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OCCUPATIONAL DISEASE HAZARDS — THEIR CAUSE AND CONTROL

Wednesday Afternoon Session

April 17, 1940

This Section of the All Ohio Safety Congress devoted to Occupational Disease Hazards—Their Cause and Control was called to order at 2 o'clock by Dr. Sidney McCurdy, Director, Medical Division, Industrial Commission of Ohio, Columbus, Ohio, Chairman.

Chairman McCurdy: Our meeting will now come to order. We have to discuss a subject that is really momentous. In the state of Ohio recently we have entered a new phase of taking care of people. We have placed the burden upon industry for practically all diseases that are peculiar to the industry in which a man works and which he customarily would not meet and would not be subjected to elsewhere. The history of our occupational disease law up to this point has been that we have carefully selected specific diseases easily capable of proof and named them, and no others were applicable to compensation. I think that was in 1921. In 1928 or 1929 we added six or seven in the same manner, by making them specific, and we went on rather slowly, and somewhat discouragedly, until 1937, when we took our place with others who had been ahead of us in recognizing, specifically, silicosis. Apparently with some fear and trembling we did that, because we stuck around that law some safeguards to limit what might be classed as a previous accrued liability. In any event, we took on silicosis with those safeguards that seemed to protect fairness and merit and in some instances, I fear, we were a bit unfair to the claimant. But there had to be a starting point and we made it in 1937. In 1939 we threw all discretion to the winds, burned our bridges behind us, and took on all diseases not classified hithertofore by name, and which, of course, in this modern day and age is a step in advance. It also introduces the Industrial Commission very definitely in Ohio into the business of preventing diseases as well as accidents. We have done something that is a little bit peculiar in our section. Perhaps it might be classed a trifle experimental. When we took on silicosis, we set up a Board of Medical Referees. Those referees were to be men especially versed upon the subject of silicosis and with special knowledge of it, two of whom could be most any specialist that we desired to choose, but one of whom had to be a roentgenologist. Their opinion was not final, but the cases had to be submitted to them, before the Commission could allow or disallow the claim. As a matter of fact, that silicotic board is made up, I believe, of three as good men as we could get in Ohio, and who have been so recognized in the communities in which they practice. I believe from working with them, that they are dealing with the cases fairly and honestly, but upon a scientific basis. That Board has been obliged, of course, to turn down some, but it has been, I believe fairly liberal in passing those cases that had merit. Remember that Board was not final. But when we took on the additional number of twenty-three other diseases, we set up again a new principle in Ohio and, I think, a new principle everywhere,

in that each claimant who was dissatisfed with the ruling of the Commission, upon medical facts, had a right to appeal to a medical Board, upon a medical fact, and upon the judgment of that Board, the case would be decided. They were final, on medical fact. That is as it stands today. Now we haven't had occasion to use that new Board. I have attempted to set it up on this basis—specialists in each of the larger cities, covering practically every field that we can expect to meet, so that if in Cleveland or Cincinnati or Toledo or Dayton or Columbus, we want to pick a special Board for a skin disease controversary, we can do it without going out of those cities. That made it necessary to select a great many men. I believe the number is forty-four. I think one of the proudest moments in our lives was when I wrote to these men, requesting that they serve upon this new Board, telling them frankly that I couldn't tell them at that time how much we could pay them, but telling them what I wanted them to do and giving them the list of those that I was asking, and not one man turned us down, and most of them wrote, thanking us for the opportunity to render their service in behalf of this new principle. We speak of this whole problem, and it is so labelled here, as "Occupational Disease Hazards." When you get into public health matters, it is spoken of as industrial diseases. I think perhaps their terminology is better than ours, because after all, these cases must arise out of, or in the course of employment. With the liberality that we now have, I think the word "industrial" could well take the place of the word "occupational." At the beginning of this symposium today, we are going to discuss first occupational diseases occuring in Ohio. Let us change the word "occupational" to "industrial" diseases occuring in Ohio.

Our first speaker has had a tremendous amount of experience in that he has been with the State Board of Health for a number of years, at the head of their Occupational Disease Division. I will introduce him in a moment, but I want to state first the rules of the game. After each speaker is through, I will throw it open to discussion. I wish each discussant would stand upon his feet and announce his name and where he comes from and if he represents anybody, I wish he would introduce who he represents. He must do that as many times as he speaks. I shall allow anyone who cares to discuss, five minutes, and I shall be rough when the five minutes is up, because others may want to talk too, and our time is more or less limited. I will rap upon the table or indicate by a sign, he must sign off very soon. With those preliminary remarks, I wish to present to you our first speaker, Dr. Kenneth D. Smith, formerly director of Division of Occupational Diseases, State Department of Health, Columbus, Ohio. Dr. Smith.

(Applause).

THE OCCURRENCE OF OCCUPATIONAL DISEASES IN OHIO

By Kenneth D. Smith, M. D.

Dr Smith: When Mr. Kearns and Dr. Obetz asked me to speak on the medical aspects of Occupational Diseases at this Safety Congress they asked me to give an informal discussion rather than read a formal paper. It was their opinion, with which I heartily agreed, that I should review certain topics which color the picture of these diseases but which are seldom seen in print and which we quite often neglect in appraising the present status of these diseases. Therefore, this discussion will be more or

less a hodge-podge of miscellaneous information. I shall not burden you with many statistics. If there are any of these data that you desire in actual figures they can readily be obtained from either the Industrial Commission or the Ohio Department of Health.

Whenever it has fallen to my lot to discuss a subject I have usually consulted the dictionaries for two reasons: I wanted to be sure that I knew what my subject meant to me after I had read the definition given by those who were experts and qualified to tell me; but more important has been my desire not to give an entire discussion which would be erroneous because I had erred in my understanding of the words. I made no exception when the title of this paper was given to me. However, when I read the many definitions of "occurrence" I found among them this: "The act of occurring." Obviously this definition, although correct, takes us to the word "occur" where we find first "to befall, to happen, to take place." Again a correct definition but inadequate here because we do not know the exact number of workers who suffer from occupational diseases because of faulty diagnoses and the wide-spread lack of reliable statistics. The next definition was more to my liking for it stated, "To exist as to being able to be found or seen; to be found; to come under observation; . . . ." Here was something to sink my teeth in for we can discuss only those things which are found or come under our observation.

Definitions which adequately and accurately tell us just what occupational diseases are have been the cause of more headaches to the industrial hygienists than the diseases themselves, and I have finally come to the conclusion that these headaches are the most prevalent of occupational diseases.

If we consider occupational diseases from a medical standpoint, a definition would appear to be obvious. Unfortunately, however, except for those specifically occupational illnesses such as certain poisonings, the pneumoconioses, and some infections (such as anthrax), we encounter erroneous reasoning bases on **a priori** reasoning. Diseases now classified as "partly occupational," "industrial illnesses," and other such terms must be clarified.

Weyl insists on the inclusion as occupational diseases not only those illnesses generally caused by the personal activity of the worker, but any frequent manifestation of symptoms affecting a given occupational class. This definition follows closely that of Van den Borght who believes that "occupational diseases are the consequences of long continued exposures to harmful effects in the exercise of a calling, and that they arise exclusively or with particular frequency amongst the workers in a given industry." Gilbert believes that "those diseases which appear in any given calling with an incidence exceeding the normal, as well as those obviously due to occupational risk," should be considered occupational. Certainly these definitions are open to criticism. The inclusion of the statement that the exposure must of necessity be over a long period of time renders those definitions fallacious when one considers wool sorter's disease. We must remember that time is relative and whether we call afflictions which follow short exposures accidents or acute specific occupational diseases, the pathology is none the less dangerous and the occupational etiology remains unchanged.

I can't agree with those previously mentioned definitions for two reasons: One is that I saw a case of lead poisoning in a dairyman and a case of silicosis in a hog sorter. Each of these were proved to be correct diagnoses. The dairyman had been soldering milk cans, holding his face

over the cans, and had been at this work for quite some time. The hog sorter worked in a stock yard situated on the lake front. The ground and floors were covered with sand and the constant milling of the stock had created an extremely dusty atmosphere. This worker had been employed for many years. Obviously the man incurred his silicosis as the result of his job. But, of course, hog sorters usually don't develop silicosis. Am I correct, Mr. Bloomfield, that we were shown a case of a tap dancer who developed silicosis when we were in Washington in 1936?

Mr. Bloomfield: Perhaps so. I don't recall, Doctor.

Dr Smith: If I recall correctly, this chap had incurred his silicosis by breathing the dust from the sand that was sprinkled on the stage when he danced. He had been a dancer for several years and the exertion of his routine entailed deep breathing.

Because of these facts, I again repeat that I cannot accept definitions which insist that an occupational disease must be one which is a frequent manifestation of a certain calling or that it must arise exclusively, or with a particular frequency within a certain industry. "Wool sorters' disease," or more correctly, Pulmonary Anthrax, proves that the exposure need not necessarily be of long duration.

Dr Hayhurst has long since stated that "an occupational disease is any affliction which is the result of exposure to an industrial health hazard," and I read a paper which had been given by an attorney stating that this definition was too loose. From the standpoint of the legal mind perhaps that is true. I don't know. As a medical man it is not too loose to me.

Certainly we have no quarrels over the definition of the word "disease." It is universally accepted to mean any state of the living body in which the natural functions of the organs are interrupted or disturbed, either by defective or preternatural action, without a disruption of the parts by violence, which is called a wound. I often wonder if we are not in the position of those, if I must use a hackneyed expression, who cannot see the forest for the trees. I believe that an occupational disease, after all, is a disease that can be proved, after the exclusion of any reasonable doubts, to have occured as a result of hazardous exposures which the worker encountered in no other place but his place of employment. To me that is adequate and all inclusive.

It may seem that I have taken an undue amount of time to discuss what diseases we can blame on the working environment alone, but it is good for us to take the time occasionally for such thought in order to appreciate the problems that confront our compensation boards and courts, and well as the worker and his employer.

The next question, obviously, would be: What are the hazards which cause occupational diseases? I shall skip that until later in order to discuss the difficulties which face us when we attempt to determine the exact relation between cause and effect, and pass on to the next questions that would arise. Without exception we all want to know two facts. How many workers are exposed to hazards that might produce occupational diseases and how many cases of occupational diseases occur? No less important is the question: What, specifically, are these diseases.

We know from the last census that there were approximately two and a half million gainfully employed people in this state, almost a million of whom were employed in the manufacturing, and mechanical industries and

in extraction of minerals. These three groups are usually known as the heavy industries and health hazards are known to exist in them.

