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Although the National Safety Council endeavors to eliminate from discussion at its conventions matters which are not pertinent to its purposes or which are contrary to its policies, the Council accepts no responsibility for the views expressed either in the papers presented or in the discussions thereon.

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NOTE: The sessions of the Street and Highway Traffic Section, the Child Education Section, and the Home Safety session are published in a separate small volume of these Transactions, available on request.

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a proper staff, and not by some enthusiastic person who has not been trained for the work. Why not use more registered nurses in the smaller plants? The registered nurse is much better qualified to interpret a physician's plan of medical service than any lay attendant.

Much depends upon the physical condition of the employees. I am of the opinion that the physician, by reason of his professional attainments, is best qualified to handle some of the problem cases among employees. Mental symptoms, brought about by worry over home affairs, quite often produce accidents. In many cases the fear and worry of sickness in the family can be greatly allayed by a talk with the doctor or the nurse. Many of these cases have come under my personal observation.

It should also be absolutely the part of the physician to say when a man shall return to his regular employment after injury, and this decision should not be influenced in the slightest by its possible affect on any "no-lost time accident" contest or record. These contests are proper and have brought about outstanding results in the reduction of lost-time frequency figures. However, there have been cases of injured employees being urged unduly to return to some form of work merely to prevent the marking up of a lost-time accident. Nothing should be allowed to interfere with the employee's welfare. The physician has every motive to return the employee to his regular work as promptly as possible, but his higher duty is to conserve both the physical and economic welfare of the employee as well as the employer.

The safety director has need of the medical service, and the two should earnestly co-operate and seek to bring about a mutual feeling among the employees. Both departments are striving by all possible means to prevent economic waste chargeable to the disabilities and hazards of industry.

TUESDAY AFTERNOON SESSION

October 4, 1932

The delegates first attended an informal luncheon, and then gathered for the afternoon meeting in a Joint Session with the Metals Section. This session was devoted to a symposium on the dust problem in industry. Chairman Greenburg immediately introduced the first speaker.

The Effects of Inhaled Mineral Dusts

By LEROY U. GARDNER

Director, Saranac Laboratory for the Study of Tuberculosis, Saranac Lake, N. Y.

As long as men have worked in stone it has been appreciated that an unusually large proportion of them suffer from disease of the lungs. It was natural to assume that such disease would be caused by the dust generated, and this belief was strengthened by the discovery of black, grey or red pigments in the lungs, sometimes accompanied by the formation of scar tissue.

The term, pneumonokoniosis was introduced to describe the lung pigmented in this manner. With further observation pathologists attempted to classify various forms of pneumonokoniosis on a basis of the type of dust inhaled and such names as anthracosis, siderosis, chacicosis and even byssinosis and tobaccosis made their appearance. It was recognized that some forms of the disease were attended by severe symptoms and result in death but there was no correlation between the clinical and pathological pictures and the causative dust. Finally, statistical study demonstrated that of all kinds of industrial dusts silica generally produced a definite type of disease with a characteristic pathological lesion and complex of symptoms.

Today the clinical entity known as silicosis is one form of pneumonokoniosis which is quite clearly defined. Moreover, within the last three or four years asbestos dust has also been shown to produce another specific type of reaction attended by symptoms differing in some respects from silicosis.

The other forms of pneumonokoniosis still lack complete definition. The widespread use of radiography has brought together a mass of descriptive data from individuals exposed to many kinds of occupational dusts but these findings have not yet been correlated with pathological anatomy, chemical studies of the tissues and detailed analyses of industrial atmospheres. There is a tendency to assume that many of these pulmonary changes are due to the action of silica perhaps modified by the chemical components of the dust. We shall only be in a position to speak with assurance about them when the pure types of dust and their various combinations have been studied in human beings or in experimental animals.

For the sake of clarity no mention has been made of the infections which so frequently complicate some forms of pneumonokoniosis. In the prebacteriological era of medicine the use of such terms as "grinders' consumption" and "miners' phthisis" reflects the popular association of pneumonokoniosis with tuberculosis. The names were justified both by clinical and pathological observation for it has been subsequently shown that, in silicosis at least, a super-imposed tuberculosis may cause death in perhaps 75 per cent of the cases. Some observers even go so far as to state that silicosis itself does not develop unless the lungs are previously damaged by a latent tuberculous infection. This is probably an exaggeration, for typical silicosis can be produced in the experimental animal by the inhalation of silica without infection.

