TWENTY-THIRD ANNUAL SAFETY CONGRESS
NATIONAL SAFETY COUNCIL

Quarry Section

Officers 1933-34

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WEDNESDAY MORNING SESSION

October 3, 1934

The opening session of the Quarry Section was called to order by John Campbell, Director, Bureau of Inspection, Pennsylvania Department of Labor and Industry, Harrisburg, Pa., who presided. This was scheduled to be a joint session with the Cement Section. Chairman Campbell introduced P. A. Mori, Works Manager, Cleveland Quarries Company, Amherst, Ohio, who made a brief address of welcome to the delegates on the part of the city of Cleveland.

In lieu of the annual report of the general chairman Otho M. Graves, who was unable to be present, a lengthy wire was read from him expressing his regrets. Chairman Campbell then introduced the first speaker.

The Dust Hazards in Industry

By DR. R. R. SAYERS

Medical Officer in Charge, Office of Industrial Hygiene and Sanitation, United States Public Health Service, Washington, D. C.

The speaker said in part: Realizing the importance of the dust problem in industry, the United States Public Health Service in cooperation with the Bureau of Mines began its first study of the health of workers in dusty trades in 1914, in the mines of Joplin, Missouri; and later, in 1923, the Public Health Service inaugurated a series of dust studies. These later studies were all conducted in the same manner in order to permit as detailed a comparison as possible between the different investigations.

Briefly, these methods of study may be divided as follows: (1) examination to determine the general physical condition of the workers under observation; (2) special physical examination to determine the prevalence of specific diseases of the respiratory system and the lung pathology resulting from exposure to the particular dust hazard; (3) record of the nature and severity of the disabling illnesses; (4) analysis and detailed study of the occupational environment; (5) occupational mortality statistics relating to the specific dust; and (6) autopsies.

The first six intensive investigations carried out by the Service dealt with the health of workers exposed to dusts in a cement plant, granite cutting industry, anthracite and bituminous coal mining, silverware manufacturing plant, cotton cloth manufacturing, and in municipal street sweeping. Brief studies were later conducted in certain slate, granite, marble and talc quarries, while more recently a rather extensive study of the health of anthracite coal miners was completed.

These six dust studies showed that the workers in the granite cutting plants who were exposed to the highest dust concentrations were found to suffer from an excess of pulmonary tuberculosis after 15 years or more of exposure and developed silicosis from 2 to 10 years. In the group exposed to a lesser amount of dust, silicosis developed only after prolonged exposure, with no excess of tuberculosis. It was found that a close relationship existed between the degree of dust exposure and the extent and severity of the pulmonary damage. Anthracite coal miners suffered from dyspnoea and other signs of pneumoconiosis and experienced a high rate of respiratory sickness; in addition, an excessive mortality from influenza-pneumonia and possibly tuberculosis was found. Bituminous coal miners experienced a generalized fibrosis of the lungs and an excess mortality from influenza and pneumonia. Cement workers showed some signs of early pneumoconiosis with an excess of diseases of the upper respiratory tract. On the other hand, workers in the cotton cloth and silverware manufacturing plants and municipal street sweepers were negative for respiratory conditions and other illnesses when compared with the general industrial population.

Rock Drilling. For five years, the United States Bureau of Mines studied lead and zinc miners in the Tri-State District, Oklahoma. The ore here is high in free silica. Of the 7,722 men examined, a group of 1,647, or 21.3 per cent, was definitely diagnosed as having silicosis, not including those diagnosed as having tuberculosis. All the men diagnosed as having first-stage silicosis had worked an average of 13 years, but those men starting in the mines after 40 years of age worked an average of only 8 years.

The work of rock drilling in subway and tunnel construction in New York City is in some respects similar to that of some of the activities in the hard rock mines, at least in so far as the manner in which dust is evolved, the type of dust and the resultant hazard. Recently the result of a study of rock drillers, blasters and excavators was reported by the New York Tuberculosis and Health Association. An examination of 208 rock drillers, blasters and excavators showed that 118, or 57 per cent of the men had silicosis in various stages of progression. The exposure of most of these men (75 per cent) had been for 20 years or more.