It would seem that if the state required that these diseases be reported in the same manner that contagious diseases are handled our problem of occurrence would obviously be solved. Theory and fact are often not the same. The reporting of any disease believed due to occupation to the State Health Department has been a requirement by law in Ohio for 26 years; compensation has been paid for industrial accidents since 1912, and compensation for certain scheduled occupational diseases has been in effect since 1921. Wherever compensation is paid for occupational diseases, more cases are reported. In Ohio 2,575 cases were reported from the date of the first report (May 15, 1913) to the date when compensation began (August 4, 1921), or an average of 322 cases a year. From the date that compensation began to January 1, 1939 (17.4 years), 23,409 cases have been reported, or an average of 1,245 cases a year. The increase in the number of cases reported when compensation is paid is further shown by the cases of silicosis reported immediately prior to and following the advent of compensation for that disease in Ohio. The law which placed silicosis in the list of compensable diseases became effective July 31, 1937. In 1936, nineteen reports of silicosis were received; in 1937, forty cases, and in 1938, one hundred and forty-one cases.

If we analyze these figures several facts are impressive. Apparently all cases are not reported because of incorrect diagnoses, lack of knowledge concerning reporting, and other reasons, or there must be an extremely small number of actual health hazards in proportion to the great number of workers in this state. It cannot be denied that the influence of compensation on the number of cases reported decreases the value of statistics based on them. Actual field studies have shown that but a small portion of cases are reported. In spite of these disadvantages, reporting is of the utmost importance and should be continued. The field studies, just mentioned, prove that many cases exist unrecognized although work done in large companies proves that the actual incidence is not as great as we would expect. On the other hand, many illnesses are reported as occupational diseases which, on investigation, can be easily proved to have no relation to the work place. When compensation for silicosis was paid, many cases of pulmonary pathology were reported as silicosis and I have received reports wherein the causative agent was given as marble dust, limestone dust, grain, and almost every other substance that is capable of existing in the form of dust.

It is an oddity that such a small amount of consideration has been given to occupational diseases in medical schools, meetings, and public health work. Especially so, since they are not of recent discovery. A discussion of the history of occupational diseases, although interesting, is not of importance here today except to mention that Hippocrates, the father of scientific medicine, called attention to them almost five hundred years B. C., and many other physicians have described, from time to time, some of these afflictions which result from the work processes. Although silicosis is generally considered to be of recent discovery, it was discussed by Georgeous Agricola as early as 1556 and a severe outbreak of the acute type occurred in this country in the early part of this century. Extremely noteworthy is the fact that Ramazinni published detailed and amazingly accurate descriptions of the diseases found in more than a hundred occupa-

tions. This momentous report appeared, not within the past few decades, but almost two and half centuries ago!

What factors have been responsible for the apparent neglect of educational facilities and informative material, lack of interest, and our relatively inadequate amount of statistics? It has often been stated that occupational diseases did not touch public appeal because of the fact that, in the majority of cases, they usually manifested themselves only after a long period of exposure to the hazards. Accidents possess a dramatic quality that cannot be denied. The suddeness of occurrence, the excitement, the crowds that gather, the immediate and obvious damage are all impressive. However, the Silicosis Disaster that occurred at Gauley Bridge and the radium poisonings in New Jersey, because of widespread publicity given them by the press, awoke public consciousness that occupational diseases of tragic consequences occurred. Misconceptions are rampant and misconceptions the rule, unfortunately, concerning all phases of these diseases.

The physical and mental health of every man is influenced almost entirely by those two important factors, his innate characteristics and his environment. Inheritance can play an important part in the resistance of an individual against occupational diseases. For example, it is probably not wise to expose a worker to substance which may damage his blood forming organs if there is a family history showing an excessive occurrence of blood disorders. Other innate factors which enter the individual's resistance are race, national extraction, complexion, sex, and individual idiosyncrasies to certain substances.

The importance of environment can certainly not be denied as probably the most important factor which controls everyone's health. Certainly then, if the worker spends a third of each day in his work place, this environment must of necessity exert a most important influence on his physical and mental welfare either for better or for worse. The question naturally arises what about the other two-thirds of the day? As a general rule most workers sleep about eight hours and it is generally considered that sleep presents no great hazards. That leaves us with eight hours during which the worker engages in all kinds of extra-curricular pursuits. The importance of these extra-curricular activities has not been given the prominence that it deserves in our consideration of an individual's resistance to a hazard that he might encounter at work. As a concrete example I might state that if this worker spends much of his time in the corner beer parlor and does even a moderate amount of elbow bending he has no business working on a job where he may be exposed to many substances used in industry. It is not unusual for as small amount as one glass of beer to precipitate an acuto mania among nitro-glycerin addicts. It is evident, therefore, that a person's working environment and his spare time have combined to weave the pattern of his health.

Other factors which play important roles in the development of occupational diseases are age, long hours of fatiguing work, hard work entailing deep breathing, uncomfortable postures, and all those factors which we usually place in our safety considerations but which one seldom hears applies to occupational diseases. The previous medical history of a worker is of importance also, for instance we would not want to place an employee in a job where he would have the slightest amount of lead exposure if we knew that he has recurrent gastric ulcers. The individual's susceptibility, or an increased sensitiveness to even small amounts of a certain substance

has been responsible on occasions for poisonings and particularly for dermatities among workers.

I realize that many of you possibly expected me to devote a great deal of this discussion to various specific occupational diseases with a detailed account of their symptoms and the occupations and industries wherein they occurred. I know that a few of you have expected me to interrelate the specific occupational diseases with the so-called "partly occupational diseases," quote industrial complaints and conditions and the relation of certain industries and occupations to increased incidents of certain diseases not ordinarily considered as of occupational origin. However, because of the limitations of time and the title of my paper, it is impossible for me to discuss anything but specific occupational diseases. If we were to diverge into the subject of the entire field of industrial health, we could hold as many sessions and have as many meetings as the program of this Safety Congress contains, and then we would have merely scratched the surface.

We have previously stated that the requirement of reporting of occupational diseases is of great assistance in solving the problem of their prevention, even though these reports are inadequate and the diagnoses often questionable. It is natural to ask why we do not study these industries and the workmen therein, thus giving us a complete picture of not only specific hazards, but also their effects upon the employees. This is probably the dream of every person interested in industrial health. However, the magnitude of such a procedure renders it impossible for such a study to give authentic results unless we had the services of hundreds of scientists. It would be necessary to take specific and detailed scientific analyses of the work places for all the hazards that might possibly exist there. It would be necessary for the physician to examine each individual worker, to take a complete medical history, and to do the necessary labratory and X-ray examination. In addition, when we realize that these examinations of both the worker and his work place must be checked not once but many times at specified intervals to determine an average, we begin to see the impossibility of such a procedure. These repeated checks are necessary in the face of the fact that both the working environment and the resistance of the wage earner varies from hour to hour, day to day, week to week, and season to season.

However, we can measure the potentialities of our health hazards by taking a cross section of industry and by what one might call observations learn the processes where one might expect the possibility of hazardous exposure. This procedure must be done by a scientific sampling process to secure a proper balance of plants which had good environments to counteract the opinions formed from those establishments which did not have healthful environments. It was my privilege to participate in such a survey when the Ohio Department of Health made a study which covered more than 3,000 establishments in the heavy industries and analyzed the working environment of 300,000 jobs for potential health hazards. This study also included the recording of control measure when present, welfare facilities such as full time or part time physicians, plant hospital, nursing service, safety directors, shop committees, insurance service and others.

The advantages of such a survey are that we are able to evaluate the potential hazards by listing them as exposures, and to know where dangerous exposures may occur. The greatest value is in the fact that one who has been warned concerning a danger is much more apt to be on guard.

Please keep in mind the word "potential" for without that word we could encounter trouble in a great number of ways.

The disadvantage of such a study, should it be published, is that readers often forget that no attempt was made to evaluate the extent of the exposure to any material listed, and the potential hazards or exposures indicate only that the worker is employed in an environment in which such substances are used or created. One should keep in mind at all times that only by precise medical engineering and chemical examinations of the workplace and the worker can one evaluate the extent of the exposure or its effect upon the worker.

Thus far I have discussed only the factors which bear on the appearance of occupational diseases and methods of approaching an evaluation of the amount of actual hazard that might be present in Ohio industries. Because of the inadequacy of occupational disease reports received and the paucity of information obtainable no one knows how many specific occupational diseases occur from day to day. However, if we take the number that is reported each year, and never more than 2000 a year is reported, and multiply by five or ten times, it is at once obvious that their importance from a epidemiological standpoint is not great in comparison to the two and one-half million workers in the state.

Although these specific occupational diseases may not be important, because of comparative rarity, we must not forget that every case of a severe or fatal nature is a tragedy to that worker and his dependents. The great importance of occupational disease is that it is a wedge that makes an opening for better industrial health programs. It took the Gauley Bridge disaster and the New Jersey radium poisonings to awake the public. In the same manner poisoning is often followed by programs to improve the health of workers. The benefits of such programs are manifold. It is axiomatic that healthy workmen do more and better work. We also know that a healthy worker is less accident-prone, the employer makes better profits, there is less chance of litigation and claims. Labor turnover is always great in an unhealthy environment. Certainly industry realizes the expense entailed in training new men, particularly in trades where expert workmen have spent years in training. Better health programs have always paid for themselves both in money and happiness and it is only through such programs that we can hope to increase our knowledge of the partly occupational diseases and of those adverse environmental conditions which exert unfavorable influences on health.

Because I have taken such a great portion of the time allotted to me in discussing the factors which are important in the occurrence of specific occupational diseases, I hope I have not given you the opinion that we know almost nothing concerning them. This field is no exception, however, for there is much to be learned in all the medical sciences. It is certainly logical that we must have a clear understanding of the difficulties facing us before we discuss these diseases. Another reason for my dwelling on the difficulties which sometimes cloud the picture is that we are all agreed on the enormity of the difficulties that face the compensation boards and courts in evaluating the true relationship between cause and effect.

In discussing the specific occupational diseases from a standpoint of cause and effect it is natural that one should properly classify various hazards which are responsible. An acceptable classification is in the same class with an acceptable definition of the term "occupational diseases". Without excep-

tion the classifications have in general followed the physical characteristics which make up the hazard.

