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TRANSACTIONS

25th National Safety Congress

NATIONAL SAFETY COUNCIL, INC.

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

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

THE Transactions of the Twenty-fifth National Safety Congress, 1936, 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 and Vehicle Fleet 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, $1.50 each; 11 copies or more, $1.25 each; copies of the smaller volume, 50 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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Occupational Diseases

FRIDAY MORNING SESSION

October 9, 1936

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

The Lesser Known Facts About Common Occupational Diseases

By DR. ROBERT B. HUNT

Medical Advisor, American Mutual Liability Insurance Co., Boston

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

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

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

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

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

Metals

Lead

The distribution of lead poisoning is quite extensive.

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

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

Those bony safe deposit vaults may retain their lead contents for days or for years, and if the exposure is removed, may also free the employee of all signs symptoms of lead poisoning. But …ine the surprise of that supposedly … person when years later, perhaps …cing some type of infectious disease …e excessive use of alcoholic bever- … he awakes to find that he suffers …ches and pains and paralyses of an … lead poisoning. As the body fluids … lead that it may be deposited, so … those fluids attempt to de-lead the … and too rapid absorption may pro- … the original disease with all its dis- …rts.

…e can readily see, then, that in some … investigation of previous occupa- … is quite necessary to determine the …al contact with lead.

…ating of molten lead causes a black … of lead suboxide to form on its sur- … and the heat from the metal dis- …s the fine powder into the air. …e, in the process of smelting ores … as zinc, copper and silver, mixed … lead, we find a rather high lead …ning rate.

…se engaged in the manufacture of … wire and cables, batteries, glass, …y and rubber industries, plumbers …sers of dry colors offer their share …d poisoning.

…bably the greatest source of lead …ning may be found among those …sandpaper, scrape, chip or burn lead … for the dust and fumes caused by … activities are rather rapid in their … Such workers may become in- …tated in a few days because the …tion of lead dust causes the maxi- … amount of absorption into the blood … in the minimum space of time.

…ium

…mium is a metal widely used as a …ation for colors, and dusts from its …s salts may produce lesions of the …nd mucous membranes of the nose. …ium plating by electrolysis may … fumes which are similarly irritat- …Although chromium poisoning does …ually cause death, the number of …f absence from work on account …apacity which it causes is gradu- …reasing.

Metals

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

Diseases Due to Dust

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

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

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

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

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

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

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

Benzole-Benzene

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

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

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

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

Chlorinated Hydrocarbons

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

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

Chemists have developed and introduced to industry many new products, the basis of which is the chlorinated hydrocarbons. These derivatives of petroin distillation are frequently combined th those from coal tar to form valua- chemical combinations. They have en placed on the market so rapidly it medical science has been unable to termine their physiological effect upon e health of man. We have known that me of these chemicals are capable of eating changes in the liver, and only cently in a city in Massachusetts one these newer products caused the death two employees and a battle to retain e among two others.

Carbon Monoxide

You remember the adage, "Where re is smoke, there is fire." We might l to that, "Where there is fire there is bon monoxide."

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

Since the advent of the motor car, ose exhaust pipe may pour forth as h as 6% of carbon monoxide, we are exposed to that gas, particularly in wded cities. The ordinary passenger liberates about two cubic feet per nute, and one can readily estimate the ysical damage that may be done if n a motor is allowed to run within the rs of a poorly ventilated garage or p. Fortunately, serious cases of such soning are not common among those ployed in public garages, but many of se employees are likely to complain headache and faintness at the end of a 's work, especially in colder weather en doors and windows remain closed.

n the steel industry, where gas is used the heating agency in the blast fur- es, care must be used to provide per ventilation. Within the mines, rkers are warned to allow enough time wing blasts for the escape of this .

ing a colorless, odorless and taste- s gas, quick of action within the hu- n body, the manifestation of the very t symptom may be too late to save a rkman from partial or total incapacity perhaps death.