Sandblasting. No study of the health of sandblasters has been reported in the United States; however, a study of the dust exposure of sandblasters was recently completed by the United States Public Health Service in cooperation with the

National Safety Council. This investigation indicated that, judged by the nature of the dust and degree of the exposure, a real hazard exists in this occupation. This study also brought out the fact that it is possible to conduct sandblasting with safety, provided properly designed and well maintained equipment is used.

Diatomaceous Silica Workers: Most of the data on silicosis have been gathered from studies made both in industry and experimentally on dusts containing free silica in the form of quartz. Such studies have been made in the granite industry, pottery trades, hard rock drilling, etc. There are other free silica minerals in existence that are not crystalline in nature but of an amorphous composition. In Santa Barbara County, California, there exists the largest and purest diatomaceous silica deposit in the world. This substance consists of about 85 per cent free silica. Recently an examination was made of 108 workers selected among those employed less than 1 year, 1 to 2 years, 2 to 5 years, and more than 5 years. All of the workers were Mexican laborers and the examinations consisted of x-ray determinations, social and medical histories, and clinical examinations of the chests. Dust determinations were also made but these were not reported. The outstanding feature revealed by the examination was the splendid physical condition of the men. Eighty-four per cent of the workers were reported in excellent physical condition. It was found that 60 men showed signs of early pneumoconiosis; 15 were in the moderately advanced stage and 6 in the advanced stage. This latter finding was among workers with a history of exposure of more than 5 years.

Dust Hazard in the Granite Quarry Industry. It is a common belief that granite quarrying is not so dangerous an industry as granite cutting in enclosed sheds; quarry work is done outdoors and hence may not be attended with very much dust exposure. However, certain quarry operations require the use of pneumatic tools, which are usually associated with the formation of considerable quantities of dust. It was thought that a study made in a representative granite quarry might cast some light on our problem. Accordingly, a study of a clinico-radiographic nature of 63 quarriers was made and occupational dust exposures were also obtained. The dust determinations show that nearly 38 per cent of the workers (drillers) were exposed to many times the amount of dust considered safe at the present time. Drillers were the only persons showing pathologic lung changes. Half of these workers with an exposure of 5 to 19 years had silicosis, and 4 of the 5 men with more than 20 years of such trade life showed this condition. This study suggests that quarry drillers may experience as high a death rate from pulmonary tuberculosis as do pneumatic-tool workers in granite cutting sheds.

Effect of Inhaled Marble Dust. The pulmonary fibrotic changes due to the inhalation of marble dust appear to be slight in comparison with those caused by stone dust containing a high percentage of silica in the form of quartz. A recent study made by us among marble workers showed that although marble dust, when inhaled in concentrations averaging about 25 million particles per cubic foot of air, produced a mild bilateral, linear fibrosis in a certain number of the 80 men examined, no serious lung changes were noted and there was no disability due to the dust, even after many years of exposure (more than 40 years in some cases). The marble dust under consideration consisted of 98 per cent calcite and 2 per cent dolomite, with no silica present.

Dust Hazard in Abrasive Industry. Artificial abrasives are widely used in industry and for this reason the effect of the inhalation of dusts produced in the manufacture or preparation of these products is of great importance. In 1925, 1929 and again in 1931, Dr. Clark of the Norton Company at Worcester, Mass., made investigations of workers exposed to aluminium oxide and silicon carbide dust produced in the manufacture of grinding wheels, which showed that during a period of 13 years there were proportionately twice as many cases of pulmonary tuberculosis among those working in the abrasive dust departments as in departments where no abrasive dust occurred. In 1931, Kessler, of New Jersey, reported the occurrence of over 100 cases of alleged silicosis in the abrasive powder industry, in which the dust consisted of 99 per cent free silica.

