Occupational Disease

WEDNESDAY MORNING SESSION

October 9, 1940

The meeting on Occupational Disease, planned as a Panel Discussion, was called to order by the Chairman, Walter S. Paine, Manager, Engineering Department, Aetna Casualty & Surety Company, Hartford, Conn., who presided.

Panel Discussion

CHAIRMAN PAINE: At every meeting that I have attended in this Congress someone has raised the question of industrial disease. This is a subject which has been maligned in some cases and has been a fantasy on the part of others. This, however, should not in any way destroy the realities that are back of the industrial disease problem.

In the discussion of this broad problem, we have asked the medical profession and the law to help us this morning. Each phase of the problem will be discussed on an orderly basis. We have assigned as the first speaker for each of these subjects one of the men on this platform. After he has finished his preamble, we will ask the members on the floor to present any question they may have on the subject.

We have the following subjects to be discussed: "Health Hazards in Spray Painting." Dr. Eugene Walsh, Associate Supervisor of Medical Service, International Harvester Company, Chicago, will open this subject.

"Fatigue and Its Relation to Occupational Disease." This subject will be taken up by Dr. Norbert Enzer, Director of Laboratories, Mount Sinai Hospital, Milwaukee.

"The Toxic Limits of Common Solvents." This subject will be opened up by Dr. Elston L. Belknap, of Milwaukee.

"Lead in Industrial Processes." Dr. Belknap will also handle this subject.

"Skin Affections." This will be handled by Dr. M. J. Reuter, Dermatologist and Syphilologist, of Milwaukee, Wis.

The last, but one of the most important, will be "Should Occupational Diseases Be Considered as Industrial Injuries?" This will be handled by H. A. Nelson, Director of Workmen's Compensation Department, Wisconsin Industrial Commission of Madison.

We all regret that severe illness keeps Dr. Paul Brehm, Supervisor of Industrial Hygiene Unit of Wisconsin State Board of Health at Madison, from being present.

The panel will be opened on "Health Hazards in Spray Painting." Dr. Walsh.

Spray Painting

DR. EUGENE WALSH: Painting is a topic that has received considerable attention. There has been an increasing number of hazards imported into the trade. Most of these have received wide attention, particularly in the past few years. It has been incident to the wide use of the spray gun and of the lacquers, particularly. Many of the solvents and products used in the paint industry have known toxicities. Others are in the experimental stage, so far as use and so far as their hazards to health are concerned.

In the old days of brush or dip or flow painting, still widely used, solvents of rather low volatility were employed, and the hazards associated therewith were not as great. However, when we come to the spray gun, particularly in its use in the recently developed lacquers, we come into a host of new solvents.

The quantities used per year in lacquers and solvents in the paint industry in the United States reach astronomical proportions. Many, many tons are used.

In the paints we have the following hazards: first, the pigments. There has been a growing trend definitely away from lead-bearing pigments toward non-lead pigments. Many of the non-lead pigments have their peculiar hazards. Many of them are relatively innocuous and can be used with relative immunity.

So far as the fluid constituents of paints are concerned, in the order of volatility in general, we have, first, the solvents which are, largely, for paints; the paraffins, oils and varnish; varnish with some turpentine or some spirits of various and sundry types. The lower the volatility, of course, if it is a toxic product, the greater the toxicity.

The ordinary paints and lacquers can be considered together because the problem of the solvents, largely, is what we wish to deal with. The solvents used are relatively low boiling products which volatilize readily, such as acetone, ethyl acetate, butyl acetate, amyl acetate, and so forth.

Next, the paint must have a diluent. In the ordinary paints—oils, turpentine or spirits may be used. In the lacquers—alcohol, toluol, xylol, mineral spirits have been used. In the past, benzol was used. We are glad to say that there is a growing trend away from the use of benzol, which has cumulative actions in the human individual, resulting in the low grade chronic toxicities due to a depression of the blood-forming organs. There is a definite trend toward less toxic diluents.

The next essential part of the lacquers includes the driers, such as ethyl lactate or cellusolve, monomethyl ethers and various other chemical products of known and unknown toxicities. Also, there must be a flexilizer or a substance giving flow to the plastic. These are relatively high-boiling low-volatility products, triphenylphosphate, castor oil, camphor and others, again of known and unknown toxicity.

The toxicities of the various individual products are often known. It is not the toxicity of the pure product, however, that we are often concerned with. It is the product which is used commercially. It is often the impurities in minute quantities that add to the toxicity. For example, we may say there is, in the case of xylol, some question as to its inherent toxicity. However, since benzol is so frequently a contaminant, we do have some benzol toxicity to be considered when xylol is used. Also, when we have two substances which are used to make a paint or lacquer fluid, its toxicity, resulting from the combination of the two substances is not usually that of a summation of the individual toxicities of the two. That is, if we have two products (A and B), A of one-plus toxicity, if we wish to use that terminology, and B of one-plus toxicity, we may get a resulting toxicity of three-plus, or something of that nature—just to use an arbitrary form.

The methods of control are: First, the substitution of non-toxic products such as we mentioned in getting away from lead-bearing pigments in paints. We are fortunate to have alert chemists in the paint industry who are alive to this problem. They are constantly striving and working with the industrial hygienists and the physicians in developing non-toxic products, so far as both pigments and solvents are concerned.

Another factor that has been considered and is of importance today in reducing toxicity is the mechanical development of the spray gun. Many years ago, in its infancy, no precautions were taken. The engineers weren't particularly interested in it. A man would spray with one or another, spreading the toxic substances about. Today, however, with the development of lower pressure spray guns, with the development of engineering methods of control of vapors and fumes and dusts incident to the process, we have less toxicity.

If an individual corporation is alert in observing and controlling the hazards present, very little toxicity need be encountered in most processes. This includes, of course, the precautionary methods for the individual, when I speak of the industrial hygienist and the engineer's phase of the problem. If an individual is working in a place where engineering methods are not feasible to control the vapors and toxic products, then the individual must have his respiratory protection to prevent inhalation. Most of the solvents which are used have a narcotic action, and their action is by way of absorption through the respiratory tract. Taking away the fumes is the way of control.

I have very briefly outlined some of the major points. Do you choose to pursue this question?

CHAIRMAN PAINE: Discussion will be carried on from the floor and also from

the viewpoint of the panel. May we proceed on this subject, namely health hazards in spray painting?

EDWARD SMITH (Jewell Alloy & Malleable Co., Buffalo, N. Y.): No mention was made about spraying whitewash.

DR. WALSH: Spraying with whitewash is a common procedure. As whitewash is largely calcium, it is a relatively innocuous substance. It is irritating to the respiratory tree and may be followed by a chronic cough. Not infrequently there are contaminants in whitewash which may have toxic products in them but, ordinarily, whitewashing is a matter that is done today, next week, and perhaps a month hence. It isn't done in most industries day after day. The exposure is relatively infrequent and the hazards are not great.

Likewise, most of the whitewashing procedures are done in large, open, airy rooms. That isn't true of some tunnels, of course. If it is done in closed rooms, tunnels and places with poor aeration, it is advisable, if the process is to consume any length of time, to have the individual protected in some manner. Just a simple draft of air or a mechanical dust type respirator probably would be usable if the exposure is to be of any length of time.

X-Ray Examinations

DR. ROBERT M. BURNS (Minnesota State Medical Assn., St. Paul, Minn.): Are there methods by x-ray examination from time to time or from year to year that will show progress of bronchial trouble as a result of these paint inhalations?