In this classification that I am presenting the first item includes any health hazard which can be classed as a material substance. In other words, it consists of matter. We can subdivide this classification into two main subdivisions, the first of which we might call the non-living substances. Here we find the poisons, irritants, and asphyxiants, such as gases, fumes, mists, vapors, dusts, liquids, and solids. Some of these may act as true poisons when they have been absorbed into the body. Various types of gases are good examples of the difference in actions. For instance, one gas, such as hydrogen sulfide, is a distinct tissue poison, another, carbon monoxide is a chemical asphyxiant in that it displaces the oxygen ordinarily carried by the red blood cells. A third, methane, would be classed as a simple mechanical asphyxiant if it replaced the oxygen in the air to the point where the oxygen supply was not high enough to sustain life. Material substances can also cause occupational diseases because of pressure and friction, causing in the case of pressure, prepatellar bursitis, or "housemaid's knee". The poisons encountered which may cause occupational diseases belong to a group of material substances and exist in one of the forms mentioned above. It is probably timely to mention that there are two very important considerations that we should discuss at this time. Industrial poisonings occur chiefly as the result of entrance of the toxic substance responsible into the body through the respiratory system. Poisoning resulting from absorbtion through the skin is probably next frequent and those poisonings resulting from ingestions of toxic compounds are least frequently encountered. The other consideration is the fact that the clinical symptoms displayed in most cases of industrial poisoning are usually almost entirely unlike those symptoms seen in acute poisonings where large doses have been swallowed or breathed, for example with suicide intent. A good example of this can be seen by comparing the symptoms which follow the ingestion of a large amount of a mercury compound such as bichloride of mercury. Our patient here presents almost immediately the picture of profound shock with a fast and thready pulse, cold and clammy skin which is pale. The patient is usually in collapse with dull and apathetic mental reactions. In "Hatters' Shakes" a chronic form of mercury poisoning seen in the manufacture of felt, we see an entirely different symptom complex. Symptoms do not usually appear until within five years of exposure and are characterized by psychic or emotional changes, muscular tremors, and inflammation of the mouth.

I believe it pertinent to mention at this time that silicosis which as we all know is the result of long exposure to free silica in the form of a fine dust may be classed as the result of exposure to a hazard belonging in this group. We may further state that all evidence seems to show that the cellular response to silica is probably due to a chemical reaction rather than because of the sharp edges of the dust particles. Evidence of this can be seen by the fact that diamond dust and the dust of the harder artificial abrasives do not cause the formation of pathology such as seen in silicosis.

Other harmful exposures that are classed as living material substances are the bacteria, fungi, and parasites.

The next agent in our classification of potential causes of occupational diseases is thermal in character. Here we find extremes in temperature, extreme temperature change, and possibly, temperature and humidity.

Another large group of exposures is that one which includes exposure to radiant energy. In this we can include visible spectrum, ultra-violet rays, infra-red rays, X-rays, radium, and radio-active substances, and possibly one might also include noise.

Abnormal atmospheric pressure such as encountered by divers and caisson workers, and relatively frequent changes in atmospheric pressure such as encountered by aviators may be responsible also for specific occupational diseases.

Fatigue, particularly from rapidly repetitive motions is responsible for many cases of tenosynovitis. A disease affecting the elbows of air hammer operators is alleged to be due to vibration.

It is only natural that it would follow our discussion of exposures which might be responsible for specific occupational diseases with what diseases we have actually had reported in Ohio. As a basis for the frequency I shall use a summary of reports received during the decade 1928 to 1937 by the Ohio Department of Health. These were chosen rather than data from the Industrial Commission in view of the fact that both the compensable and non-compensable diseases are included. This group is comprised of almost 13,000 reports of compensable diseases together with several hundred diseases alleged to be due to occupation although not compensable at that time. The most outstanding feature in our review of these cases is that dermatitis comprises about two-thirds of all cases reported. I believe that at this point we have reached the best time to call attention to the difference betwen the frequency of a disease and the severity of it. I am informed by the Industrial Commission that nearly all cases of dermatitis reported to it indicate that there has been no time lost by nearly all of the workers afflicted. On the other hand, a patient suffering from manganese poisoning is conceded to be incurable and may remain an invalid for many years incurring much expense. Lead poisoning was next in frequency with almost fifteen hundred cases and in turn was followed by tenosynovitis of the wrist with approximately the same number of cases.

Chromo ulcerations headed the remaining compensable diseases reported with the small total of less than 400 or about three percent. It is pertinent that during that period no cases of glanders, manganese dioxide poisoning, or radium poisoning were reported although they were on the list of compensable diseases. No evaluation can be made of the occurence of silicosis in Ohio due to the enormous increase in reports following compensability of this disease, as well as, the erroneous agents blamed for this disease in the reports that were received. Of the remaining occupational diseases reported in Ohio, poisonings comprise a total of less than 900 for the ten year period. Not one of these agents caused one hundred cases. They ranged from 68 cases alleged to be due to benzol or its amino- or nitro- derivatives down to 2 cases alleged to be due to phosporus. It is interesting to note that for many years no reports were received on anthrax until recently when two cases were reported. Among the infections tularemia is increasing in numbers, most of the cases being found in butchers. Please bear in mind that these reports were received during the period when Ohio had a scheduled list of diseases which were compensable. What the future will bring, in the face of our new all-inclusive Act is not known.

Since we have a little time left, Dr. McCurdy, I am wondering if you want me to say anything about silicosis. I think a great many of the men

here are vitally interested in this and there are a great number of misconceptions concerning this disease.

Chairman McCurdy: I think all the men would be interested in it, if you will speak up good and loud.

Doctor Smith: I believe that we should mention first that various types of reactions are produced by the different kinds of dusts. Toxic systemic diseases may follow the inhalation of poisonous dusts such as lead, cadmium, and arsenic. Allergic symptoms may follow the inhalation of certain dusts. A good example of this reaction may be found in the occurrence of asthma in workers who inhale cotton dust. Although some writers include metal fume fever, or "founders' shakes" as the result of the inhalation of zinc fumes and class fumes as a dust, I have never liked fumes being classed as dust. Technically, perhaps, that is true. To me the dusts, as we think of them in industry, are generated mechanically and fumes are the result of subjecting the metals to heat. Any dust, if the concentration in the air becomes great enough may cause irritation of the upper respiratory system and bronchitis. We are not concerned with any of these dusts, however, and shall not mention them except here. They are of no importance in a discussion on silicosis except to call attention to them in passing.

The first and foremost thing that we should remember about silicosis is that it can only be produced by free silica. Silica, or silicon dioxide, has the chemical formula, SiO_2, or in other words two atoms of oxygen have united with one atom of silicon. When we speak of silicosis we usually refer to the chronic form that follows many years of exposure to the dust. In foundry workers, for example, the disease does not usually manifest itself until the worker has been exposed to a harmful concentration fifteen, twenty, or thirty years.

The words, "Pneumoconiosis" and "Silicosis", have often been used interchangably, although incorrectly. Pneumoconiosis means a dusted lung or a disease of the lungs caused by breathing dust. Therefore, it includes silicosis as one of the pneumoconioses. Asbestos is also a pneumoconiosis.

You are all familiar with the definition of silicosis that is given in our law: "Silicosis shall mean a disease of the lungs caused by breathing silica dust (silicon dioxide) producing fibrous nodules and distributed through the lungs and demonstrated by x-ray examinations or by autopsy."

Obviously, only dust from material composed in whole or in part of free silica can cause the disease. Quartz is almost synonymous with silica. Sand is almost one hundred percent silica. Sandstone and granite contain varying amounts. I should mention, too, that the silica in granite is present as free silica mixed with the other constituents and not joined chemically. When free silicon dioxide, or silica, joins and forms a chemical compound by uniting with sodium potassium, aluminum, and the other bases, we know these compounds and combinations as silicates. At the present time only one silicate is known to cause a disabling fibrosis of the lungs. This silicate is asbestos and the disease resulting is called asbestosis. It is interesting to note that silica enters into the composition of many rocks and that about sixty percent of the crust of the earth is composed of these.

I believe that it is certainly of importance to name a few substances which we have had reported to us on occupational disease report forms and which have never been known to cause the disease. Among these are marble, limestone, carborundum and other artificial abrasives, rock wool, glass wool, gypsum, cement, coke, and soapstone. Coal, either anthracite or bituminous,

will not cause silicosis without an admixture of hard rock which contains silica.

The size of the dust particles is of great importance. Only those particles of less than ten microns (a micron equals approximately 1/25,000th inch) are of importance and it has been stated recently that probably only those of less than three microns are of importance. The smaller these particles are, the greater is the hazard increased. Of equal importance is the concentration of these particles in the air. It is generally conceded that five million particles of a diameter not to exceed 10 microns per cubic foot is the upper safe limit in the case of pure silica. However, if the silica is but a part of the composition of the dust, this limit is increased as the percentage of silica is decreased as a general rule. We do not yet know what effect that the composition of the non siliceous dust, or rather I should say that portion of the dust which is not free silica, has in the acceleration or inhibition of the action of the free silica.

Let us take a look at just what happens when dust is breathed. First, nature has given us other protective devices in addition to our natural resistance. Both the shape of the nose and the mucous in the nose and throat may act as traps. In addition, the ciliated mucous membrane of the windpipe responds automatically when the smallest foreign body touches it and those microscopic finger-like cilia contract rhythmically to force the particle up so that it is coughed up. It is believed that only about half the dust that enters the nose reaches the lung.

If the particle is small enough to enter the air sac it stimulates the attack upon it by the "dust cells" or "wandering cells" which pass from or through the wall of the air sac. These phagocytic cells are capable of independent motion and their function is to ingest or surround any microscopic foreign body. After the cell has ingested the silica particle it makes its way through the wall of the air sac and enters the lymph channel. The lymphatic system has been called the sewage system of the body and the dust cell proceeds along with the flow of the lymph. The lung possesses two of such systems which are often called the third circulatory system of the body. One system drains to the pleural surface, this membrane which covers the lungs. The other system, following the blood vessels drains to the hilum of the lung, or that structure near the heart in the center of the chest where the bronchial tube divides into smaller tubes and where the large blood vessels enter the lung. After the dust cell has proceeded along this channel it is killed by the action of the silica and the formation of scar tissue begins at that point. The irritation which has been set up causes a tissue increase in this area resulting in what is known as an exaggeration of the peribronchial markings since the lymphatics surround these tube and blood vessels. This reaction can be seen in the X-ray but is not limited to the silicotic process and occurs whenever there is an irritation or infection in tissue. The fibrous tissue, or scar tissue, which forms where the dust cell dies is characteristic, however. The scar tissue cells form in a circular nodule, the appearance of which under the microscope is not unlike the layer formation one sees when an onion has been cut through. As more dust is breathed and more dust cells die in the lymph channels the flow of the lymph is disturbed until when the flow is blocked no more dust cells can enter the channel. Instead of entering the lymphatic channels the dust cells die on the walls of the air sacs and the fibrous nodule forms there. All these nodules tend to grow and in time, due to their overlapping or fusing, we find massive areas of scar tissue. Due

to the encroachment of this scar tissue on the tubes which lead to the air sacs, we find a condition called emphysema which is due to the otherwise normal air sacs between the scar tissue expanding in size. All this process takes many years to reach the stage where we find the large conglomerate areas of scar tissue. Death is usually due to an intercurrent infection in the lungs such as tuberculosis or pneumonia. In fact death from uncomplicated silicosis is so rare that it is considered an oddity and some investigators declare that it does not occur. Other investigators have claimed that the large masses do not form unless there is infection, although general observation does not show this to be the case.

There are no characteristic complaints or findings on physical examination that are not found in many other diseases. The patient must show an exposure to silica for several years and an X-ray examination is considered to be the most important factor in establishing a diagnosis. Post mortem examination of the lungs clinches the diagnosis, of course.