The role of asbestos dust as an excitant of tuberculous infection is not as clear cut as that of pure silica. While there are numerous reports of death in asbestosis due to a terminal tuberculosis, nevertheless surveys of living workers have failed to demonstrate any excess of such infection. Simple anthracosis is said to prevent the progression of tuberculous infection. Statistics from coal mining districts do show a tuberculosis rate much lower than that "normal" for the age group. As yet corroborated experimental proof of protective action of coal against tuberculous infection is lacking.

Not only the tubercle bacillus but other bacteria seem to develop with special facility in the tissues previously damaged by silica. For example, the pneumonia rate among silicotic native laborers of South Africa is many times that in non-silicotic natives living under similar conditions. In coal miners, likewise, pneumonia is a common and often fatal complication.

What has been said of the effects of inhaled inorganic dusts would indicate that the reaction of the tissues is not merely a response to mechanical irritation by particulate matter. Today it is generally accepted that the injury is chemical in nature and that only certain of the common types of industrial dusts possess properties capable of exciting reaction. In the cases of silica and the silicate of magnesium or asbestos the slightly alkaline body fluids probably effect a slow solution of the dust particles liberating silica in colloidal form. This substance irritates the connective tissue cells which respond by multiplying. The result is an overgrowth of the supporting framework elements at the expense of the more delicate cells specialized for specific functions.

For these two types of dust the character and form of the pathological changes has been carefully worked out. In *silicosis* the essential tissue change consists of nodules of connective tissue which develop first in the lympoid tissues situated in the drainage apparatus of the lungs. These nodules interfere with the physiological removal of foreign bodies and subsequently inhaled particles accumulate in the framework of the lung itself. Such reaction gradually decreases the normal elasticity of the organ and encroaches upon its functional elements. As a result the cardinal symptom of the disease, dyspnoea or shortness of breath develops. Because of the excessive amounts of scar tissue formed in the lungs the right side of the heart

encounters increasing difficulty in forcing blood into the organs. In an attempt to compensate the overworked heart muscle becomes thicker and heavier and unless infection intervenes the time eventually arrives when the heart fails and death occurs from this cause.

The reasons for the prevalence of infection in the silicotic lung are not altogether clear. It is obvious that when the drainage system is so obstructed by nodules of scar tissue that more dust particles can only be removed with difficulty, the same must be true of bacteria which may be inhaled. As a consequence they remain in the lung and set up progressive infections. But this is not the whole story. The silicotic tissue apparently offers a peculiarly favorable soil for the continued multiplication of tubercle bacilli and perhaps other bacteria. Experiment has shown that even attenuated organisms of this type will produce rapidly fatal tuberculosis in a silicotic guinea pig. Furthermore, inhaled silica dust will cause a pre-existing latent tuberculous focus, harboring a few attenuated bacilli, to become progressive and spread.

The cause of this effect upon tuberculous infection has not yet been ascertained but probably it is in some way associated with the death of tissue caused by the toxic silica. Associated with this factor is an increased activity of the phagocytes which are stimulated by the irritating silica so that these cells tend to migrate rapidly and carry tubercle bacilli into previously uninvolved portions of the lung.

Asbestos dust, perhaps because of its fibrous structure, is not transported very far within the lung. It tends to lodge along the walls of the finer tubes and little of it is removed by the lymphatic drainage system. Tissue reaction, probably initiated by the solution of the fibers, occurs in their immediate vicinity. As in the case of silica this reaction consists of an overgrowth of the connective tissues which is later transformed into leather-like scars.

Aluminum oxide will serve admirably as an example of a non-siliceous dust whose particles are as hard and sharp as those of crystalline silica. When a measured quantity of such particles, 1 to 3 micra in diameter, are injected into the ear vein of a rabbit the majority of them come to rest in its liver and spleen. There they remain, apparently harmless, collected in large phagocytic cells and producing no reaction of the connective tissues for at least two years. Injection of the same quantity of the same sized quartz particles excites the formation of so much scar tissue that the functional elements are almost completely destroyed and the organs are reduced to nodular masses of leather-like consistence.

Carborundum, the carbide of silicon, when inhaled by guinea pigs for periods as long as four years, likewise fails to excite significant overgrowth of the connective tissues. It produces only a low grade inflammatory change with no nodules.

Instances such as those cited constitute the basis for believing that the cellular response to dust particles is not due to their hardness and sharpness but to chemical substances liberated by the action of the tissues upon them. The case for solubility has not been proven directly, for the detection of soluble silica in the tissues offers technical difficulties which today are unsurmountable. Nevertheless this substance is known to be a cell poison and in weak concentrations it will provoke an overgrowth of the connective tissues.

