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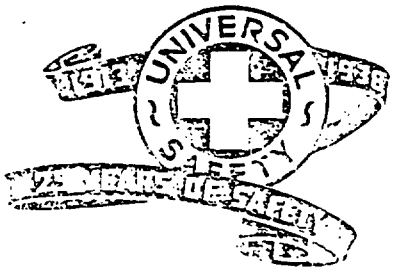

Contents

Dusts, Fumes, Gases and Vapors

WEDNESDAY MORNING SESSION

October 12, 1938

Assembling in the Grand Ballroom of The Stevens Hotel, this meeting was called to order by Chairman Walter S. Paine, Manager, Engineering and Inspection Department, Aetna Casualty & Surety Company, Hartford, Conn., and Vice-President for Engineering, National Safety Council. Chairman Paine briefly outlined the session objectives, and then introduced the speakers.

Recent Developments in Detecting Hazardous Dusts, Fumes, Gases and Vapors

By WARREN A. COOK

Superintendent, Engineering Department, Zurich General Accident and Liability Insurance Company, Ltd., Chicago

In discussing the determination of injurious dusts, fumes, gases and vapors, I am very sure that you are not interested so much in a meticulous dissertation on such phases of the subject as whether the logarithm of the reciprocal of the hydrogen ion should be 9.5 or 9.0 for the determination of lead by the dithizone method, but rather in a discussion of this matter along broad lines, pointing out what types of potentially injurious materials should be looked for, whether determination of them is in order, a brief discussion on some of the more important and common methods of determination, and interpretation of the results obtained.

Foolhardy to "Work in the Dark"

Working in the dark without any means of illumination where there may be hazardous conditions serious enough to cause loss of life or severe injury would be considered most foolhardy; yet every day men conduct their operations in atmospheres containing dusts, gases, and vapors which may cause death or severe injury to health without being able to see or otherwise perceive the potentially hazardous condition.

Most gases and vapors can no more be seen than the well-known black cat in the coal cellar. Some of them cannot even be detected by odor, though odor is itself no reliable criterion as is evidenced by the gas, hydrogen sulfide, which has a most obnoxious odor but has caused many a case of poisoning.

How, then, are we to know whether the atmosphere in which we work is safe or injurious? Are we to wait until we see the effects of unhealthful or irrespirable atmospheres on our men or is it not more intelligent to determine, within the limitations of modern methods and practical applications, just what sort of atmosphere we are subjected to?

The importance of having facts before us is well illustrated by an atmospheric condition where a life could be snuffed out in a few minutes, even though the more common situation is where excessive exposures may require weeks, months or years to cause their injurious effects.

Thirteen years ago this month a powder crew was walking down the tunnel of a new water supply system of a Connecticut city. Their duty was to inspect the roof and the face, to see that all the shots were fired. On approaching the tunnel heading immediately after the blast, they found that flying rock had broken the compressed air line, which had been left turned on in order to blow the smoke and gas away from the face of the tunnel. The crew, consequently, ran into a heavy blanket of smoke, but they were hardened workers, used to smoke and gas, and a little smoke, even though they knew it contained carbon monoxide, did not hold them back.

They found the roof intact. But four of the holes had not fired. Caps with 3-foot fuses were inserted in sticks of dynamite, one for each of the holes. The gas condition by the time this work had been accomplished was beginning to make these men feel a bit groggy. Following the usual practice, the powder foreman sent the rest of the men back down the tunnel before he lighted the fuses.

The men walked back through the smoke to the car, about a quarter of a mile down the tunnel. There they waited for the foreman. Seconds passed. The time stretched to a minute. Down the tunnel came the boom of the blast—but no foreman. The men rushed to the heading and found the foreman stretched on the tunnel floor, nearly covered with rock from the blast, where he had collapsed from the effects of the carbon monoxide.

This is a true story up to a certain point, but I have omitted a part of the story, and the ending, I am glad to say, is pure fiction. The part of the story which I omitted was that carbon monoxide determinations were being taken when those men got up to the heading, and a concentration of .3 per cent carbon monoxide was shown to be present by means of the Hoolamite carbon monoxide detector. With such a high concentration, it was realized by the man making the determinations that it would not take long for exposed persons to collapse. He informed the crew of the condition and hurried them back to the car to wait until the smoke and gas had cleared enough to permit them to work safely and fire the blast.

The difference between fact and fiction in this case, between a brief delay and a fatal case of carbon monoxide poisoning, was the ready availability of a simple means of determining the carbon monoxide concentration on the job.

The present tendency in development of methods of determination of injurious materials in air is toward such simple, quick-acting devices. As many of you know, the Hoolamite carbon monoxide detector operates merely by pressing a rubber bulb ten times and comparing a purple color which develops in presence of carbon monoxide with a standard color scale mounted on the instrument—an operation which requires about a minute. Instruments of this type are especially important for gases which may cause acute poisoning such as carbon monoxide, hydrogen cyanide, and hydrogen sulphide.

An instrument for determination of hydrogen cyanide, similar to the Hoolamite carbon monoxide detector, has recently been developed by the United States Bureau of Mine workers, and, together with a number of other of these simple detectors, is now available commercially. Determination of such materials can accordingly be made much more widely than formerly when laborious chemical laboratory methods were necessary.

Potentially Hazardous Materials

The first step in an organized endeavor to avoid environmental conditions which may cause injury to health is a listing of all materials, used or produced, which may under certain conditions be deleterious. It was found in a study by the United States Public Health Service of potential hazards in a typical industrial area (1) that a considerable percentage, nearly 20 per cent, of the workers were exposed potentially to carbon monoxide. The report by no means intimated that this percentage of workers were being poisoned by carbon monoxide, but rather that if things went wrong and a concentration of the gas built up to injurious proportions these men might become poisoned.

So I suggest that you go through your plants and see what operations involve potentially injurious materials. Of the dusts, those which may produce silicosis occur not only in the well-known industries where major studies of conditions have been conducted but in other industries as well, though usually to a lesser extent. In silver-

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ware manufacturing, for example, one man may be exposed day after day to tripoli dust in making up a polishing compound for use within the plant. A list of industries in which such dust exposures may exist is given in the report of the National Silicosis Conference.[2]

The toxic dusts and fumes are more readily spotted. We recognize and guard against lead exposure in storage battery plants, but often overlook such an operation as where red lead is being mixed with a vehicle by a worker in one corner of the top floor of the plant to color lettering on a steel part. It is not so much whether a pound of lead or a ton is used in a day, but the extent to which it contaminates the air breathed by the worker.

Carbon monoxide, hydrogen sulphide, hydrogen cyanide have been mentioned as examples of gases. The first of these occurs where producer gas or water gas is used. The last named should be looked for where fumigating may be done from time to time. Where dry ice is used in quantity or fermentation processes are conducted, carbon dioxide is liberated and has caused deaths usually at the bottom of confined areas such as ships' holds and fermentation tanks.

Vapors are present wherever organic solvents are used. Death may result quickly where high concentrations exist as has occurred when a drum of solvent was dropped on a basement storage room floor and split open, and again where carbon tetrachloride was being used for fumigating a flour mill and the fumigator sprinkled the liquid in the basement as his last operation. It was his last.

Injury from continued exposure to solvent vapor at concentrations which cause their effect after weeks of exposure is the more common condition. The various solvents differ widely in the concentration of vapor necessary to cause injury. These are divided into groups in accordance with their toxicity in a paper delivered before the Northwestern University Symposium on Occupational Diseases a year ago.[3]

Where Should Determinations Be Made?

After going over your plants and learning where potentially hazardous materials are present, it is my suggestion that, before making actual determinations of concentrations in air or instituting control measures, you make a thorough survey of the conditions and divide the various operations where these materials are present into groups: (1) those which are obviously safe; (2) those which are admittedly causing injury to health or are worse than good industrial practice dictates; (3) those conditions where it is not readily discernible by general observation whether the exposure is within safe limits.

Certain conditions we know definitely and can say definitely will not cause injury to health. I would not say that those are to be forgotten, but at least they need not be the subject of initial action. If, for example, a gas containing 30 or 40 per cent carbon monoxide is used for hot plates, and those hot plates are connected with rigid conduit rather than with rubber tubing, you can feel reasonably safe that the carbon monoxide exposure is within safe limits, and I would not recommend that determinations be made. Where spray painting is being done in a well ventilated booth in such a manner that there is no excessive rebound into the face of the sprayer, determinations of vapor or pigment need not be made even though the odor of the solvent is detectable. From time to time it may be well for state authorities to check some of these lesser exposures, but there is a considerable number of such exposures which can be accepted as safe.

The second group of exposures—that where conditions are admittedly severe—is another where determinations are not essential. Institute control measures immediately. If there are clouds of dust containing free silica in your plant, go to work on them. If excessive lead absorption is shown by development of symptoms or by high basophilic aggregation percentages, reduce the lead exposure. It may be desirable to make determinations even in these cases either to provide a before-and-after picture of exposures to show what improvement is effected or to obtain a clear picture of just what part of an operation is responsible for the excessive exposure to the end that control measures can be more specifically applied. This latter use of air analysis data is of especial value where the materials are invisible as is the case with gases, vapors and even some of the more toxic dusts such as quartz and lead.

The principal use for determination of

injurious materials in air is where general observation does not give the necessary information. Suppose exhaust ventilation and partial enclosure have been installed to reduce exposure to a dust high in free silica. You might learn whether control measures are effective by waiting ten or a dozen years to see whether silicosis develops among those exposed. It is much more economical to run a group of dust determinations. A recent series of such determinations indicated that exhaust ventilation was adequate at an operation where pulverized silica was being transferred to the hopper of an elevator, but the manipulation was at fault.

Where fumigation with cyanide has been conducted, it has long been the practice to depend upon a time period of ventilation and upon the nose of the fumigator to establish that the premises are safe for occupancy. Now that a simple hydrogen cyanide detector is available, it is in order that determinations be made in every case before re-occupancy and, further, that every municipality where cyanide fumigation is carried on enact an ordinance covering such fumigation with the provision that determinations be made, especially in any dead air spaces, before the premises are considered safe for occupancy.