DR. WALSH: There are those that would answer your question in the affirmative. Most roentgenologists, however, rather scoff at the idea of making a diagnosis of bronchiectasis by x-ray. The shadows which we see in the x-ray are largely those of the blood vessels and fibrous structures of the lung. It is true, however, if an individual is using some paints which bear silica—and one paint that I did not mention is that used in the porcelain industry, silica-bearing paint—that is another problem. If you are using a silica-bearing paint, you will get the characteristic changes of silicosis.

However, for the ordinary pigment, so little is absorbed, so few of them produce progressive changes in the lung, they rarely show on the x-ray. Most of them are stopped by the mechanical aids in the nose and upper respiratory tract, that is the hairs, the cilia on the lining of the respiratory tract and, as such, are coughed up, rather than persisting in the respiratory tract.

However, if one is using paints over a long period of time, it is conceivable that a chronic bronchitis might result. However, here one is on thin ice. There are many other factors incident to the causation of chronic bronchitis that are equally as, or more, important than the products used in the paints, either the pigments or the solvents.

MR. CARR (Eastman Kodak Company): In spray painting in rooms, using lead-free gasoline as a solvent, we have noticed as much as 450 parts per million of aromatics, and we find that many lead-free gasolines now sold contain a large proportion of benzol, xylol and toluol. I wonder if much attention has been given to that fact?

DR. WALSH: That is a problem, it is true. Certain fields of oil, particularly those bearing the naphthionic acid oils do, in their cracking processes, result in benzol in considerable portions, in some instances, in the gasoline. The straight paraffin oils may result in some benzol but not so much. It is a factor to be considered. It depends largely upon the amount of benzol present. In some instances it has been said to run as high as 10 per cent in certain gasolines. That is not usually true.

There is one factor to be considered in gasolines, and that is the difference between benzol, which is the ring-structure and benzene, which is a straight hydrocarbon, and relatively innocuous. It has some toxic properties, but they are transitory, largely.

Benzol has developed a chronic toxicity. This particular subject is receiving attention now, but very little has been produced to indicate that benzol is a definite toxic agent in the gasolines produced. But if the aromatics were up to about 450 parts per million, you certainly are on the borderline of toxicity. I think it should be reduced, if it is at all possible, by ordinary methods. At least the men should be watched very carefully for blood changes, so far as benzol exposure is concerned.

MR. CARR: In that connection, it has been necessary for us to go to a respira-

tory protection of the supplied air type, supplied also with a charcoal canister at the man's waist, so that when he breaks the connection temporarily to go back in the room, he still has the protection of the charcoal canister. The connection, when broken, automatically shuts off both the air supply and also the air connection, so that he cannot breathe the room air.

MR. WALSH: That certainly is a fine arrangement.

DR. ALICE HAMILTON (Division of Labor Standards, U. S. Department of Labor, Washington, D. C.): In the Division of Labor Standards in Washington some two or three years ago, when I was visiting automobile plants, I was told they were making a change in their coatings. I wonder whether that has proved to be true? They told me they were substituting synthetic resins for nitrocellulose and as a solvent were using hydrogenated petroleum products which had very low volatility. It seemed as if that were going to be a revolution in coating in automobile factories. I should like very much to know whether that change has been made.

CHAIRMAN PAINE: Can anyone answer the question of Dr. Hamilton?

DR. WALSH: I would like to say to Dr. Hamilton concerning the substitution of synthetic resins for nitrocellulose products in the automotive industry particularly, most of us receive all of our information concerning the newer development of hazards from no person other than Alice Hamilton. If anyone in the room can answer the question, I am sure that she can. She beautifully reviewed the entire literature in a publication that she produced in 1936 called "Recent Changes in the Painter's Trade" which is Bulletin No. 7 of the U. S. Department of Labor. It is a beautiful presentation, and it is worth while for any of you interested in the paint industry to read it.

Concerning the question at hand, I know of no particular changes at the moment that have been instituted in the industries that I have been acquainted with. I do know that such things are in progress. As Dr. Hamilton suggests, I think that they are changes in the right direction, in many instances.

DR. A. L. BROOKS (Fisher Body Division, General Motors Corp.): We do quite a lot of spray painting. I believe there has been no radical change in the solvents and diluents used in the lacquers which we are now employing. The process is very much the same.

There has been some change in the length of time required to dry these lacquers, but the constituents are the same as they were.

W. H. KRAUSE (Allis-Chalmers Mfg. Company, West Allis, Wis.): There have been recent changes in regard to the diluents used in paint. Quite a few of the larger oil companies are now producing hydrogenated naphtha. These do contain considerable quantities of benzol and toluol. I wonder if there had been any experiments made with regard to the toxicities?

Benzol Frowned Upon

DR. WALSH: I should have mentioned, when we were speaking of toxicities of solvents, that the medical profession frowns upon the use of benzol as a solvent or diluent in any proportion. We just don't like benzol, regardless of its percentage, because it is so easy to get out of hand, and the chronic effects of its poisoning come on so slowly and so innocuously, they creep up on you before you know it. It requires rather close observation wherever there is any benzol or toluol.

So far as the hydrogenated naphthas are concerned, it has been said that the hydrogenation does not change the chemical structure of the naphtha, and it does not increase, particularly, its toxicity. If it is in relatively large quantities, 400 to 500 parts per million, then there is the problem of the toxicities inherent to the hydrogenated naphtha itself. But we would much prefer not to see benzol at all.

CHAIRMAN PAINE: Dr. Hamilton, did you wish to say anything else on the subject?

DR. HAMILTON: I think not. My study of the subject is four years old. I thought perhaps very important things had come to light since then. Apparently benzol is still a lurking danger which arises in all sorts of unexpected ways, especially as we use more cracked gasoline than we did before. I quite agree that it is something that should be avoided.

We always advise the substitution of toluol, when possible, for benzol, but I don't think any industrial physician would be willing to give a clean bill of health to toluol.

e are beginning to look upon it with more suspicion. Dr. Gammon of the du Pont Company believes it is much more harmful than we have thought hitherto. I hope he will, as the years go on, accumulate more accurate knowledge about it so that we may perhaps encourage its disuse, also. I think that probably would be in the right direction.

MR. GUMMAR (Barrett Company): I would like to offer one minor observation. Commercial toluol, as sold in this country, does not contain any measurable amount of benzol.

CHAIRMAN PAINE: We will have to pass on to the next subject: "Fatigue and Its Relation to Occupational Disease." This subject will be opened by Dr. Norbert Enzer, Director of Laboratories, Mount Sinai Hospital, Milwaukee.

Fatigue and Occupational Disease

DR. NORBERT ENZER: At ten-thirty in the morning I generally have a very low level of activity and suffer from fatigue. Fatigue is a state of bodily ill health, of transient character. It is evanescent, as we understand it and as the term is commonly used but, so far as industry is concerned, fatigue is that state of the individual at work which makes it impossible for him to perform what may be considered an average good output.

It is characterized by certain symptoms. It is characterized under ideal conditions of investigation by certain objective findings which I will elaborate in a moment.

In the strictest sense of the term, I suppose an occupational disease is that condition which can be directly traced to some agent or circumstance in employment which can be labeled as the causative factor of the disease. But as our horizon widens and our concept of disease becomes broader, and as we interpret the word "disease" as it was originally used in the Greek sense, a state of variation from health, or dis-ease, then we must regard an occupational disease as any state of ill health which has been contributed to by circumstances of employment.