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

Infection

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

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

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

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

Summary

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

1. How will your product affect my business?

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

That employer is entitled to honest answers based upon sufficient chemical and physiological examinations of the questionable product. That manufacturer should be held responsible for the ills produced by the use of his product and unless he can guarantee its safety, it has no place in industry. Too many lives have been lost or jeopardized by too little knowledge of a product's action upon those who handle it.

The incidence of lost time due to illness and injury in industry has been greatly lessened by the many agencies working along lines of safety. When industry has been made fool-proof by substitution of non-toxic preparations those now found to be harmful, and w each employee is imbued with the i that constant thoughtfulness and care most necessary for the maintenance health and happiness, then, and not til that idealistic stage has been reacl may vigilance and perseverance to ma tain and preserve health, limb and be lessened.

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

By DR. W. C. TEMPLER
Medical Director, Corning Glass Works, Corning, N. Y.

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

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

Knowing that the average span of l has been increased eight years in the la quarter century and assuming that t above mentioned factors have had so bearing on it, could we decry the val of physical examinations for the gener population?

If we know that examinations made l insurance companies and their associati examining institutions, the clinics run l the United States Public Health Servic and the great mass of physicians, who a carefully examine their clientele, hav been of value in the control of diseas may we not assume that examinations i industry will help control the incidenc and extent of industrial disease, partic larly when the life expectancy of in dustrial workers is less than that of th general population?

In fact on April 14, 1936, at the Na tional Conference on Silicosis and Simila Dust Diseases, called by the Secretary o Labor, Dr. R. R. Sayers of the Unite States Public Health Service said, "Pre liminary and periodic physical and roen genological examination should be mad of all employees engaged in industria processes where there is a potential i

· actual exposure to excessive concen-
·tions of silica in the atmosphere."

Naturally in the early work of industry, y basic materials were used, ingredients ! not arrived at a state of development ! complexity, when intricate chemical npounds and other toxic materials were n known of, much less used. At the sent time over 500 materials are listed ich can, under certain conditions, cause ·strial disease and the list is by no ans complete, inasmuch as experimental rk is being done by the personnel of ctically every plant or industry to im- ve or enlarge its manufactured products taking advantage of the great amount knowledge science has given us.

ndustrial examinations are of two ds. First, the pre-employment ex- ination, which consists of a very care- history, not only of the family, but › of the previous occupations with gth of service in each, previous health ' illnesses and present habits. Naturally h a history is of no value unless truth- y given and a reasonable amount of e must be taken to acqui... details, ch are often vague in a workman's d or considered by him to be unim- tant. The physical examination, of rse, varies with the type of industry, ! should be given with the knowledge what the man's exact occupation is to and by a physician familiar with the ustrial processes in which he is to be loyed. In this way selected employ- nt can be obtained for men who have ne basic disqualification for one job, · which does not impair their ability useful employment and the conserving health in another.

e physical examination must be rough. It should include all methods determining a latent disability or one t is already present. Many examina- forms are available from insurance npanies or other health services, which e been designed entirely for industrial rk. It has been the experience of men rested in this work, that all the special ses of the body must be tested as well the measurement of motion in all joints. : cardio-vascular system is of great ortance as is the respiratory and tro-intestinal tract.

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

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

The harmful exposure to each hazard is, of course, different, ranging from a few days as, for example, an acute poisoning from toxic gases, to that of 15 or 20 years in some of the less toxic dusts; therefore the period before re-examination for each class of employee will be dif- ferent. However, individuals differ also and it is hard to state a definite period which may be satisfactory for each em- ployee in a single class of hazard. Super- visors can often be of great value in send- ing employees out for physical examina- tion whenever there is a change in ap- pearance or work ability, or when they have been off on account of some illness, such as those self-diagnosed as common cold, lagrippe, cough, sore throat or skin irritation. Such observations should be considered, where there is not a full-time physician, and they are of the greatest value in the early determination of a susceptibility to or the beginning of an industrial disease.