If one understands the underlying changes that take place, he can readily understand the changes seen in X-rays taken at various intervals of time. In the X-ray film we note the hilum, which I previously mentioned, in the central part of the chest near the upper part of the shadow cast by the heart. We can understand the changes that occur as the disease begins and progresses if we compare the appearance of the films to the changes which occur in bushes or trees when spring comes. In the healthy chest we see the hilum giving the appearance of the trunk of the tree where the large branches appear. These branches, in turn divide as they pass outward into the lung tissue until they fade entirely before they reach the pleural portion of the lung. In early, or first stage silicosis, we find an increase in the trunk and a generalized irregular exaggeration of the linear markings of the smaller branches together with the appearance of tiny discrete nodules of uniform size and evenly distributed throughout the central portions of the lungs. These nodules are not unlike the appearance of tiny buds on the tree. In the typical cases the extreme top, or apex of the lung; the outer areas; and the lower portion, or base, characteristically show few nodules. As the disease progresses the nodules increase in size and the linear markings are intensified by contrast. When the nodules exceed 6 millimeters in size and when conglomerate masses are seen, we have advanced, or third stage silicosis with some loss in the appearance of the lateral markings. In our tree we can say that the buds have burst forth into leaves and the clusters of the leaves have obscured the branches in some areas. I might state, too, that the conglomerate areas can assume almost any shape and appear in almost any area of the lung. They can extend outwards from the hilum, or be wedge shaped and extend in from the pleura, or they can appear as tumor-like masses deep in the lung tissue. All these changes described can occur in uninfected, or properly called simple, silicosis. Infection can occur during any stage and I shall not attempt to discuss it for the experts are quite often misled by the many forms and patterns that can occur. Neither shall I discuss differential diagnosis except to say that many diseases such as miliary tuberculosis, certain fungus infections, cancer, multiple calcified nodules of healed tuberculosis, and others may simulate the appearance. Simple, or uninfected silicosis, does not produce fever, however.

We have been speaking of the chronic silicosis which we designate silicosis unless specified otherwise. In the Gauley Bridge tunneling cases we had what is usually called acute silicosis although we prefer to call it rapidly

developing silicosis. Here the appearance of the lungs was more like that seen in pneumonias and these cases developed in the period of months rather than many years. Some men have expressed the opinion that they were all tuberculosis. How correct they were, I do not know.

Most authorities state that the silicotic is more susceptible to tuberculous infection and that most deaths in silicotics are due to it. Not all of us are convinced of this, however, when all the evidence is brought out and appraised carefully. I might mention that there are two terms often misused. Silicotuberculosis means that the tuberculosis and silicosis are present in the same portion of tissue: Silicosis with tuberculosis is that state where silicosis occurs in the lungs with the tuberculosis affecting lung tissue that is free of silicosis, and the silicotic tissue is free of infection.

There has been much argument concerning the role that silicosis plays in the susceptibility to pneumonia. Our greatest factor in resistance to pneumonia is considered usually to be the antibody content of the blood which is independent of silicosis or lung tissue. However, whether the blockage of the lymphatic channels, which are so important in the resistance to infection of any tissue, plays any great part, I cannot say. Also, whether the outcome of the disease is influenced by the scar tissue replacing normal lung tissue with the resultant loss of that lung tissue and the compensation because of the expanded air sacs that remain, is a moot question.

To estimate the disability one should know several things. What has been the nature and extent of the exposure? What has been the individual resistance of the particular worker to that exposure as shown by repeated examinations, and particularly when these examinations have been compared to repeated examinations of other workers who have had the same exposure? What protective devices were used and were these maintained properly and functioning efficiently? The answer to these questions entail precise histories, dust counts, and much other study. In addition there must be a careful physical examination and an X-ray or several X-rays. The technique of the X-ray exposure must be flawless or misleading factors enter.

In conclusion, we can say with assurance that silicosis is of importance to the victim, and I do not care how far it has advanced, only when it is the cause of change in his ordinary way of living. I believe that covers most of the important medical aspects. Is the picture clear?

Chairman McCurdy: I think in discussing this, if there is any discussion, we should keep away from discussing at this time anything to do with the control of the occupation disease hazard because Dr. Bloomfield probably will clear up those points that are troubling you.

I wish to open this discussion with a man who sired this whole business of arranging for an occupational disease law. He not only sired it, but he was present at its birth. I would like to hear first upon the evolution of the occupational disease law as it stands today. My good friend, Mr. Tom Donnelly, Secretary of the Ohio Federation of Labor.

Mr. Donnelly: I didn't expect to participate in a discussion, because I participated for so many years before the General Assembly. I was on the floor from 1921 until 1939, before we finally got what we thought was the proper silicosis and occupational disease law in connection with workmen's compensation.

Now of course we have had a great many battles about silicosis. At the beginning we were told that if we compensated for silicosis, we would be forcing the employer into compensating for diseases that really had no rela-

tion to the silicosis, because we would be compensating for consumption and pneumonia and a number of other things. Fortunately about the time the Act reached its greatest strength, I believe, the medical profession discovered there was a manner in which they could take X-rays of lungs and from the X-rays they could show whether the person was suffering from silicosis causing the disability or from something else. Now of course I presume in the old hand tool days, with the small objects and everything and before we had gone into different chemical industries and we used so many different kinds of metals in industry, that there was very little occupational disease such as we know it today. Of course as a representative of the Ohio State Federation of Labor, it has been my duty to endeavor to have the compensation laws in Ohio changed from time to time to meet new situations which we thought required the application of workmen's compensation principles to disabilities and deaths. I am rather at a loss what more to say, except that I have had a great passion over a number of years to bring the representatives of industry and labor together here upon the question of legislation.

There is really no excuse for the occupational disease law we got in 1921, when industry and the representatives of labor could just as well have agreed upon a real occupational disease compensation bill. Now if you have observed the history of this country, as well as the history of this state, you certainly must have observed the progressive side of this proposition, speaking generally from the side of Labor. It has been upon the side of Labor, because it was the laboring people that were getting hurt and getting killed by industrial accidents and by industrial diseases. Naturally the man who is not working in those places and does not contract those things, can't be as progressive, you might say, in trying to present to the General Assembly of Ohio laws that will compensate, nor will he be quite so arduous, in many cases, to see that these hazards are removed by engineering methods.

Now, silicosis has got everybody pretty well scared about this time all over the United States and there has been a great deal of it registered since we had compensation for it. I served on a committee, governmental committee, some few years ago, in which we made a report to show that much of these dust diseases, like many other diseases of industry, can be to a large extent controlled and to some extent eliminated, so that industry will not have to bear the cost of compensating for a lot of diseases that are caused by dust.

Of course there are many dusts beside silica dust. As I said before, I hope to live long enough—I am getting pretty well to the end of the road—I hope to live long enough that when these laws are put on the statute books, some situations as have come up in relation to occupational disease, workmen's compensation, perhaps unemployment insurance, perhaps something else, that the persons who are affected vitally by it, industry and labor, will have common sense enough to sit down around a table and work it out, rather than put it into the Legislature of the state where there is not one man, perhaps, in ten, who understands the problem you are trying to solve.

Chairman McCurdy: Thank you very much, Mr. Donnelly. Now the opening talk is opened for discussion by anybody. I am going to call upon one more man and one man only, to start the scientific discussion, if you care to call it that, although it must not be limited to that. You should ask the questions you want to know. Dr. Hayhurst, who was so many years with our Board of Health, perhaps will open the discussion.

Dr. Hayhurst: Dr. McCurdy, and those present: I haven't had time to prepare anything or see the thing through, from the very large coverage that Dr. Smith gave to his subject. My general experience, if I got one of his points, is that occupational diseases are not as frequent as he indicated. The specific occupational diseases are rather rare. Those that are partly occupational are pretty extensive. I doubt, taking it all through and through, whether more than twenty-five or twenty-eight per cent of all workers, for instance, exposed to silica, will develop silicosis, which means that there are from 70 to 75 per cent of those equally exposed who will not develop it. As persons get older, particularly with silica, they are more apt to get it, so that we find as many as half of those who are over forty years of age beginning to work with silica who develop it. I wish you had allowed us to say a word about the controlling feature. I can't sit down, without mentioning something which I think is very essential, and that is that we must have pre-employment and periodic health examinations, before we can control the health problem in industry, not only the occupational disease problem, but the health problem.

Mr. Benedict, the Aluminum Company of America: I just wondered whether exposure to large volumes of dust, as for instance iron oxide, have any effect upon the respiratory system.

Chairman McCurdy: Dr. Smith, can you answer that at this time?

Dr. Smith: There have been various limits set for any dust as a nuisance dust, whether it is health hazardous or not. When we get in the nuisance dust up to a hundred million particles per cubic foot, we run the danger of upper respiratory irritation, and of bronchitis. However, iron oxide has entered the field in another way. There have been pictures, X-ray pictures of chest of electric welders, electric welders using bare electrodes. Dr. Ensler reported that the pictures were perfect pictures of silicosis; in fact, they fooled the experts. The nodules are not due to scar tissue, but due to a deposit of pigmentation of the iron. No disablement has ever followed any of these cases. The case I am thinking of was autopsied because of, I think, an accident or an intercurrent disease of some kind.

Does that answer your question?

Mr. Benedict: Yes.

Chairman McCurdy: Come forth with any questions of things you want to learn, and ask them.

H. H. Henry, Otis Steel Co., Cleveland: Does the nodulation caused by a deposit or the effect on the lung—I understand, as you stated, it results in a similar nodulation to the silica condition—does that throw the one affected more susceptible to a subsequent infection, as I understand it, from a silica deposit? I probably worded that a little clumsy.

Chairman McCurdy: I think I can say, if everybody agrees with me, the last article upon the subject seemed to indicate this arc welder's dust upon the lungs which appeared like silicosis did not behave like silicosis. In other words it did not seem to be a cause of death or incapacity and did not seem to quicken the action of other sicknesses. Will you agree with that, Dr. Bloomfield?

Dr. Bloomfield: I don't know so much about the arc welders, but as far as aluminum oxide exposure, which the gentleman also asked about, studies have been made which indicate there is apparently no disabling fibrosis of the lungs associated with aluminum oxide exposure.

Chairman McCurdy: Recently in talking with the Medical Director of Ontario, I discovered that they are experimenting with aluminum in an endeavor to diminish the activity of silica dioxide. That might be all right, but in the present state of our knowledge, it probably will be wiser to pursue the course that Dr. Gardner recommends, get rid of the dust and then you won't have to give something to overcome the possible ill effects of the dust. Have we other questions on this general subject?

Dr. Smith: Dr. McCurdy, isn't it quite an explosive hazard in the way they use that dust as a protective feature, or not?

Chairman McCurdy: That I can't tell you.

Chairman McCurdy: Will you give us your name please?