Under that definition there is hardly a disease which, under some imaginable state of affairs, couldn't be related to what the man is doing. Those are the two extreme definitions of the term "occupational disease."

Now, any disease will produce fatigue. It is almost synonymous that disease limits the output or the capacity for work of the individual who has been affected. What we must recognize today is that fatigue may also constitute a state of disease. In other words, that we recognize fatigue as a functional disorder which must be treated, which must be recognized and corrected, and its causes eliminated.

The mechanism of fatigue is grounded in a very complex explanation which is not yet clear, and probably won't be clarified until a great deal of investigative work has been done. But in the past few years a considerable amount of investigation has been done, most notably at the Harvard School of Industrial Hygiene under Dr. Dill; and in Europe, up to recent times, a great deal of work has been done, particularly in Germany and latterly in Russia; the object being, in the European investigations, to find out what circumstances of employment contributed to fatigue, to correct those circumstances of employment to prevent fatigue and, hence, to increase the output of the individual in terms of his occupation, without sacrificing any quality of his health.

Now, the thing that we lack at present, so far as its applicability to the practice of industrial medicine is concerned, is a yardstick of fatigue. A number of investigations are going on in that direction, and I think before long something will come of it.

Broadly speaking, two main channels of investigation are being carried on. One is a state of fatigue relative to the muscular capacity of the individual. In other words, we relate muscle strength to the load. The other is a form of fatigue which I think is going to be more important as time goes on, and is related to the nervous system. That arises out of the fact that fatigue is produced by agencies which impair the ability of the brain to send impulses to the peripheral muscles so that work may be performed.

Now, monotony of work may be the greatest contributor to fatigue. I use that as an illustration. For example, we found out, in one small investigation, that individuals employed at work which called for dexterity and nimbleness and a high degree of mental alertness fatigued in less than a twenty-

four-hour period. In other words, if a certain standard of measurement was applied in the morning before work began, the same standard applied at the end of the day, we could demonstrate in almost all individuals so tested that they had experienced fatigue, and that that experience was definitely related to the ability of their nervous system to regulate their muscular activity in coordination.

Now, in jobs which call for a stationary position, manipulation of instruments, or monotony of exercise, that kind of fatigue must be recognized by the industrial physician.

The occupational disease, conversely, may produce a fatigue which may not be recognized unless the individuals are subjected to critical examination. For example, we have noted that individuals with a mild type of hypertension, increased blood pressure, have in many instances a lower fatigue threshold than individuals whose blood pressures are normal. Or an enlarged heart, due to valvular disease, a leaky valve, will produce the same phenomenon; or individuals with diabetes or individuals that have a low basal metabolic rate, because of a thyroid gland disturbance, or individuals who are abnormally obese will all show variations in their fatigue thresholds.

The only way that aspect of the subject can properly be investigated is to approach it from the medical point of view first. Examination of the individual becomes the important thing. It is important to apply critical standards of evaluation, then to attempt to correct them by medical program.

The industrial factor of fatigue, which I mentioned first, calls for a recognition that certain kinds of work can produce fatigue, and then to apply methods which will relieve it. I want to illustrate just two:

If we recognize that a certain occupation produces fatigue, we have discovered things which will relieve the fatigue. A man whose job calls for standing at a bench, in more or less one position, doing the same job over and over again, will have fatigue which can be relieved if he can periodically sit down, because his oxygen consumption in the sitting position is greatly reduced over the standing position, and he performs virtually less work within himself. Consequently he has available greater reserves of energy for his performance.

It has been pointed out, and we have been able to show in some small investigations, that if it could be arranged that this job could be done in the sitting position, the output would be increased and the individual would suffer less fatigue.

It has been shown that, in jobs which call for a to-and-fro movement between more or less fixed positions, without much opportunity to rest, if the period is broken hourly or at hour and one-half intervals, and simple freedom of motion allowed to get out of the range of what he was doing, rest is instituted and fatigue is relieved.

We have been able to show that the application of bathing, in certain kinds of industries, will produce a diminution of fatigue and raise the capacity of the individual to resist his industry or his job. Those are some of the features of the occupational aspects of disease, or the industrial aspect of fatigue, rather. With that casual introduction we can go on and attempt to answer some questions.

Tests of Fatigue

CHAIRMAN PAINE: Are there any questions from the floor? This is an interesting subject.

DR. WALSH: I should like to ask a question in relation to various tests of fatigue. The psychologists have all had people putting round pegs in square holes and all that sort of thing, rapidity of processes. That is one method that is not my concept of the way to measure fatigue, but it brings up one point; namely, the relation of fatigue to the mental status of the individual. Again, the psychological yardstick may be applied. What is the relationship of the intelligence quotient of the individual to fatigue? Does the person using his mind in his work fatigue more readily than one doing physical activity in which no mental effort is required?

DR. ENZER: If I may restate the question, I think Dr. Walsh really wants to find out whether individuals of low I.Q., so to speak, experience the same phenomenon of fatigue under the same circumstances as an individual of high I.Q.

DR. WALSH: That is right.

DR. ENZER: I would say he does, although that is not generally recognized.

BEN JOHANEK (Connor Lumber Co., Wakefield, Mich.): Do you not think a lot of this is caused through improper food?

DR. ENZER: We are now recognizing that nutrition plays an important part in nervous fatigue because we know there are certain elements in food that are important for the integrity of the central nervous system. But we have been able to show in some preliminary experiments and from some surveys that, in a general way, food intake, except in an extreme instance, is not important, but in acute instances it is. What do I mean by that? An individual who has been deprived of food for longer than he is normally accustomed, in other words, if his meals are separated by too long a period of time, fatigue will be produced. We showed that on ourselves. We took no food from early morning until late at night and were able to show increasing fatigue.

We were also able to show—and this is well known, of course—that there are certain kinds of food which give some temporary relief from fatigue, most notably the sugars, carbohydrates, and a good deal has been done on the proteins of diet. But in the sense that I have tried to lay the subject this *morning*, diet is a factor in fatigue because it becomes a disease state, and a disease state induces fatigue. Diet will produce a state of fatigue if we have some acute disturbance in the habits of diet.

Factor of Noise

MISS MARY LOU SCOTT (Jos. E. Seagram & Son, Louisville, Ky.): I would like to know the effect of factory noise in regard to fatigue.

DR. ENZER: Noise is a factor in fatigue. We demonstrated that objectively in a scientific way in a laboratory, in this manner: We tested individuals for the flicker phenomenon rate which, as I said, constitutes our base line. Afterwards, we stimulated their ear with a sound of a regular intensity, rhythm and rate, the object being to see whether we could fatigue one center of the brain and in that way effect fatigue in another center of the brain, or whether we could distract one center from the other.

We found that this investigation brought to light two rather interesting things, or I would say three, perhaps. One is that there are, constitutionally, individuals who are sensitive to sound, because we could pick out from a group of individuals people whose flicker phenomenon was greatly depressed when their ears were stimulated; which suggests, perhaps, that such individuals work best in a quiet atmosphere. That is a speculation.

Another type of individual constitutionally wasn't affected at all. His flicker phenomenon was exactly the same rate.

The third individual had his flicker phenomenon raised; in other words, he was stimulated by sound. I think casual examination amongst yourselves will probably bring to light illustrations of the individual who can concentrate on reading a book while the radio is going on and understand both of them perfectly satisfactorily.