Hydrogen sulphide determinations are today being made routinely in the spinning rooms of viscose rayon manufacturing plants. Carbon disulphide determinations involve a more laborious procedure but are regularly made in a number of departments of the larger plants of this same industry. Operations are regulated so that any exposures to these materials are within safe limits, but the continual checks permit detection of any excessive exposures before injury to health develops.

A good general rule to adopt is to make determinations of concentrations of injurious materials in air wherever there is any question that these may produce deleterious exposures.

Methods of Determination

Discussion of methods of determination will be limited to certain general considerations, reference to complete descriptions of available methods, and comments of timely interest on a very few methods.

In the collection of samples, it is of utmost importance that these samples are such as to provide the desired information. It has been pointed out that one set of conditions exists today, and quite a different set of conditions may exist the next day; that if air analyses show conditions to be satisfactory on the first day, our eyes may be closed to the fact that conditions are much worse on the second day. So, rather than encouraging the installation of safeguards, we are setting up obstacles to them.

My plea is that methods of determination be used intelligently and honestly. If it is desired to show exposures under the most severe conditions, be sure to set up these conditions when you make the test; if representative conditions are desired, see that they are truly representative. Whether you yourselves make these tests in your own plants, whether you bring consultants in to make them, whether state departments, insurance companies, or some other agency makes these determinations, make a real effort to see that conditions are as represented when these determinations are made.

For a comprehensive discussion of equipment for conducting determinations of dusts, fumes, gases and vapors, may I refer you to a paper entitled "The Industrial Hygiene Laboratory."[3] This paper includes descriptions of both field equipment and laboratory apparatus, together with a discussion of their applications.

References to the methods themselves may be obtained in the reports of the Committee on Methods of Determination of Injurious Materials in Air.[4] These reports are available on application to the American Public Health Association.

The Preventive Engineering Committee of the Air Hygiene Foundation of America has recently developed a bulletin on Methods of Determination,[5] and in that bulletin are included only those methods which have been satisfactorily used in this country. The trouble with many papers on methods of determination is that they are woefully deficient in their practical qualities and simply do not work when put to the test.

You are all interested, I believe, in a brief discussion of the methods available today for dust determination and some of the up-to-date viewpoints on collection and determination of dust. It is my opinion that where it is desirable to know whether

a condition is or is not safe in the light of investigations so far conducted in this country, it is well to collect samples by means of the impinger method. I will not go into the advantages or drawbacks of that method at the present time beyond bringing attention to the micro-impinger set-up as developed at the Bureau of Mines and now available commercially which largely overcomes the bulkiness of the original equipment.

It is to be emphasized that only the impinger will give impinger results. Due to the different characteristics of other methods of determination, you cannot get a duplication under a variety of conditions by the use of other instruments. However, other instruments, such as the grab samplers, which take a sample over a period of a second or two, are of very considerable value for a number of purposes. If an impinger sample collected over a period of an hour shows a high dust concentration exists, we may know what particular operations during that hour caused this high concentration. If we have a Zeiss konimeter, a Bausch and Lomb dust counter, or some instrument which will give us the concentration at any given instant, we can obtain precise information on those operations which are contributing most of the dust.

Furthermore, after we know whether a condition is safe or not, one of these quick-sampling instruments is extremely valuable as a control measure. Wherever a concern has a dust condition, determinations may desirably be taken by some of these quick methods regularly as a control. Whether they compare exactly with the impinger or not is of no great consequence; the important thing is whether conditions are holding at levels shown by the impinger to be safe. If dustiness is on the increase, a survey of dust producing operations should be made and control measures instituted.

Collection of lead dust and fumes is of timely interest with the commercial availability of the portable electrostatic precipitator. Most of us who have been sampling lead in this country have been using the impinger for the collection of these samples. This instrument is highly efficient for the collection of samples where lead dust is the material of interest. Where lead fumes are given off, we have evidence that the impinger collects these fumes at appreciably less than 100 per cent. We feel that the electrostatic precipitation method, which is about the most efficient method of collection, is a preferable instrument for materials of sufficiently fine division to be classed as fumes. This type of instrument has long been available, but only recently commercially; and I feel that where lead in the form of fume is encountered, the electrostatic precipitator should be used.

The facts which we have in the literature today concerning the production of lead fumes in workrooms where high temperature melting pots are used are based on the results of impinger samples, and so until we get further data from the electrostatic precipitator, we have a big question mark as to whether there is more lead fume in the air where lead melting pots are present than we had previously anticipated.

A year ago, the A.P.H.A. Committee on Air Analysis mentioned above obtained information from all the laboratories in the country conducting industrial hygiene determinations concerning what injurious atmospheric constituents had been analyzed, what methods were used and whether these were satisfactory.

Lead was the material which was determined by the largest number of laboratories. The next material of interest was hydrogen sulfide, and the reason being that most rayon manufacturers make routine tests for this gas.

If any of you believe that a man will not voluntarily walk into a dangerous hydrogen sulfide concentration, let me recount the experience of one of the promising young workers in industrial toxicology who walked into his laboratory one morning, about two years ago, found that a hydrogen sulfide cylinder had tipped over and the valve broken off. In trying to get the cylinder to an exhaust hood, he collapsed and was found dead in his laboratory by the janitor who arrived not long after. Certainly if an intelligent research worker, thoroughly aware of the toxic action of this gas, could so expose himself, we must not assume that the odor of hydrogen sulfide will cause the plant worker to avoid dangerous amounts of it.

Carbon monoxide was next in the list of injurious materials placed in the order of the number of laboratories making determinations of them. In addition to the small Hoolamite detector, previously mentioned,

several types of detectors and continuous indicators are available commercially, both portable and stationary. A home-made device has just been suggested[7] whereby air is drawn past the filament of a cigar lighter for combustion and the CO_2 formed by any CO present is determined colorimetrically. This ingenious device may solve the problem where the exposure may not justify the expense of the continuous indicator.

Mercury was the next in line. Unfortunately we do not at the present time have a quick method for mercury. One method will give concentrations of vapors within injurious limits if the sample is of several hours duration, but we would like to be able to obtain the desired information with a ten or twenty minute sample.

The list then includes sulphur dioxide, hydrogen cyanide, ammonia and chlorine in that order.

Of the organic materials, the greatest number of laboratories made determinations of hydrocarbons as such.

The inflammable vapor indicator, originally designed to show whether an atmosphere was within inflammable limits, is of value for hygienic purposes in some cases, but just because an inflammable vapor indicator shows negative results is no good reason for assuming that the condition is necessarily safe from a hygienic point of view. One of these indicators has been sensitized so that it will give as low as 20 parts of a million of benzene vapor, but the minimum reading on most of these instruments is 1,000 parts per million.

Carbon disulphide has been of much interest.

A method has been developed, and is commercially available, for the determination of chlorinated hydrocarbons, such as trichloroethylene, with which we are becoming more familiar through its use in vapor degreasers. The chemical method will give chlorinated hydrocarbon concentrations in the presence of such other materials as gasoline, with which they are sometimes mixed.

A rapid physical method for the determination of all vapors and gases having a density substantially different from air (and this includes most of them—notable exceptions being CO, HCN, methanol, and ethane) is the portable interferometer. The operation, after calibration, involves drawing air through a cylinder, turning a dial and reading the concentration. Unfortunately the interferometer is not specific for any one vapor, merely measuring differences in densities. The cost of the instrument is high, but it is available through a number of investigators and some of the insurance companies, and, where many determinations are to be made, amply justifies itself.

Interpretation

In the interpretation of results, there are a number of important items to be taken into consideration. It is appreciated that the results must be referred to some threshold value such as 100 parts per million for carbon monoxide or 2 milligrams per ten cubic meters for mercury. There are several collections of such threshold values, that published by Bowditch[8] being one of the most complete.

In referring results of determinations to these standards, consideration should be taken of the duration of exposure of the worker and also the duration of the exposures used in developing the threshold limits. If a worker is exposed to a concentration of 20 milligrams of lead per 10 cubic meters of air for a period of an hour a week, we need have little apprehension that he will develop lead poisoning; but if a group of workers is exposed to this concentration as an average condition, then we can anticipate lead poisoning cases.

The conditions under which the air samples were collected must be carefully considered. In some instances winter conditions may be the more severe; in other cases, summer conditions. If open windows adjacent to a chromium plating tank cause high concentrations of chromic acid to be blown into the plating room, the results of determination should be interpreted to indicate the need, not of increasing the local ventilation, but of keeping adjacent windows closed.

Careful note should be made of all operations which may contribute to the exposure. The dust concentrations near a group of molders in an iron foundry may be excessive, but it is possible that the cause may be due not to the molding operations, but to an unprotected sand conditioning machine in the vicinity. Where conditions change rapidly, samples must be taken frequently or over a long period in order to

permit proper interpretation. Where conditions are essentially static, a single brief sample may be adequate.

As previously mentioned, it is usually of such value to have available two types of collecting devices: one which takes a continuous sample over a long period of time, the other which gives the concentration at any given instant. The former gives valuable information on the average exposure of the worker, and the latter on the particular operation causing the major portions of that exposure. The results of both methods, used together, permit in many cases much more complete and valuable interpretation of existing conditions.

Know the limitations of the methods used and interpret the findings accordingly. We must remember that a screw driver is a very convenient tool and it has its use, but it should not be employed for making a mortise and tenon joint. These determinations have their definite value, but do not try to read more into them than they are worth. Determinations can be used more extensively to great advantage. Through determinations, we can learn whether the exposure to dust, fumes, gases and vapors is safe or dangerous even though we cannot see them. Let us not work in the dark, but rather, cast all light possible on these otherwise invisible hazards.