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

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

These objections, however, are bein[g] noticed by legislative bodies, and in on[e] State a law is in force which says: "I[t] is hereby declared to be the policy o[f] the legislature of this State, in enactin[g] this article, to prohibit through every law[-]ful means available, any requirement as [a] pre-requisite to employment which com[-]pels an applicant for employment in an[y] occupation coming within the purview o[f] this article to undergo a medical examina[-]tion." This statement is in a paragrap[h] labeled, "Prevention of Silicosis and Othe[r] Dust Diseases," and the logic of it i[s] entirely non-understandable, even thoug[h] at the present time there is no lawfu[l] means available to enforce the state[d] policy.

If physical examinations are of benefi[t] to the population at large, they certainl[y] must be to the industrial workers, wh[o] may be exposed to special hazards[;] periodical check-up examinations ar[e] necessary in any hazardous work or trade in order to protect the workers as well as the industry; and the benefits to the workers of proper and fair-minded examinations, in all ordinary cases, outweigh the objections.

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

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

By REUEL C. STRATTON
Supervising Chemical Engineer, The Travelers Insurance Co., Hartford, Conn.

If I were asked, "Can the engineer prevent the majority of occupational disease ..ses" my answer would be, "yes." Obviously, with the exception of those iseases brought about through a sudden r accidental contact with a poisonous aterial or a virulent disease-producing rganism, if the exposure were controlled y engineering technique, then there ould be no occupational disease.

The engineer must rely upon the edical director to place individuals apable of working in hazardous occupaons and to assist him in controlling iese individuals through periodic physical xaminations when the men are exposed occupational disease hazards; but the ngineer alone is responsible for reducing eneration of harmful substances and for e control of employees' contact with rocesses using harmful materials.

The ascribing of many and new occupaonal diseases to industrial environment as produced a problem for him. The ngineer generally works with materials hich he can see, but the study of instrial disease control may require the andling of invisible materials. It is a mmon fault to focus attention upon one bject to such an extent that others of qual importance may thereby be releated to obscurity. Today safety enneers and industrial hygienists are conntrating their attention upon diseases used by the inhalation of dust, but I not believe the safety engineer is warnted in confining himself to the prevenon of diseases caused by dust alone. His nsideration should extend to include all aterials produced in any manner that y may cause an effect upon a worker. he question of whether a material exists a gas, a vapor, or a dust is but one of rticle size and chemical make-up.

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

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

(1) An occupational disease inventory is required.

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

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

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

Process exposures should be studied in conjunction with hazardous materials. Assistance in compiling such data may be obtained in the bulletin "Occupation Hazards and Diagnostic Signs," prepared by Dublin and Vane of the Metropolitan Life Insurance Company, and in a publication of the United States Public Health Service, Public Health Bulletin No. 216, "The Potential Problems of Industrial Hygiene in a Typical Industrial Area in the United States."

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

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

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

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

Process Revision. To reduce trans tation of materials and exposure to ha ful substances it is desirable to have processes mechanically continuous and possible, enclosed. When this cannot accomplished, suitable physical divisi should be provided. The engineer sho consider the substitution of wet proces for dry processes, providing at the sa time for the disposal of the moist lected material in a safe place. He sho consider the substitution of autom operations for hazardous hand work machine work. A change of abras material will often reduce the quantity dust produced.

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

A plant producing a finely pulveri material created large amounts of dust bagging the material, using porous sac This high concentration of dust, not nec sarily toxic, inconvenienced the worke The cost of ventilating the departme would have been prohibitive. By care study the engineer determined that t fall of the material into the sacks forc the air out through the interstices of t material, carrying with it a quantity the pulverized product. His problem, th was to provide a means whereby this a could be harmlessly expelled from t sack prior to filling. Study led him suggest and apply the use of a collapsi paper bag which contained little or r free air. The problem was solved. Du generation was practically eliminated b this simple change. Many hazardo processes in ordinary manufacturing oper tions may be cured in like manner if th engineer exercises his ingenuity.

Ventilation. Proper ventilation is c paramount importance in the control c any occupational exposure. Most of th chief occupational diseases other tha dermatitis arise through the inhalation o the ingestion of foreign material. If ven tilating equipment can reduce the concen tration of contaminating materials to safe limit, the problem is solved. The en gineer should study each process sep arately and ventilate each separately. I is seldom wise to rely upon general ven tilation. Instead, high velocity ventilating apparatus should be installed, functioning as closely to the point of generation of the harmful substance as is possible.

