and his employer.

(d) Much will be gained if all physicians responsible for the health of industrial workers in any capacity may make greater effort to obtain precise work histories, both present and past, and may seek to gain an adequate understanding as to the work environment, its materials, machinery and possible exposures.

(e) Controversies should be eliminated in the largest possible measure from occupational disease work. Many abler physicians eschew all connections with this type of medical practice because of the sad experience that nearly every case may be so involved in controversy, litigation, disaffection, until the good physician may feel that he may be degraded.

(f) A need exists for greater disclosure to physicians of the chemical nature of work materials to the harmful nature of which employees may be subjected. Industry may have excellent reasons for hiding the nature of some of its chemical materials under code terms, but more often these code terms are designed only for convenience and not for secret formulae purposes. A greater degree of cooperation on the part of the manufacturer will eventuate in the better health protection of his workers through the more intelligent ministrations of the patient's physician.

(g) Lastly, it may be pointed out that better diagnoses of occupational diseases will come when the general medical pro-

fession, through its organizations, shall alter its attitude toward industrial medicine, shall recognize this type of work as just the antithesis of the undesirable aspects of state medicine, and may come to realize that industry, under the guidance of able medical directors, is the meritorious source of numerous cases to be referred to almost every specialty in medicine. T organized medical profession whole-hea edly should render its approval and suppo to the efforts of the physicians earne seeking to protect workers from the ma dangers connected with industry's thousa of substances and work conditions.

Necessity for Uniform Absenteeism Record In the Industrial Health Program

By MILTON H. KRONENBERG, M.D.

Chief, Division of Industrial Hygiene, Department of Public Health, State of Illinois, Chicago

You are all aware of the value of accident statistics. You know that without frequency and severity rates there would be no solution of the safety problem and we would be groping in the dark. But, since they are available, we know where corrective measures are needed and this affords us an opportunity to correctly judge the value of one method of prevention over another.

Today, the grip of statistical methods is closing down upon industry, medicine, public health and safety. Vital statistics, however imperfect, are one of the chief means now available for measuring health, longevity and the progress of medical services in the battle against diseases.

So well recognized is this fundamental principle that the effectiveness of a city or state health department is judged, in a large measure, by the accuracy and completeness of its morbidity and mortality reports and records.

The same principle obviously should hold true for the groups of workers employed in a factory, mine, quarry, public utility or department store.

These records are of value not so much to indicate what has been done, although this is important enough in demonstrating to management the value of certain work and, therefore, the advisability of continuing it, as they are to chart future action.

Insufficient data have thus far prevented the recognition of some health problems peculiar to wage-earners and there is ample evidence to indicate that morbidity and mortality rates are higher for some groups. These excessive rates are especially n able for unskilled workers as shown the accompanying table.

These death rates could only have b prepared by statistical methods of ana sis and, therefore, clearly point out wi one phase of our problem lies. If t nothing more than this we would ha plenty to do trying to uncover the mea to health among the unskilled group workers.

The morbidity and mortality data down by uniform and adequate repor of cases can also serve as a basis for p vention and health education among w ers, the same as is and has been done accidents.

It may interest you to know that Eastman Kodak Company, Edison Ele Illuminating Company, Hood Rubber C pany, Westinghouse, Metropolitan Life, eral Motors, and several others have years made sickness studies with the of statistical methods. In this way were able to evaluate the different sic problems confronting them and those ing attention, and at the same time these sickness records properly appr and evaluated, they were able to ed their employees regarding digestive eases, colds, pneumonia, tuberculosis, cer, skin disorders, as well as other ments.

Furthermore, studies conducted in cific industrial undertakings have show value of statistical methods in rev the incidence of such diseases as monia, tuberculosis, and degenerative

Death Rates by Occupation

Occupation	*All Causes*	*Tuberculosis of the Lungs*	*Pneumonia*	*Cancer and Tumors*
Professional men	670.5	26.2	38.8	70.3
Skilled worker	828.9	72.1	59.7	85.4
Semi-skilled worker	1009.3	102.1	71.6	90.8
Unskilled worker	1447.7	184.9	135.9	106.6

Rates per 100,000 occupied males, based on U. S. Census data in ten selected States.

ases to be higher than the average for e entire industrial population. This was early demonstrated in a pneumonia study mong steel workers which was conducted the U. S. Public Health Service.

Drury, some years ago, was able to show high rate of tuberculosis among workers the ax-grinding industry, and the Barre, ermont, study revealed a high tuberculosis rate among granite workers. No doubt, ther occupational undertakings would reeal data for prevention, control and eduation were it possible to have adequate tatistical records as revealed in the slide ist shown you.

Dr. Selby of General Motors, in calling ttention to his statistics shows that about .0 of a day per annum is lost due to occupational injuries and that includes occuational diseases as well, whereas, eight, ine or ten days per year is the total ost time from all illnesses. In Dr. Newist's report for the American College of urgeons, the figures are about the same. his shows us that our industrial illness roblem is approximately fifteen times the ze of our accident problem.