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Discussion

CHAIRMAN PAINE: This is a mighty important subject, and I know there are many who would like to discuss phases of it. Let us make our questions clear and concise.

A. G. SPEER (Western Electric Co., Hawthorne): Are you familiar with the fumes connected with arc welding, like iron oxide and ozone, and means of detecting them?

MR. COOK: A study has been made of iron oxide concentrations in connection with arc welding, with the thought that a large amount of iron oxide being breathed by the arc welder might injure his health. X-ray determinations have been made, and although the lungs looked very much as if they were severely fibrosed, it has been pretty conclusively shown that iron oxide does not cause injury to the lungs. This conclusion has been reached in two separate investigations.

The collection of iron oxide was made by the electrostatic precipitation method.

MR. SPEER: We had occasion to make such a determination but we used the impinger method, and we did not find toxic qualities or properties. We could not find any available data on that particular subject.

MR. COOK: A paper was published by Drinker, together with a number of other investigators, in the *Journal of Industrial Hygiene*, and the conclusion was that injury to health was caused by nitrogen oxides, with a possibility of ozone entering into the picture.

R. C. MELDRIM (Glens Falls Indemnity

Co., Glens Falls, N. Y.): Mr. Cook, do you believe that an arsine determination should be made in a metal pickling operation?

MR. COOK: Generally, no. I have seen no actual arsine poisoning from metal pickling, even though the literature includes such cases. As far as cases in this country are concerned, it has seemed to me to be largely a literature condition. In talking with Dr. Cunningham, of the Ontario Department of Health, Division of Industrial Hygiene recently, he mentioned a considerable number of arsine poisoning cases and I suggest you write him for further details. I have not seen any thorough investigation of the subject, and that has been one of the things that lead me to believe that the condition isn't sufficiently severe to cause us great apprehension. The experience in this country has hardly indicated the necessity of making such determinations. I have not made any myself. However I should like to see somebody make a series of them at a half-dozen locations where metal pickling is done.

F. L. WARNER (U.S.S. Lead Refinery, Inc., East Chicago): Do you feel that further investigation with the precipitator will change the present permissible limit of lead exposure that has been determined by the impinger method?

MR. COOK: The answer to that question is "No," but I feel that this further thought can be added: We have had many operations where lead dust was the prime exposure. Where the lead is in dust form, the impinger will get essentially the total amount of the lead; consequently where we have made physical examinations of large numbers of workers in such exposures, correlation of the results of physical examinations of workers and of incidence of cases of actual lead poisoning with concentrations of lead in air have fixed fairly definitely, within workable limits, just about how much lead can be considered to be safe. The threshold limit based on such exposure to lead dust would be the same whether the samples were collected with impinger or electrostatic precipitator.

On the other hand in rooms where lead casting is done, where there are lead melting pots, the impinger probably gives low results. The chances are that the concentration of lead in those rooms is greater than found by the impinger. But those impinger results, those that we have made, may have been around .2 of a milligram whereas 1.5 milligrams per ten cubic meters is definitely safe. Suppose instead of .2 of a milligram per ten cubic meters, there are two or three times as much present in the form of a fume as found by the electrostatic precipitator. Even if .6 or .8 milligram were present we would be within safe limits. This is further shown by the fact that physical examinations of workers in rooms where lead melting pots are present have demonstrated that there is no great lead absorption.

So my conclusion is that the collection of samples by means of the electrostatic precipitator is not going to confuse the issue at all. It is going to give us more accurate data on some of these exposures where lead is present in the form of fume.

G. W. DAUBENSPECH (Illinois Department of Labor, Chicago): How would you determine arsine in air around pickling tanks?

MR. COOK: It would be necessary to resort to a chemical method, and I think that I had better not use the time for a discussion of chemical methods.

J. W. FEHNEL (Metropolitan Life Insurance Co., New York City): You mentioned the use of the electrostatic precipitator in lead sampling. I have been doing that work myself along with the impinger samples, at various times, to correlate results on lead, both dust and fumes, since 1926.

Here is an interesting thing. I know that Bloomfield a few years ago made some tests in a large baking plant and found lead. He came up to consult with Dr. Wright about it, and it was concluded that the source of the lead was the paint they used. That sampling was done with the impinger. About two years ago I made an extensive survey in one of the General Motors plants where there were extensive soldering operations. I took impinger samples, and I got a series of factors that I presented in the report, and a short time later I was called on the carpet and told that my figures did not agree with their plant chemist's. So I consulted with the chemist. When he sampled with the electrostatic precipitator and I with the impinger, and we took them on identical reading levels, we got the same results. He had consistently gotten lower results—and we proved this later by checked samples—because he had his electrostatic precipitator mounted on a little truck that

he pushed through the aisles, and the men working on a platform that was about 12 to 18 inches higher than his main aisle, which meant that instead of sampling at the breathing zone of the workmen, he was sampling at about his waist level.

ROBERT WINTERS (U. S. Metals Refining Co., Carteret, N. J.): We have overlooked one point, Mr. Chairman, and that is the metallurgical control, the heat control of the kettles. If you have a problem on hand, or if you are pouring lead and you heat your kettle up to 1,000 degrees Fahrenheit, if you can pour that same lead at 750 Fahrenheit, why pour it at 1,000 Fahrenheit, because the more heat you have, the more liberation of oxide? So we have reduced the hazard to a large extent now.

Mr. Cook stated that the impinger system is a little too cumbersome. I would say that where you have a definite hazard in the lead industry, have your impinger system a permanent system of the organization of your department and keep it there as a permanent fixture.

The question came up too, as to the merits of the electrostatic precipitator against the impinger, and I cannot agree with that statement at all because the fumes are made up of minute particles of dust—a fraction of a micron in size—and we found that the impinger system generally is just as efficient as the electrostatic precipitator, with the exception that we do have at least six impinger bottles in series, because you cannot get efficient sampling with one or two or three bottles. You must take enough bottles to get a reliable result.

Men Who Go Down to Their Death in Tanks—A Demonstration

By S. E. WHITING

Vice President and Chief Engineer, Liberty Mutual Insurance Company, Boston

The title of this feature, "Men Who Go Down to Their Death in Tanks," should be taken extremely broadly because, as you know, there are not only stationary tanks (of which we give you a very crude simulation in our demonstrations) but there are truck tanks and there are railroad car tanks, both of which are enclosed spaces. In our city streets we have thousands of manholes for utilities, power and telephone and sewage that are also enclosed spaces, or "tanks" as we call them here. You have trenches, excavations, shafts, tunnels, mines. In your factories, you have tanks again, small basement rooms, vaults, cisterns and sumps. Even open pits may prove hazardous. On board ships you have a very complete set of enclosed spaces, compartments and holds. Even when you go out into the open country, as we here look at it, you may find dangerous enclosures—grain bins, wells and the bottom of silos. So there are just as many varieties of enclosed spaces as there are pickles, and perhaps more.

Will you please remember that from this demonstration you are to visualize the potential conditions in your own plant where there may be enclosed spaces—and you will need a very great power of imagination to do so with our necessarily crude demonstration apparatus.

There are two hazards in enclosed spaces that we shall not dwell upon at length. In any enclosed space that has not much ventilation, that collects moisture and is dark, you will have a severe slipping hazard and an accentuated electrocution hazard—but we shall here consider only the typical asphyxiation and explosion hazards.

Most of those enclosed spaces are normally just as good to work in as outside spaces and that is part of the danger. Men have worked in tanks year after year with no trouble, only to have something extraordinary come up to contaminate the tank, something that they have not anticipated, to make that enclosure a hell hole, as we shall demonstrate in merely reproducing not an exaggerated situation but only what has actually taken place.

How do these spaces get into that condition? Merely because there is no free circulation of normal atmosphere. That is of fundamental importance because all animal life, especially higher animal life, must have a constant supply of normal atmosphere to sustain life. The normal atmosphere is re-

Occupational Disease

THURSDAY MORNING SESSION

October 13, 1938

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

The Trend of Occupational Disease Legislation

By HENRY D. SAYER

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

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

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

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

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

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

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

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

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

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

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

These and other cases I might cite are the exceptions and not the general rule as to what constitutes an accidental injury. I think we may fairly assume that the efforts of administrators of the law and the courts have been directly inspired by their belief in the necessity of finding a remedy for an industrial ill for which no clear remedy had been provided by specific language of the statute. May we consider them as straws in the wind, showing a trend toward industrial disease liability? It may observed that the tendency of the courts is to construe the term "accident" in a more limited manner in those states where there is specific provision in the law covering occupational diseases. Thus, we have clear instances of what has been termed "judicial legislation," that is, the courts broadening the meaning of the law to cover situations not clearly included within the terms of the law by the duly constituted legislative authorities.

Let us now consider what we mean or intend by the term "occupational disease." Here we find a more difficult field—difficult from the standpoint of administration and judicial interpretation; and difficult from the standpoint of the doctor and the engineer.

What is disease? We think we know, and at least to laymen the term conjures up in our minds something of a rather definite nature. When we pause to consider it, of course, infinite qualifications of the term occur to us, and we are confronted with many conditions that fall into the zone of doubt—such as, for example, whether hernia is a disease. At any rate, we say it is an abnormal condition, and let it go at that.

But when we come to add to the doubtful term "disease" the even more indefinite term "occupational" or "industrial," we find ourselves in an area of highlight surrounded by a vast and increasing zone of twilight shading off into Erebian night. Just how then shall we define the term "occupational disease"?

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

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

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

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

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

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

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

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

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

Let us be realistic about this thing called health!

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

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

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

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

and compensate for all sickness and death under a form of health and life insurance. The latter obligation, if it be a valid one, is the obligation of the state and the nation —not the obligation of industry alone.

The reasonable, the intelligent, the sane way for industry to discharge its obligation to its workers for conditions of health is to provide for the greatest reasonable requirements for industrial hygiene, and to provide compensation only for those conditions that arise from specific named diseases that are truly occupational, characteristic of, and peculiar to the processes in which the worker is engaged.