Now, when we fatigued these individuals by their routine work—in other words, we conducted the same test in the morning and got a certain base line value; then they did their day's work, and we tested them at the end of the day—we found that fatigue accentuated the direction of their natural constitutional tendency. In other words, the individual to whom stimulation of the ear depressed the flicker phenomenon found that depression increased at the end of a day's work.

PAUL M. HARRIS (Western Austin Co., Aurora, Ill.): Does the human system have the ability in any way to build resistance to this monotony, so it doesn't affect fatigue other than the infusion of glucose or the increasing of the oxygenation?

DR. ENZER: That is a phenomenon known as adaptation in a physiological sense and, in the social sense, it is a question of getting used to your job; but the unfortunate part about getting used to your job is you are not the same today as you were five years ago. In other words, the individual today can't get used to the things he was used to five years ago. Age is an important factor in that direction. The longer the individual is at a fatigue-producing job, sooner or later there will come a time when his fatigue becomes manifest.

We have found that our so-called fatigue testing standards showed no important factors, so far as age was concerned, but the older individuals had a lower threshold to the thing that produced the fatigue than the younger individuals. In other words, it is

not entirely true that experience with a job is a guarantee against fatigue.

CHAIRMAN PAINE: In order that you may not be fatigued, I am going to change the subject. I am asking Dr. Belknap to take the two next subjects, 3 and 4: "The Toxic Limits of Common Solvents" and "Lead in Industrial Processes," and dwell on those subjects as one.

Toxic Limits of Solvents

DR. ELSTON L. BELKNAP: Mr. Chairman, I know there may be several distinguished guests but I am sure that we in the medical profession always feel peculiarly honored when Dr. Hamilton is in the audience. If there has been anyone who has been responsible for bringing to the attention of American industry and the medical profession the importance of toxicology in industry, I think it is Dr. Hamilton.

I will emphasize a few of the toxic limits of the common solvents, so-called thresholds. While these limits have been more or less agreed upon by authorities in this field, particularly such as Doctors Drinker, Haggard and Hamilton, there is no threshold that is arbitrarily perfect, and the actual decision of whether or not the solvent has been toxic is the observation of the patient who has been exposed to that solvent, by a physician who must determine whether or not there has been a temporary intoxication and whether or not there has been a residual.

Dr. Walsh has really very ably covered the subject of the hazards of spray painting, and solvents which are the chief hazards of spray painting, but I will mention a few which I have grouped in increasing order of toxicity.

As an example of probably the least toxic solvent—I say least toxic because no solvent is not potentially toxic; in fact, some go so far as to say that all good solvents are toxic—there is gasoline. It has been stated that 1,000 parts per million is a safe limit for continued exposure. The matter of contamination by other substances such as benzol in 5 to 10 per cent in certain gasolines, certainly would alter that safe threshold.

The next group of solvents which are slightly more toxic, are the amyl and butyl acetates and ether which are allowable in 400 parts per million. Some authorities still state that they belong in the 1,000-part-per-million class. The most recent report classes them as 400.

The third group of 200 parts per million, include the following: Methanol or wood alcohol which, as you know, may have a serious effect on vision and cause blindness; toluol and xylol, tetrachlorethylene, trichlorethylene and turpentine.

The fourth group, which has dropped to 100 parts per million, include carbon tetrachloride and ethylene dichloride.

Then the fifth group of 75 parts per million, benzene and dichlorbenzene; and finally nitrobenzene, which we, fortunately, actually use very rarely as a solvent, is 5 parts per million.

I think it is important to remember that these solvents, if in sufficient concentration, may kill. This is in contradiction to the other subject that I have been given, which is lead, which very rarely kills. These solvents kill, first of all, by simple suffocation, if they are used in an enclosed space, such as in a vat. But the sinister element of the solvent, of the toxic solvent, is the fact that it affects the central nervous system because, as you know, these solvents are fat solvents, and our nervous system is largely made up of fatty tissue or lipoid tissue, so the nervous system is very easily affected. We have involvement, therefore, of the eye, one of the most highly developed nervous structures. Then we have central nervous system involvement, paralysis, inability to walk. Also, we must realize that some of these solvents actually damage the liver and the kidney, causing an acute Bright's disease. It is thought that some of them may cause cirrhosis of the liver.

Fortunately, one of the best solvents and one of the most dangerous is not included in the list at all now, the tetrachlorethylene group used in the airplane industry in the past. That had the peculiar ability to attack every part in the body, including the heart muscle. That, too, is said to be a contaminant of some of our other solvents. It has been mentioned that possibly the former contaminance in trichlorethylene was really the reason why trichlorethylene had originally had a rather bad name.

I think one of the most important things to remember in dealing with the control of a good solvent is that we are dealing with a potentially dangerous substance and not make any effort to conceal that fact from

anyone in the factory. We of the medical profession have always felt that we like to put our cards on the table. We know that it is a great deal simpler to follow the ancient axiom and tell the truth. So that, I admire, for instance, the benzol company which puts on its barrels, the word "Poison." I am not in a position to know whether they more or less did that because they were told to, but I know they do it.

I think there are many other companies that should put the same label on their products. In this connection I would like to tell of a case that I was asked to see, where a young boy, in the middle of the summer, working in a shop which made motors, suddenly became very sick, had severe headache, was dizzy, and had to stop work. He was working with a substance which he regarded as harmless.

When I first heard of the case I insisted I would want to see the process and see the plant and get my information firsthand rather than attempt to talk to some foreman by telephone. (The medical profession as a whole is learning that it can only fulfill its responsibility by demanding the right to know all about the exposure of the patients that come into their hands.)

When I went into the shop I found that this worker was using a large paint brush, dipping it into a large bowl of liquid, which he then slapped on the motor to get the grease off. On this particular hot day he evolved the idea of setting a fan, which ordinarily, perhaps, blew the fumes away from him, directly opposite the bowl of material and blew the fumes directly in his face. He got cooled, and then he got sick.

I asked the foreman what was in that material, and he said he didn't know exactly; it was stock material, perfectly safe, as far as he knew. I said, "Well, I would like to know what it is." So there was considerable upsetting of routine. We finally went out into a shed in the yard, completely dark; we finally got a flashlight, and we found a barrel of benzol marked "Poison."

Now, no one in that shop knew what they were doing. There were a dozen other workers each doing the same thing but who, fortunately, had not gotten this brilliant idea of the fan.

The curious thing about this particular shop was that in another department, not more than thirty feet away, they were doing spray painting, and they were doing it properly. Instead of exhausting the spray overhead and bringing it right back in the worker's nose, they had their suction underneath the objects to be sprayed and took advantage of draft as well as suction. They had good engineering equipment and staff, but they simply didn't know what they were using in this particular instance.

I had another experience with a man who was a so-called neurotic. I think most of you can spot the neurotic, if you have had any shop experience. This man certainly was. He had been to half a dozen doctors. One told him he was going to die, and another one said there was nothing the matter with him.

Again I demanded to see the shop. We found he was spraying an aluminum paint with a harmless solvent, a diluent, with good suction and a good spray gun. However, on further talking with him and confirmation from the foreman, I found he was the one man in the shop who was delegated to clean the spray guns at the end of the working day. He would sit down and squirt material, which he called chloride, in and out of the spray guns, and lean over the vat he was working with. Finally, he noticed he began to get happy and whistle and sing, and he began to look forward to the experience at the end of every day. However, finally he noticed he was getting weak, he was dragging one leg, and his heart was going very fast.