Exposure to Silicate Dust. It has been the belief that the inhalation of dusts composed of silicates (combined silica), in comparison with silica (free silica in the form of quartz), was innocuous. Of recent years many investigators have become cognizant of the hazards of silicate dust exposure. Asbestosis, a fibrosis of the lungs caused by the inhalation of asbestos dust, has already been described both in its clinical and roentgenographic manifestations by investigators in other countries, but to date no studies have been reported in the United States. Cement dust, which contains about 22 per cent combined silica, has been studied, and the effects of the inhalation by workers has been discussed here. In March, 1933, Dreessen, of the United States Public Health Service, reported the results of a study conducted among tremolite talc and slate workers. The slate dust to which these workers were exposed consisted mainly of silicates, there being less than 3 per cent of quartz in the dust. The talc was a hydrous calcium-magnesium silicate, being 45 per cent talc and 45 per cent tremolite, with no quartz present. The results of the study seemed to indicate a relationship between the amount of dust inhaled and the effect of this dust on the lungs of workers.

Statistical Studies. Recently, Lanza and Vane estimated that there are some 500,000 workers engaged in the mining, quarrying and manufacturing industries in this country, in which an exposure to silica dust to a harmful degree is entailed. Their analysis of mortality experience of twelve life insurance companies for the period 1915-1926 showed that the actual mortality from respiratory tuberculosis among the silica exposed persons was about three times that of a non-silica dust group. If one considers their data for certain occupations in metal mines and granite and sandstone quarries, occupations known to be exposed to high concentrations of hazardous dusts, then the comparison is more striking, since the actual deaths among these workers was found to be ten times that of the expected deaths. More detailed statistics on occupational mortality as reported by the Registrar-General of England and Wales (1921-1923), and summarized by Britten, show the high rate of 1,886 per 100,000 for tin and copper miners, while the rate for "all occupied and retired males" was only 150. Other occupations with silica exposure showed an excess.

From the evidence just presented concerning the injurious effects produced by the inhalation of certain dusts, it is apparent that a knowledge of the properties of a given dust which determine its capacity to produce pulmonary pathology is essential. Numerous investigations of the industrial dust problem indicate that these properties are the chemical and mineralogical composition of the dust, its concentration in the industrial atmosphere, and its particle size.

In an earlier portion of this discussion evidence was presented which indicated that a close relation existed between morbidity and mortality rates from various respiratory diseases and the exposure to certain dusts in industry. In the study of the dust hazard in the granite cutting industry, it was definitely proved that there is a direct relation between the magnitude of the dust exposure and sickness and death resulting from tuberculosis. It is quite evident, as a result of these studies, that the remedy of the dust evil lies in the effective removal or suppression of the dust to concentration considered safe. However, no set rules may be established for the mechanical protection to be instituted in an attempt to control industrial dust. Specific conditions encountered in a plant will determine the type of protection to be employed.

The protection of workers against certain dusts known to be toxic may at times be accomplished by the substitution of a non-toxic material for the toxic one. One example of such a procedure is the possible use of a metallic or other type of artificial abrasive for sand in the sandblasting process in those operations in which it is not essential to use sand, a substance high in quartz content. Again, the mechanical enclosure of the dust-creating process also serves to protect the worker. An excellent illustration of this type of protection is afforded by the modern sandblast barrel used in the cleaning of small objects. Sometimes it is possible to protect the worker by the substitution of wet for dry processes, as wet drilling instead of dry. In one instance, in the granite cutting study previously mentioned, an operator using a diamond point tool worked the stone wet; the resulting dust amounted to 22 million particles per cubic foot. The same operator was then requested to work the stone dry; as a result, the amount of dust reached the high figure of 45 million particles per cubic foot. In the weaving of asbestos cloth it has been possible to reduce the amount of dust in the air by wet weaving to one-fourth of the amount present when the process is conducted by dry methods. Another example of this procedure in allaying dust is the use of a spray of water in leyner and jack-hammer drilling in hard rock, although the new type of Kelly dust trap is now finding much favor for this kind of work.