Philip Carey: I was just wondering if you had any experience of pneumonia from a sudden dust condition such as an explosion, where you might have dust for a minute or two, possibly hot dust?

Dr. Smith: I believe there is such a thing as dust pneumonia. As I mentioned, the acute silicosis cases are probably that. I don't recall, except cadmium salt, but we know that many irritating fumes and gases cause pneumonia. We know, for instance, that a person who had been overcome by carbon monoxide which was a part of smoke, quite often developed pneumonia afterwards during his recovery. Does that answer your question?

Mr. Carey: Yes, sir.

Mr. Gordon Richardson: Can cases of silicosis be permanently stopped if the patient is taken from the dust-laden atmosphere?

Dr. Smith: I don't know that you could say. In general they usually tend to progress, probably, from the start. Dr. Hayhurst could probably answer that question.

Dr. Hayhurst: Yes, for two years.

Mr. Shaffer of Dayton: The thing that is given the greatest attention is the occupational dermatitis. I think if Dr. Smith would just give us an idea of what he would classify as an occupational dermatitis, and how we can differentiate that from other skin ailments we come in contact with, it would be a big help. A few years ago we put great faith in the patch test. Now I am told by the skin specialists it isn't worth the trouble of going through it. What are you going to believe? You have something diagnosed as eczema. There is no such thing as eczema. In industry it is all occupational dermatitis. I am at a loss, being in this work, to know how you are going to come to the conclusion of what is a skin occupational disease as such.

Dr. Smith: I imagine the first procedure would be to remove the person from that job to see if the thing disappears and then put him back on it to see if it recurs again. That would suggest itself first to me. I am reminded of a series of cases, I believe McCord reported, in which a whole group of employees of one company developed a dermatitis. They looked everywhere and couldn't find any cause for it in the plant. It developed these men had started a community garden and they were getting it from materials used in the garden. It is easy to be misled, I will grant you. Dermatitis is a headache, all right.

Chairman McCurdy: Are there some other questions?

Mr. Donnelly: I would like to ask one question in relation to dermatitis. It is well known but it might be well to bring it out. Isn't it true machine

shops and other places are the prime causes of this dermatitis, industrial dermatitis, through the use of cutting oils?

Chairman McCurdy: I don't know whether I should answer that or not. I think there are incidents in which it is true, particularly those plants which use oils over and over. I remember some years ago, I ran into that in trying to study the thing out and get my mind straight upon it. It appeared at that time most of the firms were giving you a practically sterile oil to start with, but whether it remained sterile or not was another thing, particularly in those industries which used it more than once and particularly in those industries where, perhaps, in the use of it, neither workmen nor the machinery were kept in a good, clean manner. I think there is no question but what we all feel that there are industrial dermatoses which do come from cutting oils. There is no question about it.

Dr. Smith: As a matter of fact I know in the year 1937 and some other years dermatitis, as I said before, led all occupational diseases. As we know, the greatest cause of dermatitis, far above the others, was oils and cutting compounds. I have quite often been amused going into factories where they had an outbreak of dermatitis from cutting oils, cutting compounds, and men chewing and spitting in the oil and they had a common piece of waste or towel. I have seen several of these clear up, after this oil has been sterilized. We know unquestionably that there is bacteria in the oil. If you sterilize the oil, you stop the outbreak, providing the men don't spit in the oil and don't use common waste.

Mr. Gongiver: I wonder if there is any record of a case of silicosis resulting from dust spice.

Chairman McCurdy: I think I can answer that. There should not be, because you have to have silica present. There certainly should not be any silica present in a pure spice unless it has been in contact with some contaminating subject. I can't rule out contamination. It might happen in connection with the spice, if you have a foreman along the line, in the handling of spice, introduce silicon dioxide.

Dr. Smith: Now it is my turn to ask a question. I would like to know if anyone here has had much experience in the use of sodium silicate? I have seen a couple of cases of pulmonary disease blamed on it. The first case I remember in particular. I believe Dr. Kistler saw it with me, but this chap had prominent lesions that were almost typical of a very advanced tuberculosis. We made the remark at the time it was unusual he didn't have any fever and that it wasn't a picture of advanced tuberculosis, also from the symptoms. I saw another one later. I asked Dr. Gardner at the time if he had any experience with sodium silicate and he said yes, as soon as he injected it in any of his animals, it knocked them off right away and he would appreciate any information anyone has here who has been using it. This first man incurred his lesions by chipping sodium silicate in a tank car, if it was from sodium silicate. We have no proof to think it was. Sodium silicate, according to Dr. Gardner, is certainly extremely toxic.

Chairman McCurdy: It gives me great pleasure to have the opportunity to introduce to you another authority upon this subject, who has selected as his topic "Control of Occupational Disease Hazards."

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

CONTROL OF OCCUPATIONAL DISEASE HAZARDS

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

Mr. Bloomfield: Mr. Chairman and ladies and gentlemen: Sitting here this afternoon and listening to the remarks of your chairman and your first speaker made me feel very much, I suppose, like the Finnish Army felt in their recent campaign in Finland when they sat around and watched their ammunition being frittered away. I am thankful to Dr. McCurdy for having limited the discussion to the occurrence of occupational diseases. I still have a little bit of ammunition left. I want to say at the outset that I am very grateful to the Industrial Commission and to the members here of the state agencies for having given me this opportunity to come here and appear before you, because I think it is a rare opportunity to attempt to give you our viewpoint concerning the whole problem of workers' health. Now it appears that definitions have been the order of the afternoon. I won't disappoint you. I will also attempt some definitions. I can't say that I went to the dictionary for mine, but I have tried to give this subject a little thought and it occurred to me, after reviewing the entire subject of occupational diseases, that we were still in a rather chaotic state. Just think of the predicament in which a large industrial concern must find itself, and I have noticed there are several people here affiliated with large concerns, large industrial concerns, mind you, that may have thirteen, fifteen, as many as one hundred plants scattered over these United States. In some of their plants they don't have to do anything at all about the problem, for instance, if they happen to be located in Arkansas or Mississippi, where there isn't even an accident law. Arkansas passed one, but it has to come up for referendum. In Michigan they have a schedule of 31 different types of occupational diseases. Again, you might be in Ohio, where your last Legislature has practically created a condition which calls for an all-coverage law. Today you have only twenty-three states that compensate for occupational diseases. thirteen of which have a so-called scheduled law, varying from one for silicosis in West Virginia to thirty-one in Michigan, and ten have the all-coverage law such as in Connecticut and Ohio, and even in these, mind you, you don't have any unanimity in definition, I suppose, because we shall have a lot to learn about the question of the nature and effect of occupational diseases.

Just for example, let us look at some of these definitions. I want to go into that a little bit, if you will allow me, for the simple reason that I think we ought to understand, after all, so you will know what I am talking about and I will know what I am talking about. In Connecticut they say the word "occupational disease" shall mean a disease peculiar to the occupation in which the employee was engaged and due to causes in excess of the ordinary hazards of employment as such.

It is not the intent to compensate for all types of ills. I think the legislatures have attempted to compensate for only these conditions that arise cut of the occupation. In Illinois you have practically the same wording. They said the word "occupational disease" means a disease arising out of and in the course of employment, and they also, in addition, say ordinary diseases of life to which the general public is exposed outside of the employment shall not be compensable, except where such diseases follow as an incident of an occupational disease, as defined in this section

So you see you have all types of ideas of definitions and practically no two are alike. If you were a personnel manager or a medical director or a safety engineer of a concern operating in several states, you would have to place this program more or less in each, because, as I have indicated, it isn't my intent to discuss compensation laws or discuss the relative merits of general coverage versus scheduled coverage. That isn't the point I am trying to make at all. We have authorities on this subject and I think some of them spoke on the subject this morning at some of the sessions.

All I want to do is simply start out and tell you that we ought to define our subject, and secondly that I think—perhaps this will cause a lot of disagreement—perhaps we have over-emphasized the whole question of occupational disease, to the detriment of a far more important problem, and that is the health of the worker in general.

Occupational disease is really only a part of the story. Accident control is only a portion of the whole problem of industrial hygiene. I am very grateful to you, Dr. McCurdy, when you started out in your opening remarks this afternoon and said perhaps we have been using the wrong terminology, and perhaps we should do what the public health people do and that is, consider the entire problem of adult health among workers. Therefore I would like, as a prerogative of a speaker, to more or less change my subject, instead of confining myself to the control of occupational disease hazards, I would like to discuss the control of health hazards among workers.

At any rate you are here, and those of you who don't want to hear me discuss this whole broad subject, I suppose, have the privilege to walk out on me. I am serving a warning now that I am not confining myself to the subject of occupational disease control alone, but I shall cover it. I don't want to minimize it at all. It is very important, as you will see, but I would like also to take this opportunity to call your attention to some of these other problems.

Before I begin to discuss control, I would like to amplify a little bit what Dr. Smith has said and discuss some of the problems we have in this country. I am not confining myself to Ohio. I necessarily will try to discuss what information I have of the country as a whole.

First, before we discuss control measures, I would like to discuss first the problems confronting us today. I should judge those problems that are common to a nation are probably just as prevalent in Ohio, to some extent anyway. Therefore I would like to have the lights turned out. Let us begin to talk from the slides.

Before we do that, however, I would like to say this, that our aim in industrial hygiene should be the protection and the improvement of the health of workers. You can take that as a definition if you like, although we don't need to be dogmatic about it. That is really our aim as industrial hygienists, plant engineers, safety engineers. Wherever we may happen to be, our first interest should be the improvement of the health of the worker.

I am reminded of a slogan you have up here, "Safety is Better Than Compensation." That is just what I mean. May I have the first slide, please?

First I would like to indicate what we mean by industrial population in this country. As a rule when you speak of industry, it connotes manufacturing, mechanical or mining. Well, we have more persons working in some other pursuit than we have in manufacturing and mining alone. In these industries you have health hazards too. There are about fourteen million men in manu-

facturing and ten million in agriculture. If you think there aren't any problems in agriculture, you are mistaken.

We have just completed a study, which cost something like one hundred and fifty thousand dollars, on the health of orchardists who use lime arsenic for sprays. We found a good deal of lead poisoning and arsenic poisoning among some workers, depending on years of exposure and dosage they were getting. So we have their problems. We have them in connection with cricket control and in connection with some of the other insects. Then of course we have accident hazards. You know about those, probably as well as anyone. Then we have about six million people in trade and we have four or five million in domestic and personal services, transportation, communication, four million; mining, one million. Altogether we have close to fifty million persons. This is based on the 1936 Bureau of Census reports. I think we are not so very far off today. We have something like fifty million people in this country. We are directly concerned in Ohio with, I believe, two and a half million. We have on those, dependent upon them for a living, practically the entire nation. Really industrial hygiene should be of great concern to those who are entrusted with, let us say, the welfare of this nation and health of this nation. That gives you some idea of the magnitude of the problem, from the standpoint of numbers.