Industry will, I am sure, meet the challenge of the occupational disease problem, if it is presented under a law that prescribes the liability of industry in understandable terms. In the early days, the general rule was to include occupational diseases in the compensation law by specifying the particular diseases or the particular conditions leading to diseases that are deemed to be occupational and compensable. This we call a "schedule" law. It is the form in which compensation for occupational diseases is covered in all of the countries of Europe and of South America. It is so simple; it is so sensible; it is so easily administered, that the wonder is that the acceptance of the principle is not universal.

If we will keep ever before us the principle that a disease, to be deemed occupational, must be "characteristic of and peculiar to" the occupation, there should be no great difficulty in arriving at a proper statutory setup for the coverage of all true occupational diseases. Metallic poisonings are characteristic of occupations in which such metals are used. The diseases characteristic of chemicals, of acids, of alkalies, gases and fumes, are characteristic of and peculiar to those occupations in which the employees are so exposed. The diseases of the respiratory system, due to the inhalation of dusts, are the natural accompaniment and the characteristic effect of work in such dusts.

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

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

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

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

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

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

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

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

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

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

(Bishop vs. Comer & Pollock, 251 Appellate Division, 492; Goldberg vs. 934 Marcy Corporation, 251 Appellate Division, 904.)

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

booth. She contracted what she described as blotches or a rash on her legs. The blotches or rash she claimed were due to the alternate heating and chilling of her legs when she switched on or off the heater. They did not constitute a disability. However, on complaint to her employer, she was told to see her doctor. While on her way to see her doctor, on her own time, she slipped on the sidewalk and fell, fracturing an ankle. Although the day was cold and she testified there was ice and snow on the sidewalk, the claimant alleged that she fell solely due to weakness resulting from these blotches, and the Industrial Board so found; and found that the cause of the fall was an occupational disease, characteristic of and peculiar to her employment.

The Court of Appeals, in an opinion that bristles with logic and sound sense, struck this free-for-all system from the language of the New York Act. They unanimously refused to concede that this was an occupational disease. To make every disease that arose out of and in the course of employment compensable as an occupational disease, they said, would be to make the compensation law "the equivalent of life and health insurance." The court further said that to be "occupational," the disease must be one which "results from the nature of the employment"; and that by nature of the employment is meant—conditions to which all employees of a class are subject and which attach to the occupation—"a hazard which distinguishes it from the usual run of occupations, and is in excess of the hazard attending employment in general."

(Goldberg vs. 954 Marcy Corporation, decided January 11, 1938, and reported in 276, N. Y. 313 12 N.E. 2nd. 311.)

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

Just a word about hernia as an occupational disease. Never heretofore regarded as an occupational disease, but quite generally recognized under certain circumstances as an accidental injury—the Occupational Disease Law of Michigan, enacted last year, specifically included hernia in the schedule of diseases. Not all herniae, however, are so included, but only those clearly of recent origin, as to which disability follows immediately, and in which prompt report to the employer is made. This is not far different from the rule in regard to hernia as an accident. But in New York, during the past year, it has become somewhat the fashion to regard almost every hernia as either an accident or an occupational disease.

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

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

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

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

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

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

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

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

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

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

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

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

The principle of limited and graduated liability of the employer for dust diseases has been recognized by enactments in New York, Michigan, Pennsylvania and Ohio. An unusual provision has been adopted in the state of Washington, providing under their schedule form of law that the cost of compensation for occupational diseases shall be divided equally between the employer and his workers, and deductions shall be made from the employees' wages as contributions toward the insurance premiums involved.

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

It has much. The safety engineer can no longer regard himself as doing his job if he seeks only ways and means to eliminate the industrial accident. The industrial hygienist must become the colleague of the industrial engineer. Medical science must give intensive thought and study to determining the effects upon the human system of various industrial processes, and exposure to various materials therein. All exposures cannot be eliminated and still have industry perform its functions. Most important, therefore, is the medical determination of what are safe limits in exposures—the so-called "threshold limits." The engineer cries aloud today for expert medical guidance on this subject. Armed with such medical opinion and advice, the task of the engineer then is to devise practical ways and means for attaining conditions where such threshold limits apply.

Every industry presents a problem or series of problems in itself. No two industries are exactly alike. What is tolerable in one may be intolerable in another. What is good practice in one industry may be totally inapplicable for practical reasons in another. The task of the engineer then is to find how right principles may be made applicable.

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

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

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

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

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

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

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

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

Handicaps in the Diagnosis of Occupational Diseases

By CAREY P. McCORD, M.D.

Detroit, Mich.

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

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

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

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

While it may be said that there are no undiagnosable occupational diseases, it must be recognized that many remain undiagnosed, or more often misdiagnosed. The prime reason for this is that the usual physician sees only small numbers of any one type of occupational disease. Taking Ohio as a typical industrial state, the total number of occupational diseases, compensable and otherwise, reported to the State Department of Health during the year 1937 was 1,666. On the other hand, there are in this state 9,200 physicians. Thus, only one occupational disease arose for every 5.5 doctors in the state.

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

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

Definition and Terminology

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

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

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

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

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

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

Fallacious Medical Histories

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

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

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

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

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

Time as a Handicap in Diagnosis

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

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

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

Insufficient Training and Experience

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

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

tates toward an inferior physician, less concerned with the lack of qualifications. The extent to which lack of qualifications in occupational disease work may go is reflected in the fact that recently a duly licensed physician in the State of Michigan reported "intestinal peristalsis" as a diagnosis of an occupational disease.

While the unwillingness of a physician to accept responsibility for pathologic states with which he is not conversant is commendable, there still remains a duty to direct his patient into channels wherein adequate services may be procured.

Industrial Terminology

One of the most annoying handicaps in establishing the exact etiology of a possible occupational disease resides in the widespread practice of industry in using code symbols in the designation of its substances. On inquiry, the patient may state to his physician that his work consists of filling containers with "B-72." But, inquires the physician, "What is B-72?" The patient continues, "B-72 is a mixture of M-20 with H-40 and L-97." Completely the physician is left in the dark, but if the truth were known it might be shown that this patient was engaged in the filling of cans with a varnish remover, which consists of a mixture of wood alcohol, benzol and a synthetic wax.

Such situations may become so confusing that it may be almost impossible for the physician to obtain proper information as to work exposures. Medical, safety, social service or insurance departments all may have difficulty in obtaining full information as to actual chemicals and mixtures of chemicals designated in production operations only by code numbers.

The Absence of Records

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

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

Lack of Library Facilities

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

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

Attitude Toward Industrial Medicine

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

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

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

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

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

New Chemicals

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

Significance of Handicaps in Diagnosis

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

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

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

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

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

The Road to Betterment

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

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

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

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

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

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

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

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

fession, through its organizations, shall alter its attitude toward industrial medicine, shall recognize this type of work as just the antithesis of the undesirable aspects of state medicine, and may come to realize that industry, under the guidance of able medical directors, is the meritorious source of numerous cases to be referred to almost every specialty in medicine. The organized medical profession whole-heartedly should render its approval and support to the efforts of the physicians earnestly seeking to protect workers from the many dangers connected with industry's thousands of substances and work conditions.

Necessity for Uniform Absenteeism Record In the Industrial Health Program

By MILTON H. KRONENBERG, M.D.

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

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

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

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

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

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

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

These death rates could only have been prepared by statistical methods of analysis and, therefore, clearly point out where one phase of our problem lies. If told nothing more than this we would have plenty to do trying to uncover the menaces to health among the unskilled group of workers.

The morbidity and mortality data laid down by uniform and adequate reporting of cases can also serve as a basis for prevention and health education among workers, the same as is and has been done for accidents.

It may interest you to know that the Eastman Kodak Company, Edison Electric Illuminating Company, Hood Rubber Company, Westinghouse, Metropolitan Life, General Motors, and several others have for years made sickness studies with the aid of statistical methods. In this way they were able to evaluate the different sickness problems confronting them and those needing attention, and at the same time with these sickness records properly appraised and evaluated, they were able to educate their employees regarding digestive diseases, colds, pneumonia, tuberculosis, cancer, skin disorders, as well as other ailments.

Furthermore, studies conducted in specific industrial undertakings have shown the value of statistical methods in revealing the incidence of such diseases as pneumonia, tuberculosis, and degenerative dis-

Death Rates by Occupation

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

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

seases to be higher than the average for the entire industrial population. This was clearly demonstrated in a pneumonia study among steel workers which was conducted by the U. S. Public Health Service.

Drury, some years ago, was able to show a high rate of tuberculosis among workers in the ax-grinding industry, and the Barre, Vermont, study revealed a high tuberculosis rate among granite workers. No doubt, other occupational undertakings would reveal data for prevention, control and education were it possible to have adequate statistical records as revealed in the slide just shown you.

Dr. Selby of General Motors, in calling attention to his statistics shows that about 0.6 of a day per annum is lost due to occupational injuries and that includes occupational diseases as well, whereas, eight, nine or ten days per year is the total lost time from all illnesses. In Dr. Newquist's report for the American College of Surgeons, the figures are about the same. This shows us that our industrial illness problem is approximately fifteen times the size of our accident problem.

It is evident that industry could well afford to concentrate on illnesses among wage-earners, other than the occupational diseases, because they are the ones that cause the greatest amount of absenteeism and are the biggest drain on industry.

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

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

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

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

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

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

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

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

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

A card should be made out for each and every employee on the payroll, regardless of whether he or she gets sick or not. This is necessary in order to ascertain the ratio of those sick to the number on the payroll. The workers' age, sex, color and occupation are important to record since they will have to be related to the specific exposed population.

Under "occupation" state the work in which the employee was engaged when his sickness began. The "date disability began" should only be recorded for one full day or longer. In the column "work days lost" we refer to calendar days and this is necessary to put lost time on a comparable basis for all employees. For "diagnosis" one should list the sickness or injury when definitely known; if there is any doubt about the correctness of the diagnosis, a statement

Sickness Record Form

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

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

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

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

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

3. The mortality rate.

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

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

ADJOURNMENT

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Harvey, Managing Di
Conservation Bureau o
Casualty and Surety E
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The following parti
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J. D. Berman, D
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Chicago.