The Kelly trap consists of a metal chamber designed to enclose the drill steel at the rock surface. No attempt is made to secure a mechanical seal with the rock or between the trap and the drill steel. The dust is removed by an air stream and is carried into an exhaust system connected to the trap. Escape of dust particles through openings between the uneven rock surfaces and the trap is prevented by the air seal produced by the inflowing air. Tests made on this trap under actual working conditions show that the dust concentration at the worker's breathing zone may be kept down to less than 10 million particles per cubic foot with a 60 cubic foot per minute rate of air flow through the hood. This trap is a step forward in the program of dust removal; however, in underground work, such as in mines and subways, there is still the need to solve the problem of compact dust disposal equipment.

In certain cases, such as in the sandblasting of large castings in sandblast rooms, the practical safeguard to the worker is to provide him with a mask or helmet of the positive air pressure type. In the sandblast investigation previously mentioned, it was found that when from 5 to 6 cubic feet of practically dust-free air per minute are supplied to the helmet, the worker receives ideal protection. However, one must always bear in mind that the ultimate criterion of protection should be the dust determination of the air within the helmet during blasting and not the quantity of the air supply itself.

In most dusty processes, however, the most effective means of dust elimination are by the use of properly designed exhaust ventilation systems. Since in many instances it is difficult, costly, and at times an unnecessary procedure to remove all the dust in the vicinity of a worker, we need first to determine the minimum amount of a certain dust which the worker can apparently tolerate with impunity. Such information can be made available by the type of studies carried out by the Public Health Service. For example, in the granite study already referred to, it dust at the breathing level of about 10 million particles per cubic foot (35 per cent free silica).

Studies of dust removal devices used in granite cutting plants at the time this work was conducted showed that a linear velocity of 1,500 feet per minute as measured by an anemometer at the face of the dust-removal hood, would keep the dust at the breathing level to an amount less than 10 million particles per cubic foot.

A word should be said concerning personal respiratory protection against dusts. It has already been shown that in the use of positive pressure respiratory devices in sandblasting, it is important to have a well-designed device supplied with about 6 cubic feet of dust-free air per minute to give full protection to the worker. With reference to respirators of the filter type, there is still much to be accomplished in the design of an efficient and comfortable mask for continuous use. Of great value are standard methods for the testing of the efficiency of respiratory protection devices. Drinker advocates testing a device against the particular dust which the respirator is to encounter, these tests to be made both in the laboratory and under actual industrial conditions. He further suggested that some impartial agency should conduct such tests and certify the devices for industrial use, the work being done on a cost basis. The U. S. Bureau of Mines has prepared such a schedule for testing and approving respirators.

I wish to stress the importance of good housekeeping in the effort to combat the dust hazard. Good housekeeping should not only imply the removal of accumulated dust about a workroom but should also embrace efficient maintenance of dust removal devices and respiratory protective equipment. Systematic inspection of all dust suppression equipment should be an axiomatic principle in every dusty industry rather than the casual attention which it now receives in many instances.

Report of the Nominating Committee

The chairman called for the report of the Nominating Committee at this point, and new officers for the section to serve during the ensuing year were nominated and elected as follows:

General Chairman—William H. Baker, J. E. Baker Co., York, Pa.

Vice-Chairman—William E. Hilliard, New Haven Trap Rock Co., New Haven, Conn.

Poster Committee Chairman—H. F. Yotter, The General Crushed Stone Co., Easton, Pa.

Publicity Committee Chairman—J. R. Boyd, National Crushed Stone Assn., Washington, D. C.

Statistics Committee Chairman—W. W. Adams, U. S. Bureau of Mines, Washington, D. C.

Members at Large—
V. P. Ahern, National Sand and Gravel Assn., Washington, D. C.
Norman G. Hough, The National Lime Assn., Washington, D. C.
O. M. Graves, The General Crushed Stone Co., Easton, Pa.
A. L. Worthen, The Connecticut Quarries Co., Inc., New Haven, Conn.

The Foreman's Duties and Responsibilities in Preventing Accidents

By GLENN GARDINER

Forstmann Woolen Company, Passaic, New Jersey

The speaker said in part: On my first job in the clay pit of a brick works, I witnessed a disastrous cave-in which so injured one of my fellow workers that he was totally disabled for life. The accident was so plainly the fault of the foreman in charge that he was discharged for his carelessness. That accident made an indelible impression upon my mind, and let me understand as nothing else could what the responsibility of the foreman is in accident prevention.

The foreman who is responsible for getting out the work is also responsible for the control of those conditions immediately surrounding the worker on his job. He has an unexcelled opportunity to observe his workers and their habits. If he is a competent foreman, he can detect those working habits which may result in accidents. He should come to know his workers so well that he will understand when worries and outside problems are taxing their minds and powers of concentration. He may not be in a position always to do much about the outside problems, but he can, at least, govern conditions on the job.

The foreman is the one who is most likely to set up conditions on the job which cause job anxieties for the worker. He can do much to ease the worker's mind by keeping him informed about conditions which affect his job and the steadiness of employment. He can help to reduce the fatigue his men experience and in so doing directly influence accidents which are related to fatigue.

Every intelligent foreman realizes the importance of the safety functions, and that safety should be put upon the same plane of importance as the other duties his job includes.

If the worker is indifferent to safety, it is usually merely a reflection of the foreman's attitude. On the other hand, if the foreman will stand for nothing but safe working habits, the worker will proceed very rapidly to develop safe working habits. Of course, I recognize that certain workers have an attitude of recklesseness and bravado about them which make them slightly contemptuous of the dangers of the job. But it is up to the foreman to puncture this attitude and bring such workers down to earth.

A recent study of a company employing 6,600 workers indicated that 48 out of the 6,600 had had 10 per cent of all the lost-time accidents for the entire organization. The accident frequency among these 48 men was fifty times as great as that of the average for all workers.

The record also indicated that those men having the largest number of minor accidents were also the same men having the largest number of lost-time accidents. Thus minor accidents are of real significance to the observing foreman because they point out to him the men who will most probably have the lost-time accidents.

Foremen have the duty and the responsibility of enforcing safety standards. Failure to do so increases the number of accidents, and the same laxity that increases accidents lowers efficiency. We can almost judge the general efficiency of a foreman's department by an examination of his safety record.

Here are some points at which every foreman should check his own methods of enforcing safety standards. Let each foreman ask himself these questions:

1. Are safety standards clearly and completely understood by each and every one of my workers?

2. Do I give careful safety instructions to every man I hire and to every man whom I put on a new job?

3. Do I conscientiously attempt to assign the least hazardous job to those workers who are most accident prone?

4. Have I ever attempted to sell safety standards to my workers by arousing their pride on the basis that the safest worker is also the most efficient one?

5. Do I rigidly enforce the regulation that each worker should report every accident, no matter how slight?

In the last analysis, however, management itself is responsible for the attitude of its foremen on the safety question. Just as the indifference of the worker can be traced to the indifference of the foreman, likewise the indifference of the foreman can most often be traced to a certain indifference on the part of the top management with reference to this important safety and accident prevention function.

The Value of Competent First Aid

By DR. W. J. FENTON

American National Red Cross, Washington, D. C.

The speaker said in part: The definition of First Aid as given in the Red Cross First Aid Text Book, is "First Aid is the immediate temporary treatment given in a case of accident or sudden illness before the services of a physician can be secured." This definition, in itself, immediately disapproves any thought whatever that a First Aider can ever take the place of proper medical attention. A further study of the definition, it appears to me, should impress upon the mind of any thoughtful person the necessity of proper First Aid training being given to just as many people throughout the country as is humanly possible.

Remember, that the medical man is not sitting around at the scene of the accident with his equipment handy, waiting for a chance to do something. He is either busy with his practice or may be in his office or laboratory studying out some baffling case, and many miles from the scene of trouble. In case of severe bleeding, fatal results may follow unless some qualified First Aider appears at the scene and immediately applies proper methods of control, long before the physician can be secured. Imagine a crowd at a scene of an apparent drowning, or standing around the lifeless form of some victim just removed from a gas filled room or garage—but only standing there and looking on.

There is seldom any excuse in this day and age for anyone finding himself or herself standing helplessly about in such a predicament, because for years now throughout the length and breadth of our land there have been First Aid Courses taught, First Aid demonstrations given to literally thousands of audiences, and in each demonstration as well as in the standard courses simplified methods of emergency first aid have been shown so that all who saw and all who heard might be able to render competent first aid at the scene of an accident.

I wonder how many of you really know the proper way to summon your physician in case of accident or illness? Remember it is always well to tell the physician who it is that is calling, giving definite location where the patient is and what you think is wrong with him, as well as what materials might be at hand that a physician may use; and last but by no means least, it is always advisable to tell what is being done to relieve the patient and also ask the physician to advise you what further to do while awaiting his arrival.

Another thing I have learned in my travels throughout the country is this, that it is highly important if you are calling an ambulance to tell them how many victims they are expected to care for; and also if sending a patient or patients to the hospital it is wise to give the hospital a little advance notice, if possible, as to the number being sent in and something about the condition of the patients. This will often prevent delay at the hospital in getting the injured to bed and under proper treatment.

Should you or some member of your family develop quite suddenly a pain in the abdomen, would you know what to do while waiting for your physician? I fancy I hear you say, "Oh yes, I always know what to do; I would take a physic immediately and then if I do not show improvement within a few hours I will phone my physician for advice."

Do you realize that if you pursue that course you are running a very good risk of being the principal party to the next funeral in your neighborhood?

It is true, the case may be nothing more than green apples. But if you ever have to give advice for a sudden pain in the abdomen, my strong opinion as a First Aider is, to put your victim to bed at once, give him no food, give no laxatives and call a physician at once.

A great many of us who have been in the first aid and safety work for a number of years, those of us who have given a great deal of time and study to it, have long since arrived at the conclusion that the prime object of first aid instruction should be to prevent the accident. I can imagine some safety supervisor saying to himself at this point, "Now, Doctor, you are beginning to talk along the line of my thoughts. We have a fine safety organization in our plant and we have a doctor and a graduate nurse and a well equipped minature hospital, and we do not need to train our folks in first aid. If we do, then the First Aider will try and show his stuff out in the plant and our employees will soon cease coming to the First Aid Room."

I might agree with you in those last few words: "Our employees will soon cease coming to the First Aid Room." We have abundant evidence to show that where first aid training has been incorporated in the safety program of large industries, the employees who have the standard fifteen hour course in first aid training have fewer accidents than the untrained employee, and if there is no injury, then why come to the First Aid Room unless it is merely a visit.

Neither we of the Red Cross, nor any other sane person, would ever attempt to lay claim to the fact that first aid instruction alone can ever entirely rid industry of accidents; but there is accumulated evidence now on hand which does prove that first aid training, when given by well trained instructors who follow standards and teach from texts that have been prepared by men who know their field, will materially assist any organization in a more efficient safety movement.

It has been demonstrated time after time that the well trained First Aider does develop that "safety consciousness" which we hear so much about, and the fact is self-evident that he is a safety man, though he may not be the safety supervisor, or even he may not be a member of the Safety Committee.

ADJOURNMENT.

For the record of the joint session with the Cement Section, held on Thursday morning, October 4, turn in this volume to the general division entitled Cement Section.