Now what about the magnitude and scope of the problem, from the standpoint of health? May I have the next slide, please? I am going to show you one slide on accidents and that I am showing simply to indicate, according to the best information we have, only four diseases are in excess of accidents in their rate for both sexes. However, when you come to males, there you have the majority. The majority of males are employed in industry. Only heart disease exceeds accidents in the number of deaths per hundred thousand. In females the accidents are 'way down the list, as you would expect, so accidents are still a problem in this country. We have made great strides. There is no question about it. You gentlemen have contributed to the advances that have been made in the control of accidents, but we still had, last year I believe, seventeen thousand occupational deaths in this country. I believe the last statistics give about the same figure. I think it is sixteen thousand five hundred.

It is true that in 1913, when the accident movement came into being, we had something like thirty-five thousand deaths. If we had maintained that same level, we would have lost 300,000 more lives than we have, in spite of the fact we have more people working than we did in 1913. We still have a large number, at that. We still haven't gotten down to what is known as the irreducible minimum in accidents. We know that from special studies made by the Bureau of Labor Statistics in the steel industry, that contrasted accident frequency and severity in compliance with good practice as against the average. The rate for good practice plants was 8.1 in terms of man hours of exposure as contrasted to 18.1 in those plants that didn't have the best engineering and other pratices, so you see we still have got a long way to go.

So much for accidents. How about occupational diseases? If I may have the next slide, you will see from statistics of Ohio, which I got from reports of the Ohio Division of Safety and Hygiene, from 1928 to 1937 you had close to 13,000 compensable occupational diseases reported in this period. You can see of course that the bulk of them were dermatitis, skin diseases, probably fifty to seventy per cent. Then you get some idea of the number of lead poisoning cases and how lead poisoning is still about the same as in 1937. As far as the report is concerned, mind you, this may only represent ten or fifteen per cent of all cases that may have occurred. I don't know. I am con-

fining myself to these statistics. You still have 195 compensable occupational diseases reported for lead poisoning against 180 in 1928. Now I am not going to take any great deal of time in discussing this particular slide. All I want to indicate to you is that we still have occupational diseases in spite of what I say that occupational disease is not the only problem. It is still a problem. We must still do something about these diseases. 50 or 70 per cent are of skin origin, that is, occupational dermatitis. At least, that is what they are diagnosed as. My friend over here, who asked that question a while ago, made exception to that and I can't answer it. I would suggest you can get a pretty clean-cut book on that from Dr. Schwartz, Public Health Service, who is a specialist on industrial skin diseases. I am not plugging for his book or him, but he has written a very good book on skin diseases on American industry. You can get it at the library probably, unless you want to spend ten dollars.

So we have accidents and we have occupational diseases. Now, what else do we know about health problems of our workers? Before we begin discussing control, let us spend a few minutes on this. We know from hundreds of thousands of physical examinations, made on workers (and we have made many of them ourselves in the course of our investigations in industry over a 25-year period), that those who work in heavy jobs, unskilled and semi-skilled, have a far greater rate of physical defects than those, let us say, of the white-collared class. We know, for example, from the studies made by the life extension institute, that one hundred thousand workers were examined by some nine thousand of our physicians over the country. If you divide the results on those people in four groups, you find that your people in the laboring classes have more defects, with the exception of two items, hypertension and eye-conditions, than do the people who work on farms or, let us say, at clinical jobs or certain professional jobs. We know that to be true, from many studies that have been made. Where the job has something to do with it, that has to be investigated still further. The fact is, here you have a group of workers with this condition, and I think we are all interested in my side. I think you are concerned. After all, you are interested in having a healthy worker, one who will not increase spoilage and cut down production, one who is not going to be accident prone and one who is not going to be suffering from occupational disease because his physical condition may predispose him to occupational disease. So we are concerned with that problem.

As Dr. Hayhurst brought out and as I shall bring out, your health examination is a very important step in the control of that situation. In other words, we have to know what these physical conditions are, before we can correct them. That is the next step in the correction of these various difficulties. I can give you an interesting example in the value of physical examination in raising the level of the workers' efficiency in health. Misler in Chicago reported where he examined in about 1935 several thousand men and found a certain number of defects. I have forgotten the number, but I believe it was 42 per cent or thereabouts, that had certain physical defects. Those men that stayed on the job, most of them went to their private physicians and had some of their defects corrected, hernias patched up, eyes corrected, glasses given, teeth repaired and so on. Three years later Dr. Misler examined, I think, 508 of those older men and he found practically all of them had had their physical defects corrected. There were only, I think, three that they couldn't keep on the same job because of old age, and the disease having progressed so far that they had to put them on some other work. So much for that part of it. (Let us have the next slide, please.)

We will now come to mortality rates. What do we know about occupational disease mortality? You can see from a study made by Whitney in some ten states that the skilled worker has the highest mortality from all causes anywhere up to two hundred or a hundred and seventy-five per cent in excess of all the other occupations. Only when you come down to suicides do you have anything leading the list. Of course, you can see why. Probably the depression had something to do with a good many of them jumping out of their windows because their stock went down or something else of that type. But practically for all these diseases of the heart, tuberculosis, respiratory system, cancer, nephritis and so on, skilled and semi-skilled workers have high occupational death rates. This has to do with sickness.

We have been collecting sickness statistics for many years from the public health service, from some of you gentlemen here. We analyze them and we find, after many years of data of this sort, the leading cause of illness is the respiratory disease. It is something like 42 per cent of all illnesses, of all lost time. Next is digestive disturbances at 13.12 and internal causes at 9.9. Those three diseases alone account for more than two-thirds of all the lost time due to sickness. (The next slide, please.) That gives you some idea of the accident record in this country, the occupational disease story, physical condition of men, mortality among industrial workers, morbidity or sickness among industrial workers. What is the relative importance of all these things?

From limited studies that we have, such as this one here, the American College of Surgeons, such as our studies with the Boston Edison and some other public utilities, it appears for every day a man loses due to an accident or occupational disease, he loses fifteen days due to sickness.

Dr. Newquist, in his study, put the amount of time lost at .59 due to industrial injuries and non-industrial injuries at 8.85, a ratio of 15 to 1. Our study for the Boston Edison Company over a 20-year period shows a ratio of 14 to 1. Now to me this is very striking information. To me the implication is that if we are going to do a real job in industry in the control of health hazards among workers, we not only have to consider accidents, we not only have to consider occupational diseases, but we have to consider the general health status of the worker. Mind you, don't misunderstand me. I don't mean we have to compensate him when he has nephritis, which may be due to other external causes. We don't have to compensate him every time he has a cold. That isn't the question to us men who are interested in preventing whatever the man is suffering from. We ought to make some attempt to prevent that, prevent that loss of time, because it costs us money.

How much money does it cost us? As I told you earlier, we had in 1938, 17,000 occupational deaths, 75,000 permanent disabilities, 1,400,000 temporary disabilities. Medical and hospital services were estimated at a cost of about seventy-five million dollars in that one year and a quarter of a billion dollars for compensation. I think New York State alone pays out twenty-five million or so a year for compensation.

Now if you add to that some of your costs of minor injuries, your many indirect costs, loss of wages, spoilage and decrease in efficiency and production and so on, you had a staggering total. About five billion dollars a year it is costing the nation for this sort of thing. Now when you begin to talk in terms of billions of dollars, you are talking in terms of the national debt. Why don't we try to save some money by investing it in good preventative programs? Why don't we spend it as an investment that will bring returns, as I will indicate later.

All right. So much for the importance of the problem of the health of the workers and the socio-economic implications. I hope I have convinced you the health of the workers plays an important role in the causation of the disability, of dependency and perhaps in security. What are we going to do about it? What can we do about the control of health hazards? That is what you have asked me to talk about.

Perhaps I shouldn't have taken all this time to give you this background. I couldn't miss the opportunity. Well, of course you are familiar with what you are doing. Industry is doing a good deal in the prevention of these conditions. We are asked to consult with industry on these problems. Therefore I am not going to go into a harangue about what industry is doing. Neither am I going to pass out any left-handed compliments to industry nor the reasons why they are doing these things. That is beside the point. That is incidental. In the practice of industrial hygiene, I have already told you the general aims are to protect and improve the health of the workers. That can be done, if you keep in mind three principles. The first is medical and surgical care to accomplish prompt restoration to health and earning capacity following industrial accidents or disease. The second is the prevention of disease or injury in industry by the establishment of proper control over industrial environment. The third is the education of employees about healthful living both in and out of the industrial environment. Those are three cardinal principles, taking care of the man as soon as he is injured, preventing disease or injury by controlling the environment and then educating the employee as to personal hygiene, as to adult health.

What are some of the functions, what are some of the ways in which you can achieve these things? Well, I have a whole list of them here. I am going to read them off.

First is the regular appraisal of plant sanitation.

Second, periodic inspection of occupational disease hazards.

Third, adoption and maintenance of adequate control measures.

Fourth, prompt and early treatment for all illnesses resulting from occupational exposure. We are not trying to sell socialized medicine.

Sixth, reference to the family physician of individuals with conditions needing attention, cooperating with the patient and his physician in every practical way to remedy the condition.

Seventh, uniform recording of absteeism due to all types of disability.

Eighth, impartial health appraisals of all workers.

Ninth, provision of rehabilitation services within industry.

Tenth, the conduct of a beneficial health education program.

Now these are the principles recently enunciated by the Council of Industrial Health of the American Medical Association.

Now with reference to more specific steps in the control of industrial health hazards, I think the first thing industry can do is to sort of develop a viewpoint just like they developed a viewpoint concerning accident control. They say it is cheaper to control an accident than it is to pay for it. The same thing applies to health hazards. You will find it is cheaper to control them than it is to pay for them. Once you get that viewpoint and begin thinking about it and wanting to do something about it, then you are going to get somewhere, but until management itself is convinced of the value of this sort of viewpoint, the people who are trying to accept something, are not going to get far. So your first job is to convince the management.

Now I have just outlined to you what a medical control program consists of, complete control program in industry. I would like to discuss for a little bit, some slides about engineering control. I hope you will bear in mind that it is not possible for me, in the time allotted, to go into the various specific details of engineering control. I can't go into a discussion of hood design. Neither can I go into a discussion of general ventilation, air conditioning and so on. The best I can do, in the time allotted to me is to hit the high spots, and that is what I propose to do. (May I have the next slide, please?)

Now one of the first principles or one of the first things that I think a man who is entrusted with the control of health hazards should think of, if it is a harmful agent, is do I have to use that agent.

First, phosphorous poisoning was eliminated by using a harmless compound instead of phosphorous compound. Here are some results of a study we made in 1930, of probably some of your plants, in connection with sand blasting, a study made in cooperation with the National Safety Council. You can see here exposure to workers, in sandblast rooms, using sand in contrast with steel. When you use sand, the amount of dust in the room itself is around a billion particles per cubic foot, and if you bear in mind, five to ten million is as much silica dust as one should tolerate, you can see how excessive that is. No one would want anyone to work in this. That which is associated with silicosis is 42 to 98 per cent sand. On the other hand, when you use steel, the dust count is down 155 and counts only about 3 per cent, that comes off, adherent sand, from the casting.