J. T. Brown, Safety
Pont de Nemour
Hickory, Tenn.

P. N. Bushnell, M
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CHAIRMAN HARVEY
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MR. RAKESTRAW:
the-job accidents com

many natural hazards for even the most careful and skillful driver, and if accidents are to be reduced, we must stress one of the E's, building out accidents by means of proper attention to highway engineering, improving, widening, elimination of hazards and make the highways conform with the speed and traffic to which they are subjected.

The Iowa State Safety Council is definitely on record against diversion of motor vehicle license fees for any purpose other than highway construction, maintenance and safety, and we believe there is no tendency on the part of the great majority of our legislators to even consider such a plan at this time; at least up to the present time there has never been any diversion in Iowa and we have been very vigorously opposed to any program of this nature.

"Save 100 lives during 1938 and 1939 in Iowa" was announced early this year as the goal of the Iowa State Safety Council's program; and if there is no upturn in killings late this year, the 1938 part of the goal is assured.

THURSDAY AFTERNOON SESSION

October 13, 1938

What About the Health of Quarry Workers?

By W. C. JAMES

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In spite of the widely recognized need for protective measures in certain types of mines, relatively little attention has been given to the related occupation, quarrying. It is apparent, though, that quarry workmen were pretty much alert to what might be expected from their employment.

In 1913, the English factory inspector, Dr. E. L. Collis, reported that masons and quarrymen "are said to regard sandstones as dangerous while limestones they regard as harmless."[1] This interesting tradition of the stoneworkers' profession is a quite accurate summary of the modern scientific proposition that quartz is the causative agent in practically all forms of occupational lung disease.

Since this is true, it will readily be apparent that discussion of quarry health hazards cannot very well be general. It must be specific for the type of material being quarried. This paper, therefore, proposes to suggest what is known about the effect of employment in four representative types of quarries: sandstone, granite, slate and limestone.

First, though, how broadly must we relate health to quarry employment? If a workman in a quarry contracted [illegible] it would not even occur to anybody to attribute his condition to his employment. On the other hand, if a quarry worker is discovered to have tuberculosis, which is also contagious, there is a general disposition to assume that his occupation is responsible. Sometimes this assumption is carried to ridiculous lengths. For example, a cement contractor's employee discovered that he had tuberculosis. He promptly demanded compensation—on the ground that a small amount of the mix from the mechanical mixer had splashed on him. Yet this claim was given serious enough consideration to warrant two trials.

George G. Ornstein, a New York physician on the staff of Sea View Hospital, suggests that a possible connection between employment and tuberculosis can be established only in those occupations where workers are regularly exposed to tuberculars (nurses, for example) or in trades where there is continuous and extensive exposure to silica dust.[2]

Sandstone

Obviously, sandstone contains quartz. It has long been recognized as potentially hazardous. Collis reports that four millers formerly suffered from a severe lung disease which entirely disappeared when metal rollers were substituted for the stone

grinding wheels. He attributed this disease to quartz in the stone dust liberated during the dressing of the wheel.[3]

Dr. James Wheatley, county medical officer for health of Shropshire, England, investigated the health of sandstone quarriers in the Grinskill quarries in 1911.[4] The rock in these workings consisted of 95.4 per cent silica. It was quarried by hand, picks being used to gutter or channel the stone. The quarried slabs were dressed dry by hand in open sheds.

Wheatley found that the death rate from "phthisis" among the quarry workers was 7.94 per 1,000 and among the masons was 16.71 per 1,000, while the general death rate from lung disease in this community was 1.47 for males over 20. Very few living men over the age of 60 in the district had worked long in the quarries.

Wheatley concluded that their occupation was responsible for their high mortality, because:

1. The stone workers were economically a little above the average of the district and were temperate in habit.

2. The death rate from phthisis varied with the amount of exposure to stone dust. The masons and dressers experienced over twice the deaths per 1,000 that the quarriers did, but that the rate for quarriers was far in excess of the rate for the general population.

3. Wives and children of stone quarriers who died of phthisis showed no extraordinary mortality. Therefore, the condition was not infectious and might be designated more specifically, lithosis; that is, stone disease.

He recommended that protection of the men from dust by wet methods and the use of respirators, and periodic physical examinations would be necessary to reduce the high death rate.

Of course in modern standstone quarries improved methods of operation and efficient protective measures have undoubtedly done much to obviate the hazard that Wheatley describes.

In 1927, three investigators of the Ohio Department of Health, Haynurst, Kindel and Neiswander in collaboration with Health Commissioner Barrett of Lorain County, made careful physical examinations with x-rays of 912 men engaged in sandstone quarrying in the vicinity of Amherst.[5] No effort was made to separate the quarry workers from the dressers or polishers, it being assumed that all were subject to the same hazard.

They found 28.3 per cent of the entire group with silicosis but only 1.4 per cent with a complication of tuberculosis and silicosis. Comparative vital statistics showed that in the villages of Amherst and South Amherst, where most of the employees live, the death rate from tuberculosis (all forms, both sexes and presumably all ages) was almost twice that of the county and 17 times the rate for the nearest industrial city, Lorain.

Granite

There is a wealth of information on the effect of exposure to granite dust, but practically all of it deals exclusively with granite cutters rather than quarriers. There is one inconclusive study of a group by 87 quarry workers in Boya, Western Australia made in 1927.[6] Twenty-five of these men had had previous mining experience. None of the 62 without previous experience showed lung pathology. Three of those who had worked in mines showed definite dust reaction in the lungs but they had all worked from 16 to 40 years in mines and less than 10 years in the quarry. Furthermore, wet drilling was the rule so there was practically no dust exposure. In view of the known harmful quality of granite dust when not controlled, this report at least demonstrates the value of control measures.

In 1934, Dreessen and Bloomfield made an examination of 63 quarry workers in Vermont, of whom the drillers were exposed to dust concentrations in the neighborhood of 100 million particles per cubic foot.[7] No lung pathology was noted in men with less than five years' service. In the group of men with from 5 to 19 years' service, one-third of the men showed definite lung pathology and four-fifths of the men with 20 years of service were found to have silicosis.

The small number of men examined is not absolutely conclusive, but the distinction between the findings in these quarrymen as compared to those in Australia where wet drilling methods were used is certainly significant.

Age Distributio

Age Group	Total No. of Quarry Workers
Under 30	61
30–40	119
40–50	80
50–60	52
60–70	24
70–80	4
	340

Length of Servi

Employment Period	Total No. of Quarry Workers
0– 5	64
5–10	113
10–15	79
15–20	34
20–25	23
25–30	18
30–35	7
35–40	—
40–45	1
45–50	1
50–55	—
	340

Incidence of X-ray Evidence o Q

Age Period	Total No. of Men	No.	%
Under 30	61	57	93.4
30–40	119	110	92.4
40–50	80	68	85.0
50–60	52	41	78.8
60–70	24	19	79.1
70–80	4	1	25.0
	340	296	87.0

Incidence of X-ray Evidence in Quarr

Empl. Period	Total No. of Men	No.	%
0– 5	64	55	8
5–10	113	100	8
10–15	79	71	8
15–20	34	32	9
20–25	23	18	7
25–30	18	14	7
30–35	7	4	5
35–40	—	—	
40–45	1	1	10
45–50	1	1	10
	340	296	

Age Distribution of Quarry Workers and Drillers

Age Group	*Total No. of Quarry Workers*	*% of Quarry Workers*	*Total No. of Drillers*	*% of Drillers*
Under 30	61	17.94	7	8.86
30–40	119	35.00	31	39.24
40–50	80	23.53	22	27.85
50–60	52	15.29	14	17.72
60–70	24	7.06	4	5.06
70–80	4	1.18	1	1.27
	340		79	

Length of Service of Quarry Workers and Drillers

Employment Period	*Total No. of Quarry Workers*	*% of Quarry Workers*	*Total No. of Drillers*	*% of Drillers*
0– 5	64	18.82	13	16.46
5–10	113	33.24	26	32.91
10–15	79	23.24	20	25.32
15–20	34	10.00	9	11.39
20–25	23	6.76	3	3.80
25–30	18	5.29	6	7.59
30–35	7	2.06	2	2.53
35–40	—	—	—	—
40–45	1	.29	—	—
45–50	1	.29	—	—
50–55	—	—	—	—
	340		79	

Incidence of X-ray Evidence of Lung Changes Possibly Attributable to Dust in Quarry Workers by Age

Age Period	*Total No. of Men*	*0*		*F1*		*F2*		*S1*		*S2*	
		No.	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*
Under 30	61	57	93.44	3	4.92	–	—	1	1.64	–	—
30–40	119	110	92.44	7	5.88	2	1.68	–	—	–	—
40–50	80	68	85.00	8	10.00	1	1.25	2	2.50	1	1.25
50–60	52	41	78.85	10	19.23	–	—	–	—	1	1.92
60–70	24	19	79.17	5	20.83	–	—	–	—	–	—
70–80	4	1	25.00	2	50.00	1	25.00	–	—	–	—
	340	296	87.06	35	10.29	4	1.18	3	0.88	2	0.59

Incidence of X-ray Evidence of Lung Conditions Possibly Attributable to Dust in Quarry Workers by Length of Service

Empl. Period	*Total No. of Men*	*0*		*F1*		*F2*		*S1*		*S2*	
		No.	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*
0– 5	64	55	85.94	7	10.94	1	1.56	1	1.55	–	—
5–10	113	100	88.49	8	7.08	3	2.65	2	1.77	–	—
10–15	79	71	89.87	6	7.59	–	—	–	—	2	2.53
15–20	34	32	94.11	2	5.88	–	—	–	—	–	—
20–25	23	18	78.26	5	21.71	–	—	–	—	–	—
25–30	18	14	77.78	4	22.22	–	—	–	—	–	—
30–35	7	4	57.14	3	42.86	–	—	–	—	–	—
35–40	–	–	—	–	—	–	—	–	—	–	—
40–45	1	1	100.00	–	—	–	—	–	—	–	—
45–50	1	1	100.00	–	—	–	—	–	—	–	—
	340	296	87.06	35	10.29	4	1.18	3	0.88	2	0.59

Slate

Slate is apparently a material of widely varying composition, as far as quartz content is concerned.