Mention should be made of the effect of inhaled coal dust. Most city dwellers breathe in sufficient quantities of this material during an average life-time to pigment considerable areas of their lungs. Deposits of grey or black dust will be found along the course of the lymphatic drainage system but this pigmentation is associated with little or no new growth of connective tissue. The coal miner's lung is much blacker but in most instances it also develops no deforming scars. When such reaction does occur analysis usually reveals appreciable amounts of silica in the lungs. The presence of excessive quantities of carbon dust apparently influences the localization of moderate amounts of silica so that the latter is not deposited in nodules as in pure silicosis but in streaks along lymph vessels as pure coal would localize.

Coal miners' fibrosis, due to relatively small amounts of silica, is therefore dif-

ferent from that of the pure quartz worker. When the amount of inhaled silica is excessive, the effect of the coal is negligible and the reaction approximates that in pure silicosis. There is said to be more reaction to hard coal than to the bituminous variety but there is evidence to suggest that this is due to the greater amount of siliceous rock which must be worked in mining anthracite coal.

Finally, consider the silicosis of granite cutters. This develops somewhat more slowly than that of the pure quartz miner and it has been maintained that this is due to the relatively small amount of uncombined silica in granite (25 to 40 per cent). But it is believed that other components of the glomerate granite may neutralize or at least inhibit the effects of the silica so that only after prolonged exposures to high concentrations does significant reaction occur. While typical silicotic nodules develop in guinea pigs inhaling pure quartz for a year, not even the earliest suggestion of nodules have appeared in the lungs of animals inhaling comparable concentrations of granite (40 per cent silica) for four years.

This brief discussion of some of the problems involved in pneumonokoniosis draws attention to the limitations of our present knowledge. It indicates that the reaction to an inhaled dust is determined by the chemical and probably physical composition of that dust. It emphasizes the need to further study of different types of dust both in the pure state and in measured combinations. The ultimate aim of such a study should be the neutralization of the toxic action of such dangerous substances as silica.

The Dust Content of the Atmosphere in Various Dusty Industries

By J. J. BLOOMFIELD

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

The speaker said in part: The properties of a given dust which determine its capacity to produce pulmonary pathology are, the nature of the dust, that is, its chemical and mineralogical composition, its particle size, and finally the quantity of the dust dispersed in the atmosphere.

One of the outstanding results of the last 20 years of research in the field of dust inhalation is the demonstration of the fact that, in general, the degree of health hazards associated with the inhalation of any dust, all other factors remaining constant, is dependent upon the mineralogical composition of the dust. For example, it is now well established that the inhalation of certain types of dust, such as granite dust, will in time produce fibrosis of the lungs, at times associated with tuberculosis. In other cases exposure to dust may result in the production of much less fibrosis without notable tendency toward subsequent tuberculosis; this is true of cement dust. And finally, there are certain types of dust, as typified by marble dust, which in the quantities and lengths of exposure so far observed produce little lung fibrosis. In general, it has been found that those dusts which are high in quartz content are the ones which produce a disabling fibrosis of the lungs most readily.

So far as the size of the dust particle is concerned, it is apparent that in order for any given dust to produce injury to the lungs, it must gain access to the parenchyma of the lung, the site where the harmful effects of the dust take place. It is known that not all of the particles of inhaled dust gain access or are retained by the human lung. In this connection it is of importance to have regard to the size of the dust particles present in the industrial atmosphere.

With reference to the quantity of dust present in the air of a workroom it is apparent that when the dust concentration is high the exposed person will inhale a greater quantity in a given period of time than he will when the dust concentration of the atmosphere is relatively low, and since the rate of production of the fibrosis

is partially dependent upon the rate in which the dust is inhaled, this latter item plays an important role in predicting the relative danger of different environments. Hence the need for the evaluation of the quantity of dust in the industrial atmosphere is obvious.

Research on the problem of industrial dust inhalation has indicated that so far as their fibrosis producing qualities are concerned, dusts may be divided into three groups: (1) those composed completely of combined silica, that is silicates, such as pure asbestos; (2) those containing free silica in the crystalline form known as quartz, (granite contains approximately 35 per cent of quartz); and (3) dust containing free silica in a non-crystalline form such as diatomaceous earth. In general, it has been found that the harmfulness of a quartz containing dust is in direct proportion to its quartz content. For this reason, in attempting to evaluate the harmfulness of a dust, it is of the utmost importance to ascertain its exact mineralogical composition.