These are facts you can't sweep aside. By using steel abrasives instead of sand, where you can, you decrease your dust concentration, decrease your silica exposure, and you don't place as big a burden on your respirators and your protective devices. You still need your helmet, of course. (The next slide, please.)

That is an example of substitution. We are not very fortunate in resorting to substitutions. We can't always use it, but bear in mind that no matter what the hazard is it can be controlled somehow or other. There is some way of doing a job safely, no matter what the job happens to be. We are producing lead safely today without any lead poisoning. You all know what happened back in 1924 and 1925. Here is an example of isolation against sandblast. We show the ideal sandblast tables and cabinets. Here you can see a well enclosed sandblasting operation properly designed and maintained. That is important to get your dust concentration lowered. These figures here (indicating) I don't have to read to you. They are obvious. That is the third principle in connection with dust, wet methods. (May I have the next slide, please.)

You will see a contrast between drilling dry or loading dry and drilling and loading wet. This happened to be a rock drilling job in some mines we studied several years ago (indicating). You can see a decrease in dust concentration, silica dust. Even this is too high. With certain other types of dust, coal, anthracite coal, soft coal and some of your other dusts, this would be ample protection. So you can see what you can do with wet methods. I would like to show you pictures of wet methods. I would like to show you three slides.

Here is a driller in a mine. This happened to be taken in South Africa, drilling dry. You can't see the driller, but he is there nevertheless. There is so much dust there.

The next picture shows your same crew. Here is your darkey over here. The water is coming in through the part of the drill steel. (The next slide, please.)

This slide shows the same operation with water coming out from external sources, from the outside. There is your water pipe there (indicating). That shows you what you can do with wet methods underground.

Now perhaps the fourth principle—in general there are about five methods of control by engineering methods—perhaps the most applicable and universal type of control is that of exhaust ventilation, removing the substance at its source just as fast as it is being produced.

Here you see a granite cutter using a tool with no control and you can see how much dust his nose is surrounded by. He is getting several hundred million dust particles. The next slide shows a control system. These are by courtesy of the Division of Safety and Hygiene of Massachusetts. This is for the same type of job. Flexible hoods, branch pipes, hoods, flexible pipes, main lines, certain amount of air moving through those hoods in a minute. I will show how much you can remove dust concentration because the air is safe.

The next slide shows a granite cutter with a different type of tool. He is working outdoors and still surrounded with a great amount of dust. The same operation with an exhaust hood. It is not in place, but that is the type of hood you can use and remove dust as fast as it is being formed. This indicates another method of controlling dust in drilling operations. Whether outdoors or quarry excavation or building construction or whatever it may be, it shows you a so-called dust trap. That is the dust trap, this part over here (indicating).

This is drill steel here (indicating). This is the exhaust hood (indicating). You can't see any dust at all. (The next slide, please.)

That shows a picture of a dust controlling system in use. Here is where your dust is removed (indicating). Here is your fan (indicating). You are not re-circulating dust, taking it away from one place and putting it someplace else. This shows one of the drilling operations, vertical drilling (indicating).

The next one is a job with a dust trap in place. They work quite well. You can keep the dust concentration on that job materially down to about five million particles per cubic foot of air. This gives you some idea of the minimum air velocity which is required to give us dust. We have more data than that. This is all we can put on a slide. On granite cutting such as I showed you on that slide, 200 feet at the point of origin or 1500 feet at the hood will keep the concentration down to a safe level, determined by dust sampling analyses. 400 feet in quarry and mining, 600 feet on horizontal drilling, 200 cubic feet on vertical drilling, that is the amount of air necessary to keep the concentration down to a safe level, and so on right through. I am not going to take time to discuss. That data is available.

Now we come to respiratory protective devices. I hope every man, every company selling respirators, exhibiting them down here, will recognize theirs. We don't want to be partial. We attempted to show as many as we could that were approved by the United States Bureau of Mines. I think everyone is there. If we left you out, it is not because we meant to. We are not plugging for any one company.

This will give you gentlemen some idea of the various types of respirators now in use. If all these other methods I have indicated to you have

failed, perhaps you should try to resort to respiratory protective devices and protect the man against the material by the use of respirators, when necessary. That shouldn't be the first line of defense. I don't think you should use respiratory protective devices, no matter what it is, if you can do the job better with exhaust ventilation or substitution or enclosure. There are some jobs of sandblasting, for example, where you can't do without a respirator at the present time. Within the limitations of our present engineering knowledge, no matter how much air you move through your sandblasting room, you still have to have a respirator. This shows you how we test a helmet (indicating). This is a sketch right on the job.

I won't go into detail here. We determine the amount of dust that man is inhaling with the respiratory protective device in place. So much for control. At the present time many states, as you know, are developing codes dealing with the removal of noxious air-borne materials. Although we have had codes in existence in many states for some time, it is only within the last few years that our engineering knowledge has been brought to a state where such codes may be developed on a more scientific basis. We have what data we need. We have plenty of data. We know how to control occupational disease hazards. There may be a new one creep up, but give us time and we will work out a control for that. If you resort to a medical control program, an engineering control program, by some means or other you ought to be able to hit that occupational disease hazard that comes up. Again I will say a good slogan is, "Every job can be done safely, no matter what that job is." We are developing codes, good practice standards, that are based on scientific fact. Don't think for a minute, if you put in a system of this sort as a control program, medical examinations and engineering control and all the other things I have mentioned, that your job is done. Your job isn't done by a long shot. You are going to have to exercise constant vigilance, constant maintenance of equipment, constant education, before you will be able to have healthy workmen and eliminate those conditions I mentioned to you in my opening remarks.

Before I close I would like to give you some idea of what we are trying to do in the United States Public Health Service to foster and promote industrial hygiene in the United States. We are not asking industry alone to hold the burden, or labor, or anybody else. After all, industry has to solve its own problems, but it may be aided by official agencies when it so desires. All that an official agency can do is to stimulate industry and help industry do it by giving its services, technical advice, consultation services, and so on. That is what we are trying to do in the state agencies, develop this type of service so industry can see its way to solve its various problems. Now I have here an outline of a few of the things. First I want to show you we have been able to create and establish an organization for industrial hygiene services, in assisting local health departments and working in cooperation with industrial commissions and labor departments as in the state of Ohio, to give these services. This is a map indicating to you where you had industrial hygiene services prior to 1936. Only Ohio, Mayland, Connecticut and Mississippi had industrial hygiene services of an impartial nature. Since then we have been able to cover the map and now there is something like thirty-nine units, twenty-nine states, two territories, and several cities. We have made advances in the last four years and we are trying to assist these people in rendering as good a service as possible. What we are advocating that these industrial hygiene units all over the country do,

in collaboration with other official agencies in the state, such as labor, industrial commissions, medical divisions and so on, is,

First give consultation services to the plant management regarding needed corrections of environmental conditions;

Second, advice to the management and medical supervisor as to the relative toxicity of materials or processes, and advice concerning new materials prior to their introduction into the industry. That is very important. If you have something that you think might possibly be harmful, you never used it, and you don't know, for goodness' sake try to find out whether that material can be used safely and if not, how it can be used safely. How can it be used without causing skin disease or without damaging the lungs? We can tell you. If we can't, we will do some research and find out. Call on the Industrial Hygiene people in the state to help you on these points.

Third, assistance in developing, maintaining and analyzing absenteeism records.

Fourth, consultant service to medical supervisors, private physicians, compensation authorities and other State agencies regarding illness affecting workers.

Fifth, provision of necessary laboratory service of both a clinical and a physical nature, and

Last, but not least, integration of the activities of other public health bureaus so as to give you a general adult health program.

Now here in Ohio you have recently had a reorganization whereby the Health Department was reorganized from about two dozen divisions into eight. One of those divisions is known as adult hygiene. Dr. Kistler, the Director of that division, is in the audience, and if I say something that is a little bit not quite to the point, he can correct me in a discussion. As I understand it, that adult hygiene division is responsible for occupational diseases, responsible for venereal diseases, responsible for cancer, pneumonia, tuberculosis or any disease that a person may contract who works or any adults is subject to. I think that is the way it should be. They can integrate strictly occupational disease control with other general health services. So you can see that an industrial hygiene agency on the medical side of the control of the hygienic person, can not only control the specific occupational disease but can also bring through a program of general sanitation, immunization, venereal disease control, tuberculosis, rheumatism, heart, cancer and the whole gamut of mental hygiene, dental hygiene, the whole gamut of adult health, even including nursing services and following up illnesses.

On the environmental side with their engineers in the sanitary engineer division they can not only help you control working environment but also general sanitation, lunch rooms, toilets, water supply, sewage disposal, fire protection, industrial waste disposal, accident control, cross connection elimination, milk and other foods and so on.

In closing I want to say that any money, gentlemen, that you invest, or that you can get your company to invest, in an industrial hygiene program will give you distinct benefits. You will reap rewards both of the intangible kind and the tangible kind. By the intangible I mean better public relations, better industrial relations. Those are very important. By the tangible I mean improved health of your workers and therefore improved efficiency of production and decrease in spoilage; in cash benefits, lowered taxes due to decrease in relief expenditures and lowered compensation carrying costs. I wish I had time to give you example after example of the

actual cash benefits that industry gained through a program of this sort. I am reminded of the excellent striking examples that Mr. Fletcher gave at the Air Hygiene Foundation meeting last fall where he showed hundreds of thousands of dollars his company saved in a program of industrial health prevention. They have decreased their labor turnover from hundreds of percent down to three or four percent. They have saved all kinds of money. If you want figures of that sort, I will be glad to give them to you.

(Applause.)

Chairman McCurdy: I am sure we are grateful to Mr. Bloomfield for his presentation of a subject that is vital to us all. You may now ask him questions or discuss it with him.

Mr. Lisch: You spoke about infection from cutting compounds and nothing was said about the means of eliminating that. Will you speak on that just a minute?

Mr. Bloomfield: Well of course, in a way, that is a medical question that I would like to have one of my medical colleagues answer. In spite of the fact that I have had an honorary degree conferred upon me this afternoon by your esteemed Dr. McCurdy, I am an engineer and not a doctor. There are various solutions. One of course is to use cutting compounds or oils that don't have some of these acids in them. For sensitive individuals, you can use protective clothing, gloves, protective ointment and so on. I would prefer however, that someone like Dr. Hayhurst or Dr. Smith or Dr. McCurdy, any one of these gentlemen, answer that question.