Dreessen analyzed some green slate and red slate in this country in 1933.[8] He found only a trace of quartz in the green slate and 3 per cent in the red slate. In neither case would any serious effect be expected. This was tentatively confirmed by examination of 79 workers, none of whom showed any specific lung pathology. It is, however, difficult to draw definite conclusions with assurance from this data, since few of the workers had been exposed more than ten years.

Considerable information is available about the Gwyrfai, Wales slate quarying district. The slate here is estimated to contain 25-45 per cent quartz, 25-35 per cent mica, and, the balance, hydrated aluminum silicate and ferromagnesium silicate. In 1927, Dr. T. W. Wade of the Welsh Board of Health published an extensive survey he had made on the incidence of pulmonary tuberculosis in this district.[9] He found a high tuberculosis mortality rate in the entire population which he attributes mostly to unfavorable climate, but partially to peculiar dietary habits of the natives. Superimposed on this, he found an even higher rate among slate quarriers, particularly in the higher age groups. The wives of these men also die of tuberculosis in advanced age more frequently, which suggests that the tuberculosis in these workers may be of the true infectious type as contrasted with the "lithosis" of Wheatley's sandstone workers. The high tuberculosis death rate was associated with a high pneumonia and bronchitis mortality also.

Dr. Wade quotes Collis in support of his contention that the exposure to quartz dust in the slate quarries accounted for this rise: "If in any given class," Collis said, "a high death rate from pulmonary tuberculosis is found occurring at a later period of life than usual and if this high death rate is associated with a high death rate from other respiratory diseases then that class is exposed to injurious dust."[9]

In 1930, Sutherland and Bryson supplemented the work of Dr. Wade by making x-ray examinations of the chests of 120 slate quarriers, in the same district.[11] Fifty-six or 46.6 per cent of these men showed definite lung fibrosis, of a type which is non-clinical and not specifically due to quartz dust. Fourteen men, all of whom had more than 20 years' experience in the industry were found to have definite silicosis. In this study careful analyses of both the rock and the atmospheric dust were made. While the rock contained from 25 per cent to 42 per cent quartz, the quartz content of the dust was between 40 per cent and 50 per cent. The authors concluded that slate dust, when it contains quartz, is harmful, but takes longer to exert its effect than pure quartz would.

Limestone

Little scientific data on the health of limestone quarriers has been available until now. You have probably read occasional references to chalicosis, defined as "a lung disease peculiar to stone cutters." The term "disease" as applied to the effect of limestone dust on lungs is definitely a misnomer. The harmless fibrosis which occasionally is seen in the films of persons breathing non-siliceous dusts is, as Dr. Gardner frequently says, of no more importance than the callouses on the palms of the hands.[12] There is no increase in tuberculosis or other chronic lung disability, no evidence of limited chest expansion, clinical shortness of breath or any other of the typical symptoms of the silicotic. Limestone quarriers are, in general, a quite healthy group of persons, as the following information, here presented for the first time, will show.

Early in 1936, Dr. Leroy U. Gardner and staff of the Saranac Laboratory for the Study of Tuberculosis embarked on an extensive study of the health of cement mill employees.[13] The study included eleven plants located in New York, Pennsylvania, Indiana, Iowa, Missouri, Alabama, Kansas, Texas, and California.

Three hundred and forty of the employees examined during this study were workers whose predominant experience was in the quarry. Two hundred and forty-six (72.25 per cent) had been employed exclusively in the quarry. Seventy-nine of these men were pneumatic hammer drillers which is generally conceded to be the dustiest quarry job. Almost half of these men (47.06 per cent) were 40 years of age or over and 23.5 per cent were 50 years and

Age Period	*Total No. of M*
Under 30	61
30-40	119
40-50	80
50-60	52
60-70	24
70-80	4
	340

	Infe
Employment Period	*Tot. No. of*
0- 5	64
5-10	113
10-15	79
15-20	34
20-25	23
25-30	18
30-35	7
40-45	1
45-50	1
50-55	1
	340

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14.7 per cent had worked
years in quarry operations.

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Infections of Quarry Workers by Age

Age Period	*Total No. of Men*	*PC* No.	%	*Old TB* No.	%	*Non TB* No.	%	*Pleurisy* No.	%
Under 30	61	9	14.75	–	—	–	—	–	—
30–40	119	18	15.13	3	2.52	–	—	2	1.68
40–50	80	19	23.75	4	5.00	1	1.25	7	8.75
50–60	52	10	19.22	3	5.77	–	—	1	1.92
60–70	24	8	33.33	2	8.33	–	—	2	8.33
70–80	4	1	25.00	1	25.00	–	—	1	25.00
	340	65	19.12	13	3.82	1	0.29	13	3.82

Infections of Quarry Workers by Length of Service

Employment Period	*Total No. of Men*	*PC* No.	%	*Old TB* No.	%	*Non TB* No.	%	*Pleurisy* No.	%
0– 5	64	13	20.31	1	1.56	1	1.56	2	3.13
5–10	113	23	20.36	5	4.63	–	—	3	2.65
10–15	79	12	15.19	2	2.53	–	—	2	2.53
15–20	34	8	23.53	3	8.82	–	—	1	2.94
20–25	23	5	21.74	2	8.70	–	—	2	8.70
25–30	18	3	16.67	–	—	–	—	2	11.11
30–35	7	–	—	–	—	–	—	1	14.29
40–45	—	–	—	–	—	–	—	–	—
45–50	1	–	—	–	—	–	—	–	—
50–55	1	1	100.00	–	—	–	—	–	—
	340	65	19.12	13	3.82	1	0.29	13	3.82

over; 47.9 per cent of the men had had more than ten years' quarry experience and 14.7 per cent had worked for more than 20 years in quarry operations.

Lung conditions which are directly related to dust exposure are of two types: The non-specific pneumoconiosis and the specific disease, silicosis. Non-specific conditions may be seen on the x-ray as exaggeration of the normal lung shadows, these exaggerations being classified according to two degrees of intensity, F_1 and F_2. The first degree is almost imaginary. In fact, one of the leading roentgenologists of the country, Dr. H. L. Sampson of Trudeau Sanatorium, says that if the interpreter were not specifically looking for a dust condition, he would ignore first stage linear prominence. He calls it the stage of imagination.[11]

The second stage is somewhat more pronounced but still is a healthy condition. Two important facts about this condition must be understood. First of all, according to leading authorities, non-silicotic fibrosis can be just as well the result of advancing slight circulatory disturbances, arterio-sclerosis or other non-occupational troubles as of dust inhalation. Furthermore, it is non-clinical; that is, it gives rise to no symptoms, signs or complaints nor does it have any effect on the individual. Any person, especially if he has lived in a large city where he inhales considerable quantities of coal smoke, might show this condition, yet be entirely unaware of it. This fact is worth remembering, since many physicians unskilled in x-ray interpretive technique are apt to classify these harmless conditions as "early silicosis," thus unnecessarily frightening both the worker and his employer.

If the "linear exaggeration" as it is often termed is the result of such a variety of causes, one might wonder how it can be shown that it is ever due to dust. Gardner's explanation is: If a majority of individuals exposed to a given dust show this condition and the frequency of the condition increases with length of service the assumption that the dust is the cause is justified.[12]

The incidence of this condition by age is shown. You will note that only 11.5 per cent of the 340 limestone quarriers showed any evidence of the condition and in one

.2 per cent did the condition go beyond the stage of imagination. This compares most favorably with the Welsh slate industry where almost 50 per cent of the men were found to have linear fibrosis.[5]

Attention is also called to the steadily increasing percentage of men with this condition with advancing age.

The other two columns of this table, headed S_1 and S_2, show a few cases of silicosis among these men. The history of these cases is interesting. Four of them are miners, all with less than 10 years' experience in limestone, and all of that experience gained in a mine where wet drilling methods were used and where the Saranac Laboratory engineer chemists were unable to collect enough dust for analysis.

Specifically, the one man with S_2 had worked seven years in the limestone mine and the three men with S_1 had worked 9, 7, and 2 years respectively. Even in exposure to highly siliceous dusts, it is generally agreed that at least seven to ten years is required to develop S_1. The answer, of course, is simple. All of these men had worked in metal mines lying in hard rock before employment in the limestone mine. This is an outstanding example of the absolute necessity of knowing previous occupational history before relating silicosis to present employment. The history of the fifth silicotic will be discussed later.

Referring once more to F_1 and F_2, it was seen that there was a steady progression in the incidence of F_1 with advancing age. Yet the same progression is not seen in increasing lengths of service, up to 20 years. In the very long service groups (20 years and over) the number of workers is hardly enough to be significant.

These tables clearly demonstrate that workers employed in limestone quarries are not liable to acquire disabling lung disease, and that the soluble nature of the limestone dust even modifies the usual tendency of workers in non-siliceous dusts to develop a non-specific, non-clinical, mild fibrosis.