It is evident that industry could well ford to concentrate on illnesses among age-earners, other than the occupational eases, because they are the ones that use the greatest amount of absenteeism d are the biggest drain on industry.

In the recent National Conference on ealth Conservation, it was estimated that nation's bill for illness and premature aths amounts to approximately ten bil- dollars annually, and that on every erage day about four million persons in United States are incapacitated by ill- s. No doubt many industrial workers in that last figure.

The industrialist of today should recog- that a sick worker is prone to accidents, the quality of his work is of a lower grade, team work is disrupted, factory processes are dislocated, undue burdens are placed on other workers and the worker himself becomes dissatisfied. If he is occupied with weighty matters of policy and production then someone in that organization must assume the leadership and acquaint him with the problem by understandable and intelligent facts and figures.

There are progressive industrial organizations who may and have spent large sums of money for the improvement of working conditions and for the care of workers who become ill, but without current plant information about the human factor much of this money and effort has been spent on "general principles" or perhaps concentrated upon the elimination of only one or two publicized health hazards, and only from the standpoint of existing compensation laws, as for example, silicosis. But the extent of the health problem in a plant necessarily may not end here.

With the progress of industry especially on the chemical side, new health problems will arise resulting in physiological and pathological upsets. The effect on health will, therefore, have to be measured and evaluated. We must have data in order for one to judge the efficacy of methods employed to combat disease, so we must first know where health is being menaced, the relationship of occupation to these diseases and the causative factors responsible. The records you keep will be a guide to action as well as a record of action.

Therefore, I say, prove your value to industry since many a skilled industrial medical department has been limited in its budget and activities because it overlooked the necessity and value of absenteeism reports and records which could have been used to enlighten management regarding its

health problems. Perhaps in some cases the industrial establishment may find it difficult to undertake a complete record system of absenteeism. I do urge you, though, to make a start somewhere. It need not be too elaborate.

I have heard it said that the best way to detect illnesses which are causative of absenteeism from work is by periodic physical examinations. I am not fully in accord with this type of prevention. It may be helpful where the illness lasts longer than a week or ten days, but something should be done about the frequent one, two or three day absences, and I fear that periodic physical examinations will not help tremendously. This, of course, does not mean that industrial medical services should abandon or minimize that phase of health service.

The industrial hygiene divisions of State Health Departments and that of the United State Public Health Service are urging the employment and use of a uniform code for recording and reporting absenteeism of the worker due to sickness. Forms and methods have been developed after a study of some twenty years by the Public Health Service and also as a result of the recent National Health Inventory of chronic disease affecting workers. The aforementioned health agencies will gladly assist and cooperate with industries desirous of setting up and maintaining records of sickness their particular plants. An analysis a evaluation of these reports and record another service offered by them to manag ment.

Before showing you a form on which collect your absenteeism data, and which be termed the "master sheet," I should li to acquaint you with several import items that must be had for your recor before they can lend themselves to analy and evaluation. The form is self expla tory except for a few general remarks.

A card should be made out for each a every employee on the payroll, regardl of whether he or she gets sick or not. Th is necessary in order to ascertain the ra of those sick to the number on the payr The workers' age, sex, color and occupati are important to record since they will ha to be related to the specific exposed po lation.

Under "occupation" state the work which the employee was engaged when i sickness began. The "date disability begu should only be recorded for one full d or longer. In the column "work days lo we refer to calendar days and this is nece sary to put lost time on a comparable ba for all employees. For "diagnosis" o should list the sickness or injury when de nitely known; if there is any doubt ab the correctness of the diagnosis, a statem

Sickness Record Form

Name or Clock No	*Dept.*	*Occupation*	*Age*	*Sex*	*Color*	*Date Disability Began*	*Date Disability Ended*	*Work Days Lost (Calendar days)*	*Diagnosis*	*By Whom Diagnosed*	*Termination of Case*

of the symptoms experienced by the patient should be recorded. The point is that facts should be recorded and not guesses. It is more important, for example, to know that ten men in a given occupation were disabled by "pain in the stomach" than to get ten different guesses of the disease or ailment causing the pain. Another item of importance on the record is "by whom diagnosed," and should show whether the diagnosis was made by the family physician, plant physician, nurse or the patient himself. Under "termination" of case, one should record whether the illness terminated in recovery, death, relapse or ended in a chronic condition.

The following statistical information and data are, therefore, possible if the items listed in the slide just shown you are carefully prepared.

1. The frequency or severity rate of any given disease for the entire plant, individual departments or occupations.

2. The time lost due to any given disease or to all diseases combined in the entire plant or by departments or occupation.

3. The mortality rate.

4. The case fatality rate, expressed as the percentage of cases of a given disease which terminates fatally.

The intelligent application of preventive measures, of control, of health preservation must have statistics and they will always be an integral part in the solution of any problem. That it holds true in industrial hygiene is represented in my next slide which shows that the strength of any wheel is dependent on each and every spoke and each is dependent upon the other, otherwise your structure is unbalanced or collapses.