Dr. Hayhurst: I could say that in 1916 or 1917 Dr. R. P. Albol, who is the medical director of the Fuller Corporations and interests in Cleveland, while he was then with the State Health Department, made a report, a very considerable study on the subject of these oils and cutting compounds and came to the conclusion the best way to control the external environment was to heat those oils, so that idea is nothing new at all. The trouble is that the infections get started in the workmen through cross-connections, if you want to call it that, contact with rags, towels and whatnot from one to another. About ten years ago Dr. Sietz, of the White Motors in Cleveland, discovered he could control a large part of that sort of spread by the use of towels, giving every man an individual towel, a small towel slightly larger than a napkin, whenever he wanted to use it. There are some, particularly those containing sulphur, that have a high percentage of preventative elements. In those controls, all said and done, I think there is not one of us that have entered into them, and that an epidemic which is present should be under medical supervision.

Mr. Lisch: Several disinfectant companies attempt to sell you liquids which you put in your tank in very small quantities, which are supposed to eliminate any disease transferred. Is such a thing possible in a small quantity?

Chairman McCurdy: I can't answer that question.

Dr. Hayhurst: We found that practically all of the substances that are added, if they are effective, are too strong and will produce dermatitis, whether they produce infection or not.

Mr. Bloomfield: I hope the next question is an engineering question.

Mr. Henry: Would you give the upper safe limits of concentration of dust in foundries and the silicosis content?

Mr. Bloomfield: There have been several studies made in foundries. There is a New York study which was shaped entirely on X-ray interpretation, no

clinical study. There is a North Carolina study which is rather limited in the number of people covered. The public health service itself hasn't studied the health of foundry workers, foundry conditions with reference to sand blasting and so on. Those standards vary of course with the amount of silica. Most of them I think have a low limit of around ten or fifteen million particles per cubic foot for certain operations. In other operations they tolerate some higher amount. It depends on the actual composition of that foundry dust. It is difficult to say in all foundry operations, some won't exceed a certain limit and some will. For instance, granite is pretty much the same all over. We know, from our clinical studies and engineering studies ten million particles is as much as anyone should inhale per cubic foot. As soon as you get over that, you are going to get in trouble. It is difficult to say ten or fifteen or twenty million particles, because conditions vary. I would suggest that you consult the New York report and the North Carolina report, which are the only ones I know of and possibly the Massachusetts report, which have attempted to set standards of that type. You can get them by writing to the Industrial Hygiene Division. If you like, I will try to get them for you. Does that answer the question?

Mr. Henry: I understood certain standards were set up in those states.

Mr. Bloomfield: Yes, New York State attempted to set up standards. They have set them up for rock drilling and certain other excavations but now they are doing one on foundries.

Mr. Henry: Are you familiar with the standards in steel foundries?

Mr. Bloomfield: No, but they study steel and brass and all types of foundries. It is a rather comprehensive report. As I said, a moment ago, they only made Roentgen Ray studies, X-ray studies, and didn't go into the clinical side at all.

Mr. Benedict: These dust conditions you have been talking about, are there any figures available concerning them?

Mr. Bloomfield: Yes, there are figures available. I can't offhand give you an exact reference. In Ohio you might ask Dr. Kistler or some of the gentlemen of the Industrial Commission for that information, or you can write the United States Public Health Service. There have been comparative studies made, but I can tell you right now there is no consistency about them. For instance, we have made a comparative study of the konimeter, and we get consistent results until we get into very high concentration and then we get inconsistent results. From other comparisons we have made in the past—we have gone into a comparative dust and sand business very, very thoroughly—but we can't seem to get consistent results with Bausch and Lomb. If you get into very small-sized particles the ratio between the two is enormous. If you get down to coarser particles, the ratio drops. On various types of dust we haven't been using Bausch and Lomb. We have vast amounts of findings on Greenburg Smith. It may be awkward, although I think it isn't awkward at all. I used it myself for some seventeen years. It has proved to be a valuable index of the hazards of the situation in respect to dust.

Mr. Henry: How do you determine your amount of silica?

Mr. Bloomfield: We determine it in this way. We first get several samples from a vacuum cleaner which is for hours in an atmosphere in which there is as much dust as we can get in the air. We also take settled dust on rafters and beams and bring it into the laboratory and we separate the various sized fractions of dust of air flotation. We get a

fraction, say, from zero up to an amount you can't measure, up to five, ten and fifteen microns. Now we take and examine each fraction chemically and pegrographically, such as a minerologist will use to examine each fraction chemically and minerologically for the amount of quartz, amount of other minerals, calcite, opal, or whatever it appears to be. That is the way we do it. It is a job that takes a very highly skilled person. It isn't something that you can learn overnight, and we only allow specialists to fool with it.

Mr. Henry: You feel injurious particles are under ten microns?

Mr. Bloomfield: It seems to point in that direction. In the air they settle because of gravity. You will recall, Mr. Henry, I think, when I spoke on silicosis a few years ago, I showed a slide in Cleveland, Ohio, for various specific gravities of dust. You might recall, or maybe you don't, that a particle of about ten microns settles out very rapidly. I think the specific gravity of silica is 2.65 or thereabouts. It will settle at the rate of, I think, a foot a minute, or something like that, so those particles don't exist in the air. In our studies somewhere in the neighborhood of up to three or four microns, the bulk of them are one, one and a half, or thereabouts. That is probably the reason you don't find these particles in autopsy.

Mr. Henry: You do find them at the point of origin?

Mr. Bloomfield: Yes, but not in the terminal passages.

Mr. Henry: I am bringing these points out more or less from questions that have been asked me.

Dr. Smith: I would like to know what your opinion is of the electrostatic precipitator.

Mr. Bloomfield: For what purpose?

Dr. Smith: For collection of dust samples.

Mr. Bloomfield: We use the electrostatic precipitator only for the collection of fumes, because the apparatus is not very efficient for very fine matter, such as lead fumes, magnesium fumes, or arsenic fumes, where we analyze samples chemically. In collecting the dust, we have to run comparative dust tests by the impinger apparatus. It is a pretty good instrument to use. If you are fortunate enough to be able to get up to Detroit this fall, you will hear a paper by Mr. Case on that very subject.

Dr. Shaffer: I would like to ask Mr. Bloomfield one question that has been a little troublesome to me. We all agree, especially those in the medical profession, that examinations of every one is the ideal thing. I was wondering whether or not he had come in contact, in his various surveys in all the various states, with many employers who have instituted the general health examination without first being obliged to find out what it was worth to them, from this small, little, insignificant occupational investigation. After you can point that out to them, you can re-check on periodic examinations. They just say, "Oh yes, we will not examine everybody unless there is some reason for it," and that reason usually is this little insignificant occupational disease thing that starts the ball rolling.

Mr. Bloomfield: Dr. Shaffer, you brought out several interesting things. To begin with, we have established industrial hygiene practices like I showed you, in 29 or 30 states. I have recently completed an analysis of surveys of that type on 17,000 plants in 15 states covering one million and a half workers. One of the things we found out was that the information on what industries are now doing in the practice of industrial hygiene prevention is something like this: Only about 15 per cent of the employees have full-time

medical services, only 29 per cent have full-time safety practices, only about one third have full-time nursing services, and so on down the list. The little plant is the one that can't have them. That is why we are trying to establish industrial hygiene services in official agencies to impartially give them that service and help them control these conditions.

Now you are quite right in saying that the opening wedge is through occupational disease control. For goodness' sakes, don't get the idea, in my talk this afternoon, that I was trying to minimize occupational disease control, not at all. We use that as a means of getting into a plant and selling them later on this whole program of adult hygiene, which is so important. You are quite right there, that the only way you can get in is when they have something wrong, such as silicosis, because the average industrialist and the average worker still thinks industrial hygiene means accidents alone.

Mr. Phillip Carey: Can you tell me whether any of these companies also find it advantageous to try to carry out some constructive program in after working hours, to keep these people, say, out in the open, or something that would tend to help the conditions?

Mr. Bloomfield: Let me give you some figures. I didn't want to take the time, but these are just two examples that might answer your question. One is in connection with a company that had a lead poisoning accident in a storage battery plant. These figures haven't been proved because, as I was telling you, it is all new. They used to pay three hundred to a thousand dollars per case compensation for lead poisoning. In 1920 they had twenty cases per hundred in their plant. In other words, it cost them six thousand to twenty thousand dollars at that time for compensation for lead poisoning. They put in an industrial hygiene program, a complete program, both inside and outside the home, outside the work place, and their rate dropped down in 1929 to four cases per hundred. From 1934 on they haven't had a single case because of good engineering and medical control programs.

Now then, here is this example that was reported by Mr. Fletcher, I told you about. You will find it described in **Occupational Hazards.** I will cite you these figures, because it answers your question specifically. The firm employed 2500 people and had a labor turnover of 250 per cent a year. In other words, in order to maintain that 2500, they had to hire 6,250 men a year. The cost for such replacement was estimated at $250,000. Today this cost would be five times as great. At that time, even as far back as 1920, it cost a great deal. Today it would be about four or five times as high. It costs more to train a man today than it did in those days. By a good program of employee health, the labor turnover was reduced in 1926 to 40 per cent and today it stands at 3.6 per cent. Among the conditions that were improved were the construction of a good water supply, better schools and improved housing, including a control of the working environment in the factory itself. Later physical examinations, both pre-employment and periodic were instituted, thus correcting any physical defects.

In addition proper milk sanitation was also initiated. Of course that is possible where you have a one-industry town. It is also possible to a certain extent, even if it isn't a one-industry town. That is one of the things your official agencies can help you on, for example, your health department. Let them come in there and give you a program of immunization. Every once in a while smallpox will break out in a plant. I was citing a case at lunch today where an epidemic of smallpox broke out in a shoe factory. They immunized every worker there. Or let them give you something in connection

with the degenerative diseases, nephritis, heart, pneumonia, syphilis. Of course syphilis is not an occupational disease, except for certain types of occupations, that I don't need to go into. You would be surprised how many doctors and nurses report syphilis as a result of occupation. You see, I wasn't thinking of the same thing you were. After all, it is very important both to industry and labor. As to the syphilis rating in industry, it runs, from our studies, between three and four per cent. Because that man is more accident-prone, more prone to all kinds of conditions, your health department is in a position to give you a good program of syhpilis control in industry. Principles have been enunciated whereby a man should not be discharged, unless he is a menace to his fellow-worker. Under a physician's care, he can be made non-infective, after a certain number of treatments. If you have a very constructive policy on that point, you can do something about syphilis among your workers. By improving the home environment, furnishing swimming pools, recreation, all those things will help to decrease your loss of time and improve the health of the worker in industry. Do those things, because it is darn good business to do them. Let us not kid ourselves about that.

Chairman McCurdy: I certainly think we have enjoyed our afternoon, and you have gotten a great deal of good knowledge from these two talks. The Industrial Commission is very grateful to Dr. Smith and Mr. Bloomfield for their illuminating discussions, and I am sure we are grateful to them for coming. I think it is time now that we adjourn.

The Occupational Disease Hazards Section of the Eleventh All Ohio Safety Congress then adjourned.