Dusts are often suspected of increasing the exposed individual's susceptibility to infectious lung diseases, particularly tuberculosis. The situation in the Welsh slate industry, for example, demonstrates that some dusts do predispose to infection. Is this the case with limestone quarry dusts? The tables here give the answer. Not one

Incidence of X-ray Evidence of Lung Conditions Possibly Due to Dust in Drillers by Age

Age Period	Total No. of Men	0 No.	0 %	F_1 No.	F_1 %	F_2 No.	F_2 %	S_1 No.	S_1 %	S_2 No.	S_2 %
Under 30	7	7	100.00	–	—	–	—	–	—	–	—
30–40	31	28	90.32	3	9.68	–	—	–	—	–	—
40–50	22	17	77.27	4	18.18	–	—	–	—	1	4.55
50–60	14	12	85.71	2	14.29	–	—	–	—	–	—
60–70	4	2	50.00	2	50.00	–	—	–	—	–	—
70–80	1	–	—	1	100.00	–	—	–	—	–	—
	79	66	83.53	12	15.19	–	—	–	—	1	1.27

Incidence of X-ray Evidence of Lung Conditions Possibly Due to Dust in Drillers by Length of Service

Empl. Period	Total No. of Men	0 No.	0 %	F_1 No.	F_1 %	F_2 No.	F_2 %	S_1 No.	S_1 %	S_2 No.	S_2 %
0–5	13	10	76.92	3	23.08	–	—	–	—	–	—
5–10	26	26	100.00	–	—	–	—	–	—	–	—
10–15	20	14	70.00	5	25.00	–	—	–	—	1	5.00
15–20	9	8	88.89	1	11.11	–	—	–	—	–	—
20–25	3	3	100.00	–	—	–	—	–	—	–	—
25–30	6	4	66.67	2	33.33	–	—	–	—	–	—
30–35	2	1	50.00	1	50.00	–	—	–	—	–	—
35–40	—	–	—	–	—	–	—	–	—	–	—
	79	66	83.53	12	15.19	–	—	–	—	1	1.27

Chronic

Age Period	Total No. of Men
Under 30	7
30–40	31
40–50	22
50–60	14
60–70	4
70–80	1
	79

Empl. Period	Total No. of Men
0– 5	14
5–10	26
10–15	19
15–20	9
20–25	3
25–30	6
30–35	2
35–40	—
	79

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Chronic Lung Infections in Pneumatic Drillers

By Age

Age Period	Total No. of Men	PC No.	PC %	Old TB No.	Old TB %	Pleurisy No.	Pleurisy %
Under 30	7	5	71.43	–	—	–	—
30–40	31	6	19.35	1	3.22	–	—
40–50	22	5	22.73	–	—	3	13.64
50–60	14	2	14.29	1	7.14	–	—
60–70	4	–	—	1	25.00	–	—
70–80	1	–	—	–	—	–	—
	79	18	22.78	3	3.80	3	3.80

By Length of Service

Empl. Period	Total No. of Men	No.	%	No.	%	No.	%
0– 5	14	6	42.86	–	—	–	—
5–10	26	5	19.23	–	—	1	3.85
10–15	19	3	15.79	1	5.26	–	—
15–20	9	2	22.22	2	22.22	1	11.11
20–25	3	1	33.33	–	—	–	—
25–30	6	1	16.67	–	—	1	16.67
30–35	2	–	—	–	—	–	—
35–40	—	–	—	–	—	–	—
	79	18	22.78	3	3.80	3	3.80

single case of active tuberculosis was seen in the x-rays of 340 employees. 3.8 per cent of the men had at one time had tuberculosis, but it had healed or was at least quiescent when the x-ray was taken.

It is generally assumed that among industrially employed males about 2 per cent will be found to have active tuberculosis and anywhere from 4.5 per cent to 11 per cent would show the scars of healed or quiescent infection.

Such a record would have been impossible in the presence of a real dust hazard, according to authorities. These cases of old or healed tuberculosis, in the older men especially, would in all probability have become active in the presence of a dust with a silica hazard. In this connection it is interesting to note Gardner's statement to the American mining and metallurgical engineers last February. He said: "With calcium compounds, there is a tendency to deposition in the areas of tuberculous degeneration and an accelerated healing of the infection. . . . On the other hand, free silica, in the body at least, seems to have a specific stimulating effect upon the growth of the tubercle bacilli."[9]

Primary complex or healed clinical tuberculosis and pleurisy are simply evidences of old infections probably acquired and cured many years ago. They are of minor only as a matter of general interest and have no bearing on the question of occupational health.

Since a large number of quarry workers are not exposed to more dust than the average outdoor worker, it seemed desirable to make a special analysis of the pneumatic hammer drillers. If the dust of limestone quarries is at all harmful, one would expect to find these men affected. The following charts tell the story even more clearly than words. No case of pronounced linear exaggeration was found among the drillers but there is a higher percentage of F_1 in all age groups.

The one case of S_2 was found in a driller in a sandstone quarry being operated in conjunction with a cement plant. He was the only sandstone driller found during the survey and had been working at this job for a little over ten years, in a dust concentration in the neighborhood of 12 million particles per cubic foot. It should be noted that this man was not disabled, even partially.

In the classification by length of service the same increase in percentage of F_1 and the same lack of uniform increase in the condition with increased length of service is seen.

Aspects of the increased [illegible]

dust, even though the concentrations be moderate, will increase the incidence of this distinctly harmless departure from normal—but, the increase is not progressive with increased length of service and as far as is now known, never goes beyond the harmless stage.

The incidence of healed lung infection among drillers paralleled closely the incidence among quarry workers generally. Both were under the average of 4+% for adult males.[16]

Acute Illness

Little satisfactory data on the amount of acute illness among quarry workers exclusively is available. In Gardner's survey of the cement industry, which we have just been discussing, the men were asked to report any disabling attacks of acute respiratory illness they might have had in their working lives. Approximately 17 per cent of the quarry workers reported that they had suffered at least one attack of influenza. Only a little over 1 per cent had suffered from pneumonia and 1¼ per cent had suffered a disabling attack of bronchitis. Among the drillers 9 per cent reported influenza, 1¼ per cent, pneumonia, and 2⅓ per cent gave a history of bronchitis.

Gardner's observation is that these figures do not seem excessive. He could hardly say more without a definite basis of comparison with the general population.

During the last two years, the Portland cement industry has made a complete analysis of absenteeism among its employees.[17,18] This has given us valuable information on the exact condition of health of cement industry's workers. No effort was made to secure information on quarry workers separately but in general it can be stated that cement workers showed no pronounced difference from other men of their age and economic condition. The upper respiratory illnesses, influenza, rheumatism and heart trouble were the leading illness causes, as would be expected in any group of predominantly outdoor workers. Unfortunately, so few other industries have kept accurate absenteeism records (at least they have not published them) that no general comparisons can be made.

An excellent statement of the value of absenteeism studies has been made by Dr. R. R. Sayers, Senior Surgeon, United States Public Health Service.[19] "A knowledge of absenteeism with respect to frequency, duration and cause in each numerically important occupational group in an industry or in a factory, serves to reveal to those responsible for the industrial health program the type of action which should be taken to obtain a maximum reduction in the amount of time lost from work on account of disability. In the absence of such information it is impossible to estimate the relative importance of sickness problems in need of attention. For example, the incidence of pneumonia may be abnormally high in some occupational group, but the situation may be undiscovered for years when the number of cases occurring in the group is not related to the population exposed. When such sickness rates are available for specific diseases by occupation, the effect on health of certain environmental conditions may be measured and evaluated."

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tell him, (3) talk it over, and (4) let him try the operation by himself.

9. *School vs. On-the-Job.*—The decision as to method is a question of economy (not cheapness). For a given situation—considering geographical distribution of students, availability of instructors and equipment, effect on service, etc.—one method will be found to be most effective at least cost.

10. *The Foreman's Kit.*—In the old days there was a tendency to create foremen simply by picking a good workman, giving him the title, the "book of rules," and the authority to boss the gang.

11. *Trained Foremen Are Good Supervisors.*—Just as trained men are good workmen, so does it follow with foremen; with the proviso that administration of the organization is good.

12. *Preventive vs. Corrective Supervision.*—Supervision should anticipate possible difficulties or hazards rather than wait for these situations to develop and use them as "horrible examples" and subjects for discipline. An emphasis on safe practices is better than a study of accident reports.

13. *The Foreman's Job.*—A technically competent workman is not thereby qualified as a foreman, since supervision is a "craft" in itself.

14. *Developmental vs. Informational Training.*—Since the nature of the supervisor's job is different, it seems evident that the training approach should be different. *Developmental* training cultivates *judgment* and an understanding of *principles*, and so is better suited to supervisory people than *informational* training, which imparts *facts*.

Occupational Disease Hazard in Public Utility Industry

By DR. J. J. WITTMER

Medical Director, Consolidated Edison Co. of New York, Inc., New York City

An occupational disease has been defined as:

> "A disease peculiar to the occupation in which the employee is or was engaged and due to "causes" in excess of ordinary hazards of employment as such."

In 1935 the New York State Industrial Board, before the "all inclusive" amendment became effective, offered the following definition for the guidance of its referees:

> "The disease must be characteristic and peculiar to the occupation to make it come within the provision of the law."

A recent court decision in the Connecticut Supreme Court of Errors ruled that:

> "To come within the definition, an occupational disease must be a disease which is a natural incident to a particular occupation, and must attach to the occupation a hazard which distinguishes it from the usual run of occupations, and is in excess of that, attending employment in general."

It is with this interpretation that we will consider the occupational disease hazard in the Public Utility Industry.

Consistent with uniform experience, dermatitis is one of our major problems. A dermatitis can vary from a mild irritation lasting a few hours or days to a chronic weeping lesion which may continue for weeks or months. Dermatitis may be produced by the preservatives and insulating substances incorporated in various kinds of equipment. To avoid dermatitis, particular care is necessary not only in the selection of insulating materials, preservatives, and even transformer oils but also in the way it is handled by the men.

Each summer we have had several compensation cases arising in our distribution work where contact with poison ivy was a natural incident in the employees' particular occupation. Certainly education in the recognition of the poison ivy plant and immunization of the more susceptible helps to eliminate this hazard.