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

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

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

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

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

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

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

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

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The first session was called to order by General Chairman Welton A. Snow, Associated General Contractors of America, Inc., Washington, D. C., who presided, outlining the activities of the past year and commending the work of the various committee chairmen. Addresses were given as follows:

Construction Safety Ain't Different

By G. O. GRIFFIN

Safety Director, Dravo Corporation, Pittsburgh, Pa.

The construction industry in 1935, out of 30 major industries, ranked twenty-seventh in accident frequency and twenty-ninth in severity; and the only excuse that was ever given is, "Well, we're different." We aren't different! It's just an alibi. The cement, quarry and public utilities industries contain many hazards similar to those of the construction industry, yet each has a superior accident rate.

The following table gives a percentage

Type of Accident	Per cent in Construction Industry	Per cent in All Industries
All types	100.0	100.0
Handling objects	25.9	26.8
Falls to the same level	9.5	9.6
Falls to a different level	8.7	14.9
Machinery	12.0	7.5
Vehicles	10.9	6.0
Falling objects	8.7	11.1
Using hand tools	7.6	7.9
Stepping on or striking against objects	5.6	6.5
Electricity, explosives, heat	3.6	2.7
Harmful substances	2.1	2.6
Other	5.4	4.4

distribution of the cases (nearly all compensable) covered in recent one-year reports from Illinois, New York, Maryland, New Jersey and Pennsylvania. These reports cover 224,661 injuries in all industries and 40,620 injuries among construction company employees.

Is it not remarkable how nearly equal these percentages are for most types of injuries? In only four instances does the difference in percentage exceed 1 per cent. The construction industry had 6 per cent more accidents due to falls to a different level, and 2 per cent more due to falling objects, than the average for all industries. Construction work had 4 per cent fewer accidents due to machinery and 5 per cent fewer due to vehicles.

It would appear, therefore, that the solution to the problem, the reduction of construction accidents, could be accomplished by the use of the same methods that other industries have used so successfully.

Actually, the best safety records known to the National Safety Council for construction work were not, as one might expect, made by contractors, but by the construction departments of an oil refiner, a manufacturer, and a public utility. The Norco Refinery of Shell Petroleum Corporation holds the best record with 1,929,478 man-hours operated without a disabling injury. DuPont's Penn's Grove plant has a record nearly as good; and the construction department of the Indianapolis Power & Light Company has the third best record.

These outfits didn't have any tradition of "a man a floor" or "a death for so many hundred thousand dollars worth of work" to live up to. They knew they weren't different; they just went ahead and did it. They had the safety programs of the parent corporation which were not built in particular for construction work, but which apparently functioned very well.

I have heard this same excuse in my own company many times. But last year we were rather fortunate in having one job hang up a record of about 125,000 man-hours without a disabling injury. That's nothing to write home about, but it sure was a help when the boys on the other jobs began the old "We're different" story.

Our company has several fields of operation besides that of heavy constructio[n]. We build boats, operate a barge lin[e] and a sand and gravel company, besi[des] fabricating steel, installing machinery a[nd] handling contractor's equipment. [The] types of accidents reported by these va[ri]ous subsidiaries diffffer very little. T[he] boat or construction job, machine sh[op] or gravel yard—they all report falls, cu[ts] and other injuries in about the same pro[]portion. However, there are some qu[eer] ones. One day last week we had a ma[n] fall out of his berth and crack a rib; a[nd] in the other case a spider bit the pil[ot]. Recently, on one of the dam jobs a ma[n] was hurt because he didn't understan[d] the foreman's order. The foreman ha[d] just had all his teeth out.

All books and theories on safety sa[y] that accident severity cannot be co[n]trolled. In general, I agree, but I fe[el] that it can be controlled to a greate[r] ex[]tent on construction work than on man[y] other types. Most severe accidents i[n] construction can be attributed to certai[n] types of occurrences which can b[e] guarded against fairly completely; b[y] this I mean prevention of long falls b[y] special types of scaffolding and railing[s] and the reduction in falling of materi[al] by the close inspection of mechanic[al] equipment. To a very great extent, thi[s] has been done and the records show it.