ADJOURNMENT

Steam Railroad

TUESDAY AFTERNOON SESSION

October 11, 1938

The first meeting of delegates to the Steam Railroad Sessions was called to order by Mr. W. W. Wood, Superintendent of Safety and Welfare, Baltimore & Ohio Railroad Company, Baltimore, Maryland, who presided. Chairman Wood briefly outlined the significance of the programs of the two sessions planned, and then introduced the first speaker.

"Hidden Causes"

By FRED W. SARGENT

President, Chicago and North Western Railway Company, Chicago

We have seen the evolutionary growth of accident prevention work from its inception, as applied to the American railroads. Many of us here knew Mr. Ralph C. Richards intimately, and discussed his hopes and ambitions with him frequently. Though he met from time to time with discouraging results, yet he never surrendered. He laid the foundation for safety work that is vastly enlarged and is rapidly ripening into collateral lines that are of benefit not only to employees and managements but to the entire economic and social structure of the country.

In the beginning, and even until rather recent times, the greatest emphasis was laid upon working rules and physical conditions of plant and facilities; in other words, a safe place to work. There was every reason in the world why the greatest emphasis should be placed upon these factors, and, indeed, we are not yet so far along that we can afford to lessen our efforts with relation to these matters.

In the beginning, the idea of a surgical department was to care for men and women after they were injured. Gradually this conception has been enlarging and changing into a broader field and greater service, if a greater service is possible. This department no longer has as its sole objective the healing of wounds and the saving of human lives after injuries. Gradually, steadily, the whole conception of safety work has progressed and evolved until today it has become a nationwide activity, drawing to its cause the best minds and the finest characters in our social structure. And with this greater interest in the work it has been but natural that the whole scope, theory and conception of the undertaking should gradually enlarge to embrace the wider field of accident prevention, to which I am about to refer.

In recent years many of the railroads have enlarged their conception of this work and have come to the realization that safety work involves not only safe tools, safe way and structures, and safe surroundings, but involves likewise, and with equal importance, the very physical and mental condition and attitude of the employee or officer himself. With this thought in mind we have changed the title of the head of our surgical organization from that of "Chief Surgeon" to that of "Medical Director," because if men are to avoid accidents we know that they must not only be surrounded with safe working rules and safe working conditions, but they themselves must be physically and mentally fit; and that the so-called human element, always and ever present, must constantly be reckoned with if we are to achieve the ultimate beneficial results so earnestly desired.

And so it is that in all this work, whether

of informing the public as to the number of accidents, their causes and how they may be avoided. With this limited application of effort, automobile accidents of all kinds have been constantly increasing. We have found in our efforts to prevent accidents to employees that we must supplement our educational methods with rules regulating the conduct of the individual and that such rules to be effective must be enforced. It is imperative that a similar procedure be followed if we are to curb the recklessness inherent in certain motor drivers.

Ninety-five per cent of the motor drivers of this country are competent and careful. It is to them that we appeal to aid us in the enforcement of such rules and regulations as are necessary to eliminate from our highways the one and one-half million drivers who are reckless and incompetent.

THURSDAY AFTERNOON SESSION

October 13, 1938

Safety and Public Relations

By ROBERT S. HENRY

Assistant to the President, Association of American Railroads, Washington, D. C.

The safety movement, which constitutes one of the proudest chapters of American industrial achievement, naturally falls into two main divisions. Safe conditions must be created, in the first place, but there must be also created a safe state of mind.

No doubt the pioneers of the safety movement encountered industrial managers willing enough to install safe equipment, but skeptical as to the need or the value of the education and exhortation needed to instill safe ways of thinking. Every man knows that to get hurt will cost him time and money and suffering, these skeptics might have said, so what's the use of going to a lot of trouble to tell him so? He'll take care of himself!

Fortunately, the safety pioneers realized that safety was a matter of the minds of men just as much as a matter of machines, and that the safest equipment and the safest rules did not, in and of themselves, make a safe man. They fought their battle for safety on both fronts—safe conditions, yes, but safe thinking as well, achieved through constant iteration and reiteration of simple principles.

The early leaders of the safety movement pioneered in a field broader than their direct goal of promoting personal safety. They pioneered in the field of securing and organizing the wide-spread understanding and cooperation without which their movement must have failed of its full measure of success. How well they and their successors did the job is told in the statistics of declining accident rates, of lives and limbs saved.

In these latter years, American industry is faced with the need for another sort of understanding and cooperation on the part not only of those employed but of the whole public which our industry serves.

In the short space of little more than a century, our American scheme of enterprise has settled and civilized a continent. It has made possible a standard of material plenty and well-being unknown before in the history of the world, and unknown elsewhere in the world today. We are told that one-third of the people of the nation are ill-fed, ill-housed and ill-clad, but it should be borne in mind that when this American way of enterprise began to function a century and a half ago, practically the whole population was ill-fed, ill-housed and ill-clad, according to our modern standards. Mistakes have been made, perfection is a long way off, but there is in the record of achievement much solid ground for pride.

Today, as never before, the best operation, the safe functioning, the very existence of the vast and varied organization of our economy of free enterprise, depend upon public understanding and appreciation of what it is, what it does, how it works, what it means to all of us.

The safety movement is built upon safe