Care must be used in the selection of all materials for cleaning purposes. Even ordinary hand soaps for the personal use of employees must be selected. In considering industrial dermatitis we are all aware of the frequency of individual sensitivity where the material itself may not be at fault. A substance may be entirely harmless to the vast majority of men but peculiarly harmful to a certain few. Therefore, our problem is not in the selection of materials

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materials, but also in not permitting
employee who is allergic to certain
tances to be exposed to them. The
solution for elimination of dermatitis
man who is individually sensitive is to
ove him from exposure.

One of the most troublesome problems
the hazard incident to volatile solvents.
standing in this group is carbon tetra-
loride, which is extremely and danger-
ly toxic. When inhaled in concentrated
rm in space that is poorly ventilated, it
ll produce unconsciousness with practi-
lly no premonitory symptoms, followed by
most immediate death. Several years ago
made a study of the use of carbon
trachloride and found a large amount
ed in various maintenance operations. As
nonflammable grease solvent, it was a
vorite in maintaining good housekeeping
a generating station. It was extensively
ed in cleaning meter parts and in the in-
ection and repair of meters. While no
im had been filed, and no cases of poison-
g, we discourage its use entirely where-
er the operation permits. Carbon tetra-
loride is not necessary for cleaning pur-
es in most of the places where it is
ed. Stations where it was considered
dispensible have since its exclusion main-
ined a clean house and efficient operation
using only clean rags to keep the equip-
nt free from dirt, grease, and grime.

Where carbon tetrachloride is essential
the operation of the plant, we insist on
closed system, adequate down draft ven-
tion or a fresh air mask for the work-
n, whichever is the more practical. A
se check is kept through our purchasing
partment of the amount of carbon tetra-
loride used and through inspectors of the
afety group, as to where and how it is
ed. Another important use of carbon tet-
chloride is in the fire extinguisher. Hap-
ily, fires do not occur often and the in-
dent exposure is rarely in a small confined
ace. The use of a substitute such as tri-
lorethlene has been discouraged, since we
lieve it presents a greater health hazard
an carbon tetrachloride. When it is used
e same precaution mentioned above should
followed. The extreme fire hazard inci-
nt to the use of benzene, gasoline, or
ohol discourages their use and, accord-
ly, they present practically no health
zard.

Wherever lead is used in any combination, the possibility of lead poisoning is present. However, in the utility industry the hazard is easily controlled and can be quickly eliminated. The lead covering the transmission cable and the soldering of splices offers no problem of lead poisoning, if the workman follows ordinary rules of personal hygiene so that he does not ingest the lead. The soldering operations incidental to meter repair work offer no difficulty if hooded ventilation and strict personal hygiene are followed. Lead melting operations in the reclaiming of scrap conduit or for surfacing parts is not hazardous, if the temperature of the lead pot is held to that point where there is no emanation of extensive fumes, but adequate exhaust ventilation is advisable since one cannot always visualize chemical vapors. Acetylene cutting of lead pipes does present a problem of lead poisoning, if the workman is not given adequate protection from lead fumes.

The maintenance of equipment and properties requires the services of painters who still must use paints containing lead. The degree of hazard and the possibility of controlling the hazard are the same as with painters in any other industry, viz., to eat food uncontaminated with paint particles from the hands and to keep the hands out of the mouth. Probably the greatest possibility of the workman ingesting or inhaling lead dust in the utility industry exists in the operation of chipping or blowing off lead paint from old structures preparatory to repainting. Here, respirators and good hygiene are absolutely necessary.

The utmost care must be taken in concluding that an occupational disease really exists. It must not only be clearly demonstrated that the individual's complaint or incapacity is due to a toxic material, but very definitely that the particular occupation exposes the employee to that toxic material. Three recent cases illustrate this problem.

First, a middle aged employee who had been a painter for fifteen years was confined to his home suffering with headache, nausea, vomiting, and elevated temperature. The attending physician, informed on his first visit that the man was a painter, filed a report with the State Labor Department that the employee was suffering from lead

poisoning. Extensive studies of blood and urine during the next month failed to show any evidence of pathological lead absorption. The employee actually presented a classical picture of acute intestinal infection. He received treatment for this condition and was sent back to work in two weeks. Subsequent investigation has shown the man to be in good health since.

Conversely, another employee in his thirties who had worked as a painter less than two years was treated, over a period of three months by several doctors, for gastroenteritis and cystitis. On a close checkup, cystoscopic examination revealed his urinary tract complaints were due to the heavy metal poisoning. This diagnosis was confirmed by tests of the blood and urine.

Again, a case of lead encephalopathy occurred in a fifty year old Italian laborer, who had always done pick and shovel work. While the mental symptoms might have been thought of as indicative of lead poisoning, extensive investigation revealed that he at no time had ever worked with lead. Our nearest clue to the source of the lead poisoning was the fact that the employee had always made his own wine.

The reconditioning of equipment, furniture, and vehicles presents the problem of spray painting with all the attending risk of poisoning from the volatile solvents contained in the paint removers, paints, enamels, and lacquers. I cannot emphasize too strongly that the employee must be protected by forced draft ventilation of a spray paint booth or by wearing a suitable fresh air mask.

While it is generally conceded that the health hazard associated with welding operations is not great, yet precautions must be taken. We all are aware of the necessity of protecting the eyes from the rays of electric arc welding. The different metals to be welded, the impurities in these metals and the material contained in the coating used on the welding rods make it necessary to protect the men from the metal fumes emanating therefrom. On the small job in a well ventilated area there is no metal fume hazard. On the big job requiring several days or more of exposure, fresh air masks must be worn, if forced exhaust ventilation cannot be maintained. In the welding shop where small welding operations are going on continuously, adequate exhaust ventilation must always be maintained. Under all circumstances, the eyes of the welder and "surrounding" workmen must be protected.

Silicosis is not a problem in the routine operation in the industry. Where there is any tunneling job which requires drilling through silica-bearing rocks there is, of course, a silicosis hazard present. In the average street excavation work, the laying of mains, or the repair of underground transmission lines, I believe that drilling operations incidental to this work present no silicosis hazard. The workman's head is usually well above the street level and being in the open, he is not exposed to such a dust concentration as to cause silicosis. It is conceivable that even in some street excavation jobs, the character of the excavation can be such that unless dust protection equipment is applied, the man may be exposed to a dangerous concentration of silica-bearing dust. All jobs must be studied and answered according to the conditions presented.

We are often confronted with the problem of the rock driller being incapacitated from silicosis contracted in the course of previous employment. In my opinion, this troublesome problem has been at least partially solved by the provision in New York State whereby the workman is not deprived of employment even though by x-ray and history he shows evidence of silicosis; but on the other hand the employer is protected by a fixed period of liability, should the workman become incapacitated. Our information and knowledge as to relationship between pulmonary tuberculosis and dust exposure is in such a state of confusion that I merely mention pulmonary tuberculosis as an associated problem which still has to be satisfactorily solved wherever there is a possibility of excessive dust exposure. The solution of this confused state rests more with the medical than the engineering fraternity.

The inventive mind of the engineer and chemist in developing new processes, new materials and new uses of old materials, places mechanical progress in advance of our knowledge of the health hazards which may be present in the new procedure. As an example, I cite the process of metallizing wood and other surfaces. This new metallizing process under experimentation

in one of our construction shops resulted in a case of cadmium poisoning in one of our employees. Fortunately, it was a mild exposure and the employee was not seriously ill nor did any after-effects result. It illustrates the care which must be taken in making sure that no health hazard exists in any new procedure.

Recent attempts in the literature to confuse the results of acute carbon monoxide poisoning with claimed effects from so-called chronic carbon monoxide poisoning warrant some comment. There can be no question but that in some cases harmful after-effects may result from acute carbon monoxide poisoning. It is also generally conceded that the possibility of after-effects is greater where the individual has been exposed to a low concentration of gas over a long period of time, that is continuous exposure for several hours or even a day or two. We also know that in this type of exposure the probability of fatality is greater. But these are still cases of acute carbon monoxide poisoning and any unfavorable sequellae which may be attributed to the exposure are the result of "acute" carbon monoxide poisoning. I have never seen, nor do I know of any authentic case where symptoms or pathology were the result of repeated exposure to a low concentration of the gas for short periods; or where at the time of the exposure the individual had no symptoms. So, while we do recognize the occupational disease consisting of the sequellae following acute carbon monoxide poisoning, yet we do not recognize any problem of so-called "chronic carbon monoxide poisoning."

Contrary to popular belief, the incidence of acute carbon monoxide poisoning in the utility industries is comparatively rare. The requirement of efficiency in production and distribution demand a closed system and a minimum amount of waste due to leaks. It can safely be said that the workman in a gas manufacturing plant or around a holding station is exposed to less carbon monoxide than the average traffic officer at a busy metropolitan intersection.

It must not be inferred that just because the material is toxic or capable of producing an occupational disease, that the material or process must be discarded. Only recently two methods of processing the ends of poles to prevent decay and termite destruction were presented to our medical department for an opinion as to the health hazard. In each process the chemicals used were poisons. However, in conferring with the engineers, a procedure in the uses of these two processes was devised, i.e., using heavy gloves or long handled brushes; or where the chemical was injected into the pole, unbreakable containers are used, so that there is no health hazard present to the workmen who follow instructions.

The public utility industry must constantly keep before them the possibility that an occupational disease hazard may exist in any of their various operations. It is only by a continuing preventive program that the employee will be adequately protected. Need I say that the employer will also thereby be aided in getting a better job done?

There is no need for any hysteria over the occupational disease laws which are being enacted. A calm, intelligent, and rational approach to the problems which they present will eventually result in an improvement in the health of our workmen and a benefit to the industry.

One of the greatest hazards in this industry or in any industry is the human reaction to existing hazards. Contempt because of familiarity or long contact with a procedure or substance is hard to overcome. However, constant reiteration of rules and regulations and in special instances severe disciplinary action do aid in holding down the number of cases. Absentmindedness or periodic lack of concentration does increase the exposure hazard. Close observation and an understanding of the character and behavior of each employee by the immediate supervisor is of material aid.

ADJOURNMENT