I am about, however, to suggest some[]thing which may be quite controversia[l]. All rules for safety contests and su[p]posedly all fair safety men insist that if [a] temporarily injured employee is unab[le] to return to a regularly established jo[b] on the day following his injury, he shoul[d] be kept at home and recorded as a lost time accident. How the case is recorde[d] is of little interest to me.

It is my contention that on constru[c]tion work you can improve your severi[ty] rate and do everyone concerned a fav[or] by keeping the injured man on the jo[b]. In this way, you can keep control of hi[m] and of his injury, be sure he receives ade[]quate treatment and reduce his sufferin[g] and loss of wages. If you don't do thi[s] you frequently lose control of the cas[e] entirely and have a simple seven-day [in]jury turn into an expensive one with lo[ng] disability.

To get back to our real subject, th[e] program which, in my opinion, would ma[]

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

Dust Diseases As They Affect the Construction Industry

By A. J. LANZA, M. D.

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

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

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

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

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

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

There is no silicosis without silica—free silica. So right off, the manufacturer or industrial company has the first clear-cut index of the potential harmfulness of a dust which may be causing concern to him or his employees. Does it contain free silica in appreciable amounts?

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Physical Examinations of Construction Employees on Public Works Programs

By L. M. DEARDORF

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

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

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

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

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

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

Systematic Organized Safety Effort

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

The Present Status of Control of Dust and Fumes in Industry

By H. B. MELLER

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

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

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

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

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

Classification of Dusts

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

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

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

Ability of Dusts to Cause Injury

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

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

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

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

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

After silicosis has become well established in the lungs, medical science has not found a way to arrest the progress of the silicotic process toward the of disablement except through unit. preventing further exposure to silica Nor has medical science found a wa prevent tuberculosis from being s imposed upon silicosis, except thr control of contact. The course of si tuberculosis is chronic and is very cult to influence by treatment, accor to phthisiologists.

Medical Control. As a basis for u gent determination of the physical f of a man for a job in a dusty t physical examination, with stereo roentgenograms of the chest, is neces Along with this study goes, naturall preparation of an occupational his with detail as to the exact nature of p ous work and of exposure to indu dust—not a valueless recording of o pations as "laborer," "machinist," Dr. Sayers, of the U. S. Public He Service, has developed a method of se ing information for a proper occu tional history; among others, Cumm of Saranac Laboratory, also has wo out a useful history blank.

Standards have been developed for diagnosis of silicosis. There is als suitable technic for taking roentge grams of the chest in order to bring the characteristic lung changes.

From the considerable amount of w that has been done, it is possible to f cast with a reasonable degree of a racy the silicosis potentiality of var dusts.

Periodic physical examinations, incl ing roentgenograms, are essential if ployers are to be enabled accurately learn the effect of individual expo and intelligently to transfer affected w men to lower dust concentrations be serious injury has been done, or to out a system of rotation where indi as desirable in order that exposure be intermittent. Such examinations helpful also in showing the efficienc engineering control methods.

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

Asbestosis. Clinical experience shown that the inhalation of a suffi amount of asbestos dust causes a se type of fibrosis, which is not accompa by an unduly high incidence of tuberculosis.

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

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

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

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

Preventive Engineering

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

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

Methods of Determining Dust

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

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

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

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

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

Dust Elimination

Obviously, it is better, when possible, to purchase equipment already supplied with exhaust hood, rather than to have to worry to fit one to equipment not designed to be hooded. Thus the responsibility for potential efficiency is upon the manufacturer.

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

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

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

Permissible Dustiness

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

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

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

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

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

Some metal-mining companies hav[e] gone further, setting the maximum [o]f permissible dustiness at 5 million particl[es] per cubic foot.