It has been our experience that to determine accurately the exact mineralogical composition of a dust one should resort to a combined chemical and petrographic analysis. By no other method have we found it possible to determine the amount of quartz present in a given sample. In certain instances, such as when one is dealing with a mixture of quartz and pure potash feldspar, it is possible to determine the amount of quartz present in such dust merely by a chemical analysis. However, most dusts which come into question are mixtures of quartz and silicates. Take granite for example. The average granite is made up chiefly of three minerals in about the following proportions: feldspar 60 per cent, quartz 30 per cent, and mica 15 per cent. Chemical analysis shows that this average granite contains 70 per cent of silica. Of this 70 per cent, 30 per cent is present as quartz (free silica) and the other 40 per cent is present as combined silica, in chemical combination with the other minerals that make up granite; it is possible to determine these proportions only with the aid of the petrographic microscope.

We find in practice that samples of dust settled out of the asmosphere at the breathing level of the worker serve admirably for both chemical and mineralogical determinations. Table 1 presents the quartz content of dusts obtained in various industries which we have studied.

TABLE 1

Percentage of Quartz Present in Various Industrial Dusts

Kind of Dust	Percentage of Quartz
Rock drilling dust (bituminous coal mine)	54.0
Granite cutting dust	35.2
Rock drilling dust (anthracite coal mine)	31.0
Brass foundry dust	19.0
Dust from raw mills in cement plant	6.5
Slate mill dust (Vermont red slate)	3.0
Silverware polishing dust	1.7
Anthracite coal dust	1.5
Bituminous coal dust	1.2
Cement dust	1.0
Slate mill dust (Vermont green slate)	trace
Talc mill dust	none
Marble cutting dust	none

It is evident from this table that rock drilling occupations in the coal mining industry and certain occupations in the granite cutting industry and in brass foundries would be in the hazardous class as judged by the proportions of quartz in the atmospheric dust.

It has been demonstrated that particles of dust of a size greater than 10 to 12 microns in longest dimension are very seldom found in the lungs. This absence of larger particles is partly due to the fact that the numbers of such particles greater than ten microns in size present in industrial air is, as compared with the lower sizes, comparatively small; furthermore, these larger particles do not penetrate to the terminal portions of the respiratory tract. Hence we need only concern ourselves with those dust particles that are less than ten microns in longest dimension.

In order to ascertain whether or not an industrial dust is capable of gaining access to the lungs, it is necessary to know something of the size of the particles in the dust under consideration. In practice the samples for particle size studies may be obtained by the use of the Owens jet dust counter. The advantage of this instrument over other devices is that the Owens apparatus projects the atmospheric dust in unaltered condition directly on a microscope cover-slip. This cover-slip may then be properly mounted and examined by any one of several methods. In another method a microphotograph of the dust is made at a high magnification: the particles revealed on an enlarged print or screen may be measured by means of a millimeter scale. No matter which method one uses for particle-size measurements the results may be treated in the customary manner. The particles may be grouped in classes according to size, from which a percentage distribution curve is easily obtained.

As pointed out earlier, a knowledge of the quantity of dust dispersed in the atmosphere is very important, since with any given dust the rate of production of the injury will be dependent upon the total quantity inhaled.

From the practical hygienic viewpoint, the particle count is at present the best quantitative index of the degree of atmospheric pollution. The decision as to the size range of the particles which should be included in the dust count is a question requiring careful consideration. Obviously the size of the smallest visible particle will depend on the magnification and type of illumination used in the microscope, the refractive properties of the dust and to some extent on the visual acuity of the observer. We must bear in mind that our chief interest in this problem is in the industrial hygienic aspect. Primarily we are interested in differentiating between the dust content in the ordinary normal atmospheres, not yet known to be harmful, and certain industrial dusts which are known to be associated with lung damage. This difference is sharply marked so far as the dust particles between approximately one-half and ten microns in diameter are concerned; but the difference between such normal and abnormal air is masked and lost when we include in our determination the particles of ultra-microscopic size which are present in vast numbers in all air.

So far as the upper limit of particle size is concerned it has been demonstrated by the South African studies that particles greater than ten microns in longest dimension are, as a rule, of negligible importance. The data concerning the lower size limit of potentially hazardous dust is not so conclusive. Moir of South Africa, who examined microscopically 120 dust particles obtained from two specimens of silicotic lung, found that only 13 per cent of the particles were less than 0.5 microns and about 36 per cent of the particles were less than one micron in diameter. The majority of the particles, 60 per cent, were between one and three microns in size. The median size of the dust was found to be 1.2 microns in diameter. Drinker, in comparing the size frequency of the particles measured by Moir with the particles measured by him of the dust found in the sputum of men employed in ore mills, found a close correspondence. These findings have also been corroborated by Navrogordato.

In connection with the lower limit of particle size of dust of pathological significance the following pertinent question arises: Aside from the evidence direct or indirect of the non-retention of minute particles of dust by the lungs, what

TABLE 2
Average Dust Counts in Certain Dusty Trades

Industry and Occupation	Dust exposure in millions of particles per cubic foot	Average per cent of quartz in dust
Talc Mining and Milling:		None
Jack-hammer drillers	2,160	None
Packers	50	None
Muckers	45	None
Crushermen and cylindermen	14	None
Slate Finishing Mills:		3
Floormen	1,598	3
Loaders	1,276	3
Disc crusher operators	312	3
Quartz Grinding Plant:		99
Mill operators	173	99
Laborers	83	99
Packers	55	99
Granite Quarrying and Finishing:		35
Leyner drillers	144	35
Jack-hammer drillers	112	35
Hand pneumatic tool finishers	59	35
Machine pneumatic tool finishers	36	35
Plug drillers	37	35
Attendant labor (indoors)	17	35
Anthracite Coal Mining:		1.5
Miners and helpers	232	1.5
Attendant labor	31	1.5
Bituminous Coal Mining:		1.2
Coal cutters and loaders	112	1.2
Attendant labor	4	1.2
Marble Cutters	33	None
Cotton Cloth Manufacturing:		None
Carders	9	None
Weavers and spinners	5	None
Silverware Manufacturing:		1.7
Dusty trades	5	1.7
Non-dusty trades	2	1.7

evidence is there that appreciable percentages of ordinary industrial dusts ever fragment into those minute sizes less than 0.5 microns in diameter? The best answer to this question would be data of actual measurement of such dust. Unfortunately we have but scant published data on the particle size frequency of dusts in the air of industrial establishments. In 1929 Fehnel made some particle size measurements in connection with the dust study of hard rock drilling in New York City. He reported the findings on three samples, which showed the dust which was less than 1 micron in size to vary from 1 to 15 per cent. Most of the dust in these hard rock drilling operations was between 2 and 5 microns in size. Badham, in studying the dust hazard among sandstone workers in Sydney, Australia, measured some 16,000 particles of dust in the air of work places and found that 67 per cent of these particles were about 1 micron in size. In a particle size

Average per cent of quartz in dust
None
None
None
None
None
3
3
3
3
99
99
99
99
35
35
35
35
35
35
35
1.5
1.5
1.5
1.2
1.2
1.2
None
None
None
None
1.7
1.7
1.7

study of twenty-five samples of eleven different kinds of aerial industrial dusts made by the filar micrometer method at a magnification of 1,000 diameters, the speaker found that practically all of the dust was less than 5 microns in size. Only 2 per cent of the particles were less than 0.5 microns, 21 per cent were less than 1 micron, and the majority of the dust, 71 per cent, was found to be between 1 and 3 microns in diameter.

From all of the evidence therefore, and in the absence of conclusive proof to the contrary, it is apparent that we need only be concerned with those dust particles between one-half and 5 microns in size, and from a practical standpoint the lower limit of particle size to be counted may well be taken at about 1 micron. Many methods have been devised and used for the purpose of determining the quantity of dust in air. Suffice it to say that for the purpose of dust sampling in either high or low dust concentrations, the Greenburg-Smith impinger apparatus now finds universal favor. This instrument has been used by the United States Public Health Service in all of its dust studies during the past nine years and is also being used by other workers in this field in this country and abroad.

During the past nine years the writer has made numerous investigations of dust hazard in many industrial establishments throughout the country. In Table 2, a summary is presented of the average dust content of the air in a few of these dusty industries. This table clearly shows that the highest dust exposure was in the talc mines, slate finishing mills, quartz grinding plant, coal mining and granite cutting industries. Owing to the high percentage of quartz present in the dust of the quartz grinding and granite cutting plants, as compared with the dust in the other industries listed in Table 2, quartz grinding and granite cutting are revealed to be the most hazardous of the occupations we have studied.

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Clinical and Statistical Aspects of Silicosis

By ALBERT E. RUSSELL, M. D., F. A. C. P.

Surgeon, U. S. Public Health Service; Surgeon, U. S. Bureau of Mines, Washington, D. C.

It would be difficult to estimate with any degree of accuracy the number of people in the United States who are engaged in dusty trades. It is evident, however, that more people are exposed to dust, which constitutes the greatest single industrial hazard, than is generally supposed. Certain dusts contain poisonous elements, such as lead, arsenic, mercury, etc., which give rise to general conditions resulting from their absorption. This paper however will deal only with those dusts which are known to be direct factors in the production of pulmonary diseases.

Economic Aspects of Silicosis

The economic problem presented by silicosis is tremendous. The suffering and loss of life due to it cannot be adequately measured. In the gold mining area around Johannesburg, South Africa, during the period 1911 to 1929, more than 53 million dollars have been paid in compensation alone. The costs of medical care, hospitalization, and legal proceedings further augment this enormous figure.

Mines in Australia are reported to have been bankrupted by payment of silicosis compensation. I know of a company in our own country which has claims amounting to more than a million dollars for disability due to dust inhalation. There are other plants in the East which will be bankrupted if all the claims which are filed against them are allowed. In most of the industrial states the number of claims filed has greatly increased in recent years.

It is clear that dust-prevention work, like any health-promoting activity, would pay many times in money, good health, and efficient operation.

Strangely enough, only during the past 25 years has dust received much attention

Safety Section, A.R.A.--Steam Railroad Section, N.S.C.

Section Officers 1931-32

Chairman—C. T. BAILEY, Chief Safety Agent, Oregon Short Line Railroad.
First Vice-Chairman—C. E. HILL, General Safety Agent, New York Central Lines.
Second Vice-Chairman—C. L. LAFOUNTAINE, General Safety Supervisor, Great Northern Railway.
Secretary—J. C. CAVISTON.

(NOTE: The following pages contain a condensed abstract of the records of the sessions of the Safety Section, ARA—Steam Railroad Section, NSC, as published in full by the American Railway Association in a booklet entitled, "Proceedings of the 12th Annual Meeting of the Safety Section, Washington, D. C., October 4 to 6, 1932.")

TUESDAY MORNING SESSION

October 4, 1932

The sessions of the Safety Section, American Railway Association—Steam Railroad Section, National Safety Council, convened in the Hotel Washington with Chairman C. T. Bailey, Chief Safety Agent, Oregon Short Line Railroad, Salt Lake City, Utah, presiding. The invocation was given by L. G. Bentley, Chesapeake & Ohio Railway.

Report of Committee on Relations with National Safety Council

By ROBERT SCOTT

Director, Insurance and Safety, Atlantic Coast Line Railroad

Mr. Scott said in part: Your committee finds pleasure in reporting that much satisfactory progress has been made in the direction of co-ordinating the work of both sections with the view of avoiding duplication of effort and expense and to the end that the cause of safety might be advanced.

The first annual meeting of the Steam Railroad Section, National Safety Council, was held in Philadelphia in October, 1915, while the Safety Section of the American Railway Association held its first special session in Boston in September, 1921. Both of these sections have been functioning properly and well ever since they came into existence, and have been a powerful force in the reduction of avoidable accidents.

On September 2, 1931, a meeting was held in Chicago at which there were present members of the committee on relations and officers of both sections. At this meeting

in the stress of economy it has been necessary drastically to restrict all expenditures, and dark because the economic depression kept our backs and shoulders bowed to the storm which has raged around us—but during all this stress, you gentlemen of the Safety Section have carried the banners of safety and safety first flying, and your shock troops have been supporting and defending them and there has been no let-up. While there have been let-ups in other directions, there has been no let-up in this safety movement, even with your depleted forces.

Now, as we approach the crest of the hill, the slogan "33 by '33" floats down to our ears from the throats of thousands whose lives have been spared by the drive for safety. I see the light growing clearer ahead and as we lift our heads and throw back our shoulders, I see a smoother, broader, lighter pathway with more moderate slope stretching away to the green meadows above. The storm clouds are breaking, the warm rays of the economic sun are gradually coming through; doubt and despair are nearing their end.

TUESDAY AFTERNOON SESSION

October 4, 1932

Report of Committee on Prevention of Highway Crossing Accidents

By H. A. ROWE

Manager, Claims Department, Delaware, Lackawanna & Western Railroad, New York City

The speaker said in part: The Committee is again gratified to be able to announce a further reduction of grade crossing accidents, fatalities, and injuries in 1931 as compared with 1930. Thus we have had three consecutive years of progress in the curbing of crossing crashes, the records being as follows: 1931, total accidents 4,100, killed 1,811, injured 2,657; 1930, accidents 4,853, killed 2,020, injured 5,517; and in 1929 there was a slight reduction.

The year 1928 was the peak year in railroad crossing fatalities, since which time the reduction of such fatalities has been 757 per year, the 1931 record being but one more killed than in 1922, when the careful crossing campaign was inaugurated.

The outstanding accomplishment of crossing accident reduction can be better grasped when we note that motor vehicle fatalities on streets and highways in 1922 were 13,676 but in 1931 there was an increase of 18,913 deaths or 139 per cent. During this same 10-year period there was an increase of but one death at railroad crossings.

A very important feature of the committee work has been the careful crossing campaign which has continued to enlist the interest and cooperation of many organizations and the general public. This has been furthered by general publicity, the regular posters initiated for this special campaign and other literature.

During the past year the National Safety Council has been active in its educational campaign for the prevention of accidents, and in its May, 1932, issue of the *National Safety News* contributed a most useful and illuminating frontispiece. The crossing accident situation was stressed in the same issue of the *News*, and in many other respects the National Safety Council has shown deep interest in cooperating in the prevention of crossing accidents.

Opportunity is presented for a fuller enjoyment of the facilities offered by the 41 Community Safety Councils associated with the National Safety Council. Collectively, 30 Councils reach 808,000 school children through 3,141 meetings. Railroad safety representatives, cooperating with such local Councils, have an excellent opportunity of extending the gospel of careful crossing over railroads. These Councils hold vast numbers of other meetings and should be regarded as fertile soil.

WEDNESDAY MORNING SESSION

October 5, 1932

Report of Committee on Train Service Accidents

By D. G. PHILLIPS

Superintendent of Safety, The Wabash Railway

The speaker said in part: In the year 1931, out of 5,099 fatalities and 35,656 persons injured, according to reports to the Interstate Commerce Commission, 4,624 of these fatalities and 18,849 of the persons injured occurred in train service accidents. While it is true that a large proportion of these fatalities occurred in grade crossing accidents and to trespassers, it is also true that over half of the fatalities to employees on duty occurred in what is known as train service accidents and about one-third of the injuries to employees occurred in train service accidents.

We feel, therefore, that we are justified in saying that the prevention of train service accidents is probably the most important safety problem confronting us today, as far as accidents in and around railroads are concerned.

Under the heading "coupling or uncoupling cars or locomotives" in 1931 12 persons were killed and 394 persons injured. This may be compared for the year 1930, when 30 persons were killed and 604 injured. The year 1931, therefore, shows a decrease of 60 per cent in the number of fatalities and 35 per cent in the number of personal injuries; and these may be compared further with the record for 1920, when there were 151 fatalities and 2,450 injuries due to this cause.

The principal reason for personal injuries under this heading is due to employees stepping in between moving cars, usually at a time when coupling is about to be made, to determine if the knuckle has fully opened, to adjust location of couplers, or to adjust the coupling or uncoupling lever, with the result that they are caught between the couplers; or perhaps due to tripping or falling while performing this act, and are thus run over by the car. Our remedy for correcting this dangerous practice is for each and every railroad to make a positive and definite rule prohibiting employees from going between moving cars when nearing each other, to examine the employees to see that the rule is understood by them, and that supervisory officers see that the rule is enforced.

Under the heading "coupling or uncoupling air or steam hose," in 1931, 13 persons were killed and 175 persons injured, which may be compared with the record for 1930, when 7 persons were killed and 232 injured. The increase of 86 per cent in the number of fatalities is decidedly regrettable, although the record shows a decrease of 24 per cent in the number of injuries. The principal cause of employee injuries under this head is due to their failure to protect themselves by performing this work in accordance with the rules.

The remedy for this class of accidents where car men are employed rests in a full and complete enforcement of the blue signal rule which is quite uniform on all railroads. Railroad managements should improve this blue signal so as to make it as efficient as posssible. The rule should also govern the placing of the blue signal so as to make sure that it is in a location where it will serve the best purpose as a signal to warn train, engine and yardmen who might be guided by it. Where engine is coupled onto cars and trainmen are performing this work without blue signal protection, they should not permit themselves to get into a place where an unexpected movement of the cars might cause an accident, without first notifying the engine man and fireman so as to be fully protected.

Under the heading "operating hand brakes," in 1931 there were 18 fatalities and 824 persons injured, as compared with the record for 1930 when 26 persons were killed and 1,154 injured. The year 1931 shows a decrease of 31 per cent in

It may be argued that no one has time to dignify minor accidents by careful and painstaking investigation, but the answer to any such argument is that if they are investigated carefully and with sufficient thoroughness to bring out any underlying condition or situation which may exist, the time soon will come when there will not be very many to investigate, and we may rest assured that the occurrence of major accidents will decrease just as rapidly as do the minor accidents. Furthermore, all employees involved are available for questioning, whereas in the more disastrous accident important witnesses are often permanently silent.

Railroad casualties have been decreasing for years, although just what the immediate trend is I cannot pretend to say; you may rest assured, however, that they will continue to decrease, but only if all accidents are treated with the importance they deserve. As to the steps to be followed by the various railroads in this humanitarian work, these must be worked out for each individual organization. They all have the same object in view, the saving of life and limb, and I do not believe that anything can impress itself to any better advantage on the rank and file of railroad workers in the way of accident prevention than to have the investigation of the minor accident, regardless of its character, as thoroughly and painstakingly handled as the investigation of the major accident. The investigation of the major accident obviously would take more time because of more facts to be developed, and more evidence of one kind or another to be considered, but aside from the question of volume there would appear to be no difference in the investigation itself. The result to be accomplished is the same in each, and only by handling it in the same manner can those results be best attained.

WEDNESDAY AFTERNOON SESSION

October 5, 1932

Value of "Safe Practices" Committees

By F. HARTENSTIEN

Assistant to General Manager, Lehigh Valley Railroad

The speaker said in part: In our efforts to reduce the number of casualties on the railroads it becomes natural for us to analyze their causes and if possible adopt ways and means to prevent repetition. After a careful study of this subject, and considering that 75 per cent or more of the injuries that occur on the railroads are the result of unsafe practices, it appears to be in order to make a change in our safety organization that is adaptable or more in keeping with the causes which are responsible for producing unsatisfactory safety records. With the hope and expectation that a change in the name of safety committees to that of "safe practices committees," will be conducive of better results, it is recommended to the members of the Section that such a change be made.

The change is recommended for the purpose of inspiring careful employees who are dependable safety workers to caution their co-workers when they observe them doing anything that is liable to result in personal injury. Also, to more clearly instill in the minds of committees and other employees that the causes of the majority of personal injuries on the railroad are from unnecessarily taking chances and their discontinuance will be a large contribution to the goal that we are struggling to make by the end of the year 1933.

If it is decided to change the name of committees it should be understood that reporting any unsafe conditions observed on railroad property must not be discontinued, but a careful analysis of the records indicate that a very small percentage of our injuries occur from defects and unfavorable conditions, and the change suggested should direct the attention of officers and employees to the real reason for the majority of railroad accidents.

of train, a trainman may go over the running board if necessary to get on top of the train to extinguish fire or pass signals. If anything should develop on the engine requiring getting out on the running board to fix it, and such work cannot be deferred, the train must stop between stations to permit it to be done.

THURSDAY MORNING SESSION

October 6, 1932

Power Apparatus in Maintenance of Way Work

By LEM ADAMS

Engineer, Maintenance of Way, Union Pacific System

The speaker said in part: The maintenance of way employees on any railroad are constantly beset with hazards of accidents. When the motor car is set on the track for the day's work there is a potential hazard of being struck by a train, an automobile at a grade crossing, or another track car. Hence we surround them with innumerable rules and regulations to safeguard their movements.

Men in this branch of railroad service must constantly be on the alert to protect themselves. Their tools are watched closely for the smallest defect that might result in injury from particles of flying steel, and the very best steels and heat treating methods are used to provide tools that will be as nearly fool-proof as possible.

Yet with all these precautions, we still have accidents. Perhaps a rail is struck with a spike maul when a spike is not properly hit, or a sledge hammer fails when striking a track chisel in cutting a rail, and we have a cut or eye injury from flying steel, or an adze strikes a knot in a cross-tie when adzing for gauge and a foot is cut. Or perhaps a bar slips, or the trip gives way when operating a ratchet jack for spotting track, and we have a broken arm or other serious injury. These things are especially prevalent when large groups of men are working in a rail renewal or ballasting gang.

With such a picture before us, we maintainence of way men have for years been thinking in terms of machinery to do the more arduous and dangerous operations. Then, too, we were thinking in terms of efficiency, for safety and efficiency usually go hand in hand.

(The speaker then showed a score or more of lantern slides illustrating various types of power equipment employed in maintenance of way work.)

This set of equipment is one of our best safety agents. However, all power operated tools are unfortunately not the safest to use, although they are great labor savers. Some tools in this class are the power saw, the sandblast for cleaning surfaces preparatory to repainting, the power drill for either rail or bridge work, and many others—but efficiency and accuracy of work demand their use, and with proper care on the part of the operators they can be handled safely.

Planning for Safety in Track Construction

By FRANK R. BRADFORD

Director of Safety & Fire Prevention, Boston & Main Railroad

The speaker said in part: My object in being here is to show you a picture illustrating one of the modern methods of main line rail renewal. The operation, which is notable in many respects, is the outcome of the idea that the old established methods of rail renewal were no longer justified from the standpoint of economy, advantage of the operating department, or safety to the maintenance of men.

(10) Avoiding getting men excited by unnecessary hollering on the job, etc.

(11) Have all laborers examined as to physical condition before employment.

The report of the resolutions committee was then presented by J. A. Long of the Delaware & Hudson Railroad, Chairman, and