Well, this illustrates one other sample. This was a large corporation. Yes, they were using chloride. Finally, after great difficulty and having to go to the treasurer of the organization and going into the files we found that this was a material which they had bought from a supply house in another city, and they did not know what was in it. We finally found out it was ethylene dichloride.

The course of that individual is interesting, in that we put him in the hospital. It eventually cost that company quite a lot of money. I was in this to find out all I could learn about the action of that particular substance. I put the man in the hospital three or four weeks and did a number of delicate tests on him.

Well, he came through, and interestingly we found that he had an opportunity to de-

velop a cold once or twice. Every time he did, he developed jaundice. Then, of course, we did liver function tests and found reduction of that. We found he had a weakening of the heart muscle. We found a definite loss of the reflex in one ankle-joint, showing a definite involvement of the central nervous system.

We were able to get all the physicians to agree that this man was considerably disabled, that it was due to his occupation. You will understand, I was seeing him not for himself but for the company. I think a good many of them thought I had been a little generous to this malingerer. This man went ahead and got a large settlement. I don't know anything further about the case except that I did hear that the man died and that the death certificate said "cirrhosis of the liver and heart failure." Unfortunately, we didn't have an autopsy to confirm it.

In my opinion, the toxic solvent is one of the most dangerous substances and it may seriously disable and kill.

Lead in Industry

As a preface to the subject of lead in industry I would like to say that I am not specializing entirely in industrial medicine. I am one of that increasing group who feel that industrial medicine is not a specialty in itself but is merely a division of internal medicine or diagnosis, the large field of medicine which in private practice corresponds to or is correlated with the field of general surgery. I am glad that a large proportion of my practice is still private practice. I am also consulting medical director to one of our industrial concerns in Milwaukee, with branches over the country, so that I have an opportunity to see lead and other toxic materials.

When you see a man who has said, "I have lead poisoning," do not forget he may have some other disabilities and diseases, such as acute appendicitis, gallbladder, kidney colic and so forth. In my private practice my interest has been sharpened so that I always make an effort to take a very careful occupational history on a patient, even though he may come to me purely as a heart case, lung case or what-have-you.

In this particular plant in Milwaukee, which began by having and still has, as a large proportion of its work, storage battery plants, when I came there about ten years ago we were having an incidence of about 24 lead cases per 100 employees per year, which corresponds pretty well with the percentage of 15 to 16 reported by the Public Health Service in work about that time.

In five years, by cooperation with the medical department, the engineering department and management, we dropped that to an incidence of 2 per 100, and for the past five years we have had no cases of lead poisoning at all. We are still handling lead, and we are still handling it in large amounts.

I think that in the storage battery industry, probably, men are exposed potentially, at least, to the greatest concentration of lead for absorption directly into their bodies than in any other industry. I am glad to report that, having followed this particular group of workers of about 80 for this period, at the end of ten years they are certainly just as healthy and, in many respects, I think healthier than the general run of the population. Of course, we have reduced their lead absorption, but at times it will break down the physical resistance and respiratory protection. They occasionally have large doses of lead. Many of these workers were persons who had had lead poisoning or serious lead absorption in the period of observation.

Lead is one of the most widely used so-called poisons in well over 200 industries. I think there is no doubt but in the large industry the hazard is well controlled. First of all, it is recognized and then every effort is given. No expense is spared to study the men and to reduce the continuance of any exposure. However, in the small industry, which is the major portion of industry in this country, lead is continually cropping up, and even silicosis, which got the center of the stage in recent years, certainly in Wisconsin, has now taken a back step, and lead has come back into its own, together with the ever increasing use of solvents.

I would like to stress again the danger here is one of non-recognition, that we have our trouble in the small plant, not in the large plant. I will rapidly run through the types of industry where I have seen lead poisoning occur and in which it is an important factor.

The most important is the storage battery industry. Then the streamlining of our automobiles and trucks where, after welding, of

course, as many of you know, they were at first smoothed off by lead paste which, after it cooled, was then ground by machine grinder and produced a great amount of finely divided, inhalable dust. This brings up the fact that the most important hazard in any lead industry is the point of inhalation. Remember that lead dust inhaled is much more dangerous than swallowed, and that very rarely are lead compounds absorbed through the skin, perhaps with the one exception of tetrachloride fluid which is an organic and fat soluble substance.

It is rather amusing that many plants, smaller plants, particularly, have had to give up machine grinding of welded joints. Here is a return of modern industry to the horse-and-buggy stage. They are going back to hand filing where, of course, the particles are heavy and are too large to be inhaled. The problem can be licked, however, even by machine grinding, if one uses respirators.

It has always been said that lead poisoning was very common in painting. My experience in ordinary painting nowadays is it is very rare, particularly on inside painting where lead has been substituted by other substances, such as titanium, zinc and so forth, which are harmless. On the outside, however, lead is still used, in many instances, because it is the one substance that will stand the weather.

Here we come again to the question of finely divided, inhalable dust where men burn off old paint in private homes; not in the large installations, of course, or sand, either by machine sanding or by hand sanding. There we have the question of finely divided dust which is inhaled. You must remember that dust when inhaled passes directly into the system and immediately circulates throughout the entire body.

I make a recommendation, therefore, that any worker that has gotten his lead by burning off or sanding, be given a respirator for that purpose, even though he is an outside worker.

In the wrecking of old buildings and old ships, of course, there is the constant presence of lead absorption when the steel has been coated with several coats. It ideally forms a fume which is so fine as to be almost invisible and is absorbed directly into the system. The only way that a worker doing that can really protect himself, in my opinion, is to use an air-line respirator. I have seen a great many men in one particular type of ship industry, cutting up old ships outdoors in mid-winter, and I have never seen men leaded up so rapidly. Of course, this is an old story. The Navy found this out twenty years ago when they scrapped many of the old ships. Unfortunately, some people in industry, as well as doctors, are not very good on keeping up on their own work, by reading, and experiments have to be made again.

In the smelting of lead or zinc ore and scrap metal, lead poisoning occurs. In pottery making where a glazed mixer is used, one most usually is exposed to lead. In the printing industry we have heard a great deal of lead poisoning.

I had an opportunity recently to make a survey of a group of printers with the Wisconsin Industrial Hygiene Unit. They went into an analysis of the air, and I examined the men. To be sure, our list was not large, some 30 men in fourteen different printing establishments, but it was striking that all of these men were in excellent health and, as far as I could see, there had been no great deal of turnover.

However, there are one or two spots in the printing industry that are danger spots; that is, of course, the man who remelts the old type metal or who saws it, if he uses a machine saw. I think it is interesting, going through our records of printers in the State of Wisconsin for a great number of years past, we have had only three cases, one of which was really a serious case, and that man was one who remelted—he was the forgotten man, worked down in the basement on a kettle, where nobody paid any attention to him, and there was no protection.

In passing, I will simply name soldering, and that occurs very frequently even in the evaporated milk industry out in the country; tempering of metals, brass foundries, ink making, insecticides. This potentially may occur in leaded steel when it is scrapped. Then I would class as the final one, the risk which says they have no lead hazard. That is the place you should look particularly.

As I said, the important portal of entry is through the nose. If we bear that in mind, the problem of control of lead poisoning is really not difficult. If, of course, your engineers reduce the exposure to 1.5 milligrams, I don't think you will have a case of

lead poisoning. However, as a matter of practical interest, I think it is very difficult to get there in ordinary industry, and I would more or less formulate 3 as a safe level. I think it has also been found by other workers. However, if you get over 3 you certainly have the possibility of serious lead absorption.

I want to emphasize that mere lead absorption does not mean the man has lead poisoning. He may have a lead line, may have lead in the urine, .08 milligrams per liter, but that does not make lead poisoning. That is merely evidence of absorption. He must have, in addition, clinical symptoms of one of the three types of lead absorption.

As a final word in regard to the role of the medical profession in its cooperation in industry, it seems to me that the medical man should first of all be responsible to the highest man in authority in the plant, so that he can go direct to him with any problems that arise, and before any new procedure is used or any new chemical, have a conference with the physician to see whether there is any possible danger, whether there are volatile solvents or lead, so that the danger to the men may be prevented before it happens.

I am not making a plea for absolute substitution for and avoidance of the use of lead. I think industry cannot get along without the use of lead, cannot get along without the use of a number of these solvents; but if industry is forewarned, and if the worker is informed correctly so he will cooperate in the use of protective devices and, finally, the medical profession is allowed to see the patient as often as they see fit, perhaps every two or three weeks, then there need occur no occupational disease in industry.

CHAIRMAN PAINE: Are there any questions on either one of these subjects that you would like to ask?

MR. HUTTER: What is the effect of the smell of kerosene on the worker? Is that a permanent effect or just temporary?

DR. BELKNAP: As far as I know, there is no ill effect from the inhalation of kerosene.

R. S. SKYRM (Employers Liability Assurance Corporation, Boston): Would Dr. Belknap recommend the direct venting of lead pots on linotype machines where the pots are electrically heated and thermostatically controlled so the temperature of the lead does not exceed 500 degrees?

DR. BELKNAP: That is a good practical question. As we know, lead melts at a much lower temperature when volatilized. In my experience, lead does not really volatilize until around 1,000 or 1,100 degrees.

In this group of workers that I am following, some years ago, large lead pots, two or three feet in diameter, were unhooded because of certain changes in technical procedure, and the plant never got around to the hood. I disapproved of that and repeatedly said they would have cases of lead poisoning there if they didn't hood. They said they would just as soon as it was practical. It has never been practicable, and I am here to say we have had no lead cases develop to the point of disability, and we have had very little lead absorption result from that. The same men have worked there for ten years, dipping lead out of the pot, incidentally, at temperatures ranging usually from 850 to 950 degrees. In this group of linotype workers we found no evidence of lead absorption in some of the shops where they had no suction. I would not say in my own experience that hooding is necessary at 500 degrees.

MR. CARR: I wonder if there is any evidence to indicate the toxic limit for butyl alcohol could be raised above that given? We had experience over some twenty years with the same group of men, working in concentrations from 200 to 400 parts per million, and under careful examination they have shown no indication of trouble.

One other question is whether much work has been done on toxic limits of dioxene?

DR. BELKNAP: I think Dr. Hamilton will have to state if she recalls whether we have toxic limits established for dioxene.

DR. HAMILTON: Dioxene is the trade name for diethylene chloride. No toxic limit has been established for that. We considered it a fairly safe solvent until some very disastrous cases occurred in England from over-exposure, causing five deaths. Since then we have looked upon it with a good deal more suspicion. There has not been enough work done on it to establish any maximum allowable concentrations.

DR. BELKNAP: In regard to butyl alcohol, the butyl radical acetate is much less toxic than ethyl or methyl, particularly. So I would be interested in your point of view.

I think probably it could be made at safe limits.

MR. GUMMAR: I want to endorse completely the principle of maximum clearances of safety standards in engineering, but they should be based on factual data. As regards toluene, there have been enormous quantities used in the lacquer industry since spray painting came into use. It is sprayed into the air as fine mist, and even though it evaporates at a slower rate than benzol, if you inhale the mist, you get severe effects, if it is toxic.

I have employers in four states, New York State, New Jersey, Ohio and Connecticut, who for the past sixteen years have not had any reported cases of chronic toluene poisoning; yet Ohio in the past sixteen years has had over 69 cases of poisoning from gasoline in the petroleum industry.

As to the experimental results, I can find no experimental data indicating the toxicity should be such a low value. Some of the confusion arises from the failure to distinguish between chronic and acute poisoning. It is a fact that in extremely high concentrations, toluene and xylene are more toxic than benzol; that is, if you go into a chamber where there are 20,000 parts per million, you would be unconscious quicker from toluene and xylene than you would with benzene, but that is an entirely separate phenomenon from the slow chronic poisoning.

CHAIRMAN PAINE: The next topic will be "Skin Affections" and that will be handled by Dr. M. J. Reuter.

Skin Affections

DR. M. J. REUTER: When we consider to what extent the skin of the worker is exposed to injuries, the action of chemical irritants and the various infectious agents, it is not surprising that occupational skin diseases are a major problem in industry. The United States Public Health Service estimates 69 per cent of occupational diseases are skin diseases. They carried out a study in 100,000 workers and found, in the course of a year, that one per cent of these workers were affected with some skin disease as a result of their work. This did not include burns, splashes of acids and alkalis, and the ordinary pus infections of scratches or abrasions.

The problem confronting the physician is to determine the relationship between the skin disease and the occupational environment, to discover the nature of the offending agent and to adopt measures designed to cure the condition and prevent its occurrence.

There are many predisposing causes of occupational dermatosis, such as uncleanliness of workrooms, of clothes and of person. Previous skin diseases as, for example, eczema, are potent factors, because individuals with eczema react seven times more frequently to external irritants than non-eczematous individuals. The skin of the young and old is more susceptible to irritation and infection than the skin of persons in middle life. Dry skin is more vulnerable to irritants than oily skin.

The skin of certain parts of the body is especially sensitive, for instance, that of the eyelids and genitalia. Anything which lowers the normal threshold of resistance of the skin may act as a predisposing factor in the production of dermatitis and of infectious lesions. These factors include bruises, marked sweating and maceration, prolonged exposure of the skin to water and especially to alkalis and repeated scrubbing of the skin. These agents tend to remove the normal protective coats of the skin, that is the outer horny layer, and thus expose the sensitive epidermal cells directly to irritating material. A point fairly recently emphasized is that individuals with common athlete's foot are much more prone to occupational dermatitis of the hands. Apparently this infection of the feet acts as a sensitizing factor.

The actual causes of occupational dermatoses are mechanical, physical and biologic agents and chemical irritants. Mechanical agents produce bruises and lacerations, as well as friction and pressure resulting in various inflammations and thickenings of the skin.

The physical agents which may produce an occupational dermatosis are heat and cold, either dry or wet, electricity, ultraviolet rays, either from the sun or artificial, and x-rays or radium.

The biologic agents are the common bacteria, fungi and parasites.

For the most part, however, occupational affections of the skin are the result of contact with irritants of a chemical nature,

usually acids or alkalis producing simple inflammation of the skin.

As a subject for discussion, I might say that probably cleansing agents used by the workers are one of the most potent factors in the causation of occupational dermatitis.

CHAIRMAN PAINE: This is a subject in which there are a number of men interested. Will you expedite your questions?

DR. ENZER: I would like to ask Dr. Reuter to say a work about skin cancer in occupational exposures.

Skin Cancer

DR. REUTER: Ewing has set forth five postulates which must be fulfilled before accepting trauma as the cause of given cancer. Ewing states: "First, the authenticity and adequacy of injury must be established." That is, the patient's statement regarding injury must be substantiated, and there must be actual tissue damage.

"Second, the previous integrity of the wounded part before the injury must be established.

"Third, the cancer or tumor must arise at the point of injury.

"Fourth, there must be a reasonable time limit between injury and the development of the tumor." That is, if the tumor develops within two or three days after the injury, it isn't reasonable that in that short a time a tumor could have developed.

"Fifth, the positive diagnosis must establish that there is an actual tumor present and the nature of the particular tumor."

CHAIRMAN PAINE: Dr. Enzer, do you want to speak to the point?

DR. ENZER: I thought Dr. Reuter might say a word about the increasing attention now being given to highly complex chemical agents which have the property of inducing cancer in the experimental animal. We know of certain agents which have that property in the human. The commonly known one is tar cancer. We know also of certain aniline products which would produce cancer of the skin, of the urinary bladder, and so on. I think that subject is highly complex, but I think it should be brought to your attention that in the dermatology of today we deal not only with dermatitis but also deal with tumors.

DR. REUTER: I have had very little occasion to pass on a question of cancer of the skin arising from alleged contact with some carcinogenic agent.

C. T. DENSMORE (Koppers Co., St. Paul, Minn.): I would like to hear a little about the effects of coal tar and creosote oils in relation to cancer and what-not, and also the inhalation of the creosote vapors.

DR. REUTER: Regarding the development of cancer from coal tar and creosote, I have had no experience. We do know that coal tar is the nearest to the skin and does produce an inflammation about the hair follicles called folliculitis. It is undoubtedly due to the plugging of the follicles with the tar and perhaps some stimulation of the epidermal layers of the skin from the tar, which sets up this inflammatory reaction around the hair follicles. I think the same is true with creosote. But, regarding the actual development of hypertrophic lesions of the skin, particularly cancer, I have had no experience.

DR. BELKNAP: As for creosote, I have had no actual cases brought to my attention. As far as I know, the fumes would be no more irritating, possibly, than causing an irritative cough. I know of no cases, really, of acute chronic bronchitis or other carcinogenic results.

CHAIRMAN PAINE: We will leave any other questions to the end of the session and hear Mr. H. A. Nelson, Industrial Commission of Wisconsin, on the question: "Should occupational diseases be considered as industrial injuries?"

Disease Vs. Injury

H. A. NELSON: Mr. Chairman: The question which I have been assigned is susceptible of treatment in several ways. We can treat it in a highly technical way and quibble about the court construction of the word "injury" or we can treat it in a general way and ask whether occupational diseases should be compensated. That is the real crux of the question today.

It sometimes astonishes me that thirty years after the passage of compensation acts we are still disputing this question of whether we shall compensate a condition which may cause disability and which arises

out of industry just as clearly as does an accidental injury. There are various ways of meeting the problem. One, of course, is to do nothing about it and that is what about eighteen states in the Union are doing. They are not compensating occupational diseases at all. Out of the other states there are a few which are compensating all occupational diseases, and some of them are compensating by schedule.

Now, schedules are usually designed so that there are a great many diseases which are named, but very generally you will find that they leave out the one occupational disease which causes the most disability. For example, silicosis is left out of a great many of the state laws which have schedules. Therefore, silicosis, which is a serious occupational disease is not compensated.

When we go back to the prime principles of workmen's compensation, we wonder why the compensation fathers didn't face the question at the time the compensation acts were passed. That was the time to do it. Either through inadvertence or, in some cases, through design, occupational diseases were left out of the laws pretty generally, but accidental injuries were to be compensated. I think that was largely because of the rather violent split from the old common law system and leaving out of consideration the question of negligence. It was a rather violent split, but it is surprising that in all of these years occupational diseases still remain uncompensated in so many states.

When we consider the nature of an occupational disease, which is usually a slow, insidious process, over which the man himself, the employee, has no control, but over which the employer, as these physicians have told you this morning, has the entire power of control, there seems to be one hundred times more reason why the employee who cannot protect himself in any possible way should be compensated for occupational disease rather than for accidental injury.

I suppose there is no question but that the real crux of the matter is that of expense to the employer, and that comes because of the so stated accrued liability. Here has been an accrual of dosage which finally eventuates in disease, and this accrual is such that the disease may come at a given moment.

If the employer has a large number of employees who have this accrual of dosage, it may be that in periods of depression the expense to him will be rather great for the time being, and that must be met in various ways. Employers are humanitarian. Most of them would like to do these things but they are also in competition with each other, and that means there must be laws and regulations for the compensating of occupational disease if the job is to be done in a satisfactory way.

Another reason that is often given is that industrial commissions and accident boards are unable to decide the question of occupational disease, as to causation, between the process and the final condition which results in disability. I think that is a rather fatuous objection, in view of the development which has been made in medical science within the last few years.

I think those questions are no more difficult to decide than the questions of aggravation of pre-existing conditions which are clearly under the law, if we may ascribe them to accidents, and also to the obscure conditions which are ascribed to accidents and as to which compensation boards and commissions have to make decisions every day.

Can Stamp Out Disease

But the most glorious thing that has been accomplished by occupational disease laws is the fact that employers have become conscious of the fact that they can stamp out occupational disease. I am glad to say that in Wisconsin we have practically stamped out silicosis, that in a few years more it is going to be practically a negligible thing. Dr. Belknap has shown you how lead poisoning can be almost entirely eradicated. That is the glorious thing which we have achieved through the passage of occupational disease laws. I want to give a very few figures showing the drop in silicosis in the State of Wisconsin since 1933 to 1939. These figures are the percentages of compensation which were paid in silicosis cases as compared with the total. In 1933 the figure was 9.4; 1934, 8.8; 1935, 7.9; then 5 and 2 and .9 per cent, and, in the year 1939, 1.3 per cent which we figure is getting about on a level.

I think there is no question but that the public is demanding that occupational dis-

ease be compensated. The trend is coming on. I believe that industry and society will be gratified when the problem has been solved by whatever methods may be adopted and suited to the different states.

CHAIRMAN PAINE: Are there any questions you want to ask Mr. Nelson before we go into the general discussion?

ADOLF AMRAM (Hamlin & Co., New York City): We passed a compensation law in New York State some two or three years ago. Perhaps you recall that first we passed a most illogical law, the all-inclusive act which acted most disastrously not only to industry itself but to the workmen. You are familiar with the history and the recall of that act. I dare say in a number of states it is absolutely right and proper the compensation act should include silicosis, but it should include silicosis on a schedule basis, as I think is the case in Illinois.

MR. NELSON: All states are not as fortunate as some other states. I think we are showing generally throughout all of the states that the problem can be solved.

Protection for Welders

CHAIRMAN PAINE: We have a few minutes. Anyone in the audience has the privilege of asking this panel of doctors any questions they want to raise on these main subjects.

J. S. GREEN (Edgewater Steel Co., Oakmont, Pa.): I would like to ask to what extent an ordinary welder in a small plant should be protected? Once in a while there will be a hardening material which has poisonous results. Other times there will be flame cutting of paint on a product which will raise some noxious poison. To what extent would a welder or a cutter have to be protected?

CHAIRMAN PAINE: The question is, how are we going to protect, and what is the exposure to welders on new material or on old material that has been painted? I will ask Dr. Walsh to answer that question.

DR. WALSH: Within the past couple of years we have had occasion to go over a group of about 1,000 welders. Of that group some 300 have been welding for ten or more years. They were gone over from the clinical point of view. X-rays of the chest were taken. Disability due to sickness over the ten-year period was calculated and seen for each individual man. There certainly was no marked difference in sickness rates and in disability rates in the welders as compared to the general run of employees working at their side in the same plant and in the same economic situation.

When you are considering welders who are cutting painted materials, lead-bearing paints, or who are welding in confined spaces, you have a different problem; but for the ordinary welding group, working in a large, airy room, with ordinary precautions and ventilation, their health is just as good as any other group of workers. If they are cutting paint or toxic coatings of any kind or lead-bearing steel, or if they are working in a confined space, then additional respiratory protection is necessary.

So far as the question that was rampant a few years ago, that is the development of so-called fibrosis of the lungs due to welding, we have not found this to be the case. Dr. Enzer and Dr. Sander at Milwaukee have had occasion to examine at postmortem a few of these individuals who have been welding for long periods of time in confined spaces, usually. They did find there was an increase of iron in the lung but no fibrosis causing harm.

Recently, we also have examined another group of welders, that is a variant of the welding trade, scarfers, in the continuous production of steel. These scarfers use a long torch and blow out the defects in the billets rather than chiseling them out. This group also, while it is an infant in the group of welders, apparently have no health hazards of any consequence in their trade. In other words, I think if ordinary precautions, so far as ventilation and so forth are concerned, we need not be concerned other than if we are using lead or chromium or some of the toxic materials.

CHAIRMAN PAINE: Dr. Enzer will speak for a minute on the subject and then Dr. Belknap will follow him right up.

DR. ENZER: I want to seize the opportunity to make some comments relative to the general attitude of this panel discussion. It is most important that in any approach to the problem of industrial health we remember that a statistical analysis of groups is not a true criterion of the health of the individual. In other words, just like the sur-

geon who might boast of a 99½ per cent recovery rate from a specific operation, the individual who happened to belong to that ½ per cent constitutes 100 per cent mortality for the individual. There is a very sharp contrast there.

Now, when we talk about safe limits of toxic solvents, safe limits of toxic agents, safe limits of an industry, we must remember that the problem is not going to be solved by a blanket generalization of a problem, but by a careful and meticulous analysis and study of the individuals exposed to the industry. I know of no other way that this can be done except that industry realize that the profession of medicine forms the keystone to the solution of these problems.

DR. BELKNAP: I simply wanted to amplify what has already been mentioned, and that is when a welder or cutter works on material that has been painted or coated with lead, he, of course, probably will acquire lead absorption in a serious fashion about as quickly as, if not quicker than, in any other way.

It is very simple now, with the respirators we have available, for a shop welder, whenever he is doing that type of work, to use such a respirator. In my own particular series of cases one of our cases of lead absorption was a welder who had been repairing some ovens containing a large amount of lead.

Also, I had occasion recently to see half a dozen cases of cutters who were cutting up tanks in a large chemical plant. These steel tanks had been lined with lead. They could not understand why the men were getting lead. They went through the lead with a torch 3000 or 4000 degrees and they absorbed lead exceedingly rapidly. It is not a difficult question to solve at all but it is a matter of having perfect confidence in what the work is for and preparing for it.

MR. CARR: In connection with welding, we have had instances of zinc chills from work on galvanized iron. We have also had nitrous fume poisoning from the use of coated electrodes.

I would also like to call attention to a relatively new development, that of the flame cleaning of metals before painting, by the use of a special oxy-acetylene torch. That includes previously painted metals as well as those which simply have mill scale on them.

R. J. WOODHOUSE (Continental Casualty Company, New York City): I had a case a short time ago that I was called upon to investigate. The man worked in a small printing plant where he was assumed to have contracted lead poisoning. After making impinger tests which proved negative, an award was given by the commission to the widow in the amount of $13,000. The lead was melted around 650 to 700 degrees and the experts proved that toxic fumes were not liberated.

I wonder what yardstick the referees used to measure those cases, in the face of such expert testimony.

MR. SKYRM: I would like to know the relation of hemlock poisoning and poison ivy to skin disease.

DR. REUTER: Poison ivy, of course, is the most common plant that causes dermatitis. Hemlock is occasionally the cause. Poison ivy is an intense irritant to most people's skin. It is a question of whether in itself it is not an irritant to all people's skin.

We used to think we knew the cause of poison ivy dermatitis, but more recent work has tended rather to disprove that we do know the actual cause of what it is in the plant that produces dermatitis. Apparently it is a water-soluble fraction rather than an oil.

Its relation to occupational disease depends on what the individual is doing. If he is exposed to it in his occupation, for example, as a farmer, WPA worker, lumberman or any occupation that keeps an individual out-of-doors, and he contacts poison ivy, it certainly would be an occupational disease. Poison ivy dermatitis is apt to be a much more violent dermatitis than that from hemlock.

CHAIRMAN PAINE: Mr. Gumaer, will you repeat your question?

P. W. GUMAER: The question was, what is the basis of the comparatively low maximum concentration of toluol in the absence of any reported occupational disease cases, and are there any experimental data to warrant such a low concentration where such experimental data deals with chronic poisoning and not with acute poisoning?

DR. BELKNAP: The question is, whether toluol is really as toxic as I intimated it might be, being permissible in only 200 parts per million. Is that right, Mr. Gumaer?

MR. GUMAER: Yes.

DR. BELKNAP: As far as the official authority of that is concerned, it is taken from the code for safe concentrations of certain toxic substances used in industries, whose authors are Bowditch, Drinker, Haggard and Alice Hamilton which appeared in the June 1940 issue of the Journal of Industrial Hygiene and Toxicology.

I do not know whether there is any practical experimental work backing that up, but inasmuch as toluol and xylol are very closely related to benzol, I assume that the authors felt that it as yet could not be given an entirely safe record, for instance, compared to gasoline.

I will say, among a group of workers who have been working with adequate protection for several years with toluol solvents, I have seen no general reaction.

DR. HAMILTON: May I speak to that for just a moment? That presentation to which Dr. Belknap refers was got out simply because a small group of us felt that we might as well let the public know what was our best guess at the present moment with regard to maximum allowable concentrations of the most commonly used solvents. It is founded very largely on guesswork.

The quantity of 1,000 parts per million for gasoline is guess, and so is 200 parts of toluene. We are hoping that we shall be able to give more accurate figures presently.

The American Standards Association has a committee at work in this field, with a small subcommittee. We have just finished dealing with two gases and two volatile solvents, carbon monoxide and benzol and carbon disulphide and hydrogen sulphide. There we have been able to get pretty accurate figures because we have data to go on.

We are now trying to deal with twelve others which are going to be increasingly important in the munitions industry. We hope to be able to give out more accurate figures then. But it is a very difficult problem. You see the only way we can get any accurate figure is by having a combined inquiry made by the physicians, the chemists and the ventilation engineers, because we have to know how many cases developed in a given workroom at a given concentration, and also at what concentration do no cases come.

We could do that with the four I have mentioned, but it means, as you see, a great deal of careful study in the factory and in the physicians' examining room. Bringing those two together, we can do it with regard to lead; we can do it pretty well with regard to mercury, and we have pretty good data with regard to zinc oxide fumes in galvanizing iron and brass foundries and zinc smelting; but the rest of the substances still are more or less in the realm of guesswork.

CHAIRMAN PAINE: May I, in your behalf and in behalf of the National Safety Council, thank the gentlemen on the platform who have so kindly led us in this discussion? Will you express that thanks by giving them a rising vote?

. . . The audience arose and applauded.

ADJOURNMENT