Certainly, there is a degree of air clea[n]liness that is safe, from the standpoint o[f] concentration of harmful dust. But th[e] engineer may find himself in the positio[n] of practically being forced to control an[y] dust, harmful or otherwise, if he woul[d] protect his employers against suits [a]t common law and the possibility of awa[rd] of damages to men who have breath[ed] dust containing little or no free silica. [A] dusty workplace is difficult to defend i[n] court. Neither courts nor compensatio[n] boards, and certainly not juries, hav[e] seemed to be greatly impressed with [a] low silica dust count in an otherwis[e] dusty atmosphere.

Quoting from one of the reports re[-]ferred to: "Each state is a unit—a sover[-]eign—and it handles its problems in i[ts] own way. Uniformity is lacking, althou[gh] of course the statutes of many states ar[e] similar. The courts of the various stat[es] follow such precedents as appeal to the[m;] consequently, on any important questi[on] there is likely to be a divergence of opi[n]ion among the courts, and often t[he] courts fall into two or more groups, eac[h] group following a different theory wit[h] respect to the same legal problem."

Workmen's Compensation Acts

Workmen's compensation acts ha[ve] been passed in 46 states (all exce[pt] Arkansas and Mississippi) and the Di[s]trict of Columbia. These acts are com[-]pulsory as to private employers in [15] states and elective in 31 states. Insur[-]ance to cover the risk is compulsory [in] seven states.

A state fund, out of which compens[a]tion is paid, is maintained in 18 sta[tes;] in two of these the employer may, [by] proving financial responsibility, carry [his] own risk with limited contribution to t[he] state fund for the expense of administr[a]tion; in 11 more of this group of stat[es] the employer is not required to ava[il] himself of the privileges of the state fu[nd] and may provide compensation otherwi[se.] In 28 states there is no provision for [a] state compensation fund.

Administration of the compensation a[ct] is vested in a commission, board, or sing[le]

Steam Railroad Meeting

WEDNESDAY MORNING SESSION

October 7, 1936

The Steam Railroad Meeting of the National Safety Congress was called to order by Chairman W. W. Wood, Superintendent of Safety and Welfare, The Baltimore and Ohio Railroad Company, Baltimore, Md., who presided, welcoming the delegates and introducing the speakers in turn.

Safety in Construction and Maintenance From the Viewpoint of a Chief Engineer

By C. H. PARIS

Chief Engineer, Chicago & Illinois Midland Railway Co., Springfield, Ill.

Accident Bulletin No. 103 of the I. C. C. reports, table No. 55, shows casualties by classes of employees and other persons for non-train accidents. For the 10-year period 1924-1934 the casualty rate for the maintenance of way department was greater than the rate for all employees on duty. For example, in 1930, this casualty rate was 11.07 while for all employees it was 9.36. In 1934, for maintenance of way employees it was 8.06 while for all employees it was 7.04.

In 1930, 70 roads out of 162 had rates in the maintenance of way department below the average for their group. In 1934, 62 roads out of 158 were below the average. This means that less than one-half of the roads have casualty rates in the maintenance of way department better than their rates for all employees.

In 1930 the spread between the lowest and the highest rate for the maintenance of way department was from 0 to 77.92. In 1934 the spread was from 0 to 89.11. This shows lack of uniformity of results and it is plain that the maintenance of way department has a safety problem. Its casualty rate is too high and this rate is too widely divergent as between the different carriers.

Now what about the nature of the accidents that go to make up the casualty rate? The four principal causes of injury are: 1. Handling rail, ties, timber, etc. 2. Falls. 3. Using hand tools, jacks, etc. 4. Motor and hand car accidents.

Why cannot employees handle rail, ties, timber, etc. safely? Is it because of improper methods, improper tools and equipment, poor quality of men, too much haste without regard to safety, or what? The majority of injuries are to hands and feet. Take the handling of creosote-treated ties for example. These ties may come loaded in flats, gondolas, box or stock cars. They are slippery if freshly treated, so this hazard is added to that of picking them up and throwing them out of the car. The elimination of injuries can only come through careful instructions as to exactly how the ties should be picked up, the assignment of the correct number of men, and their proper placement so they will not foul one another. This is true not only of the men in the car but also those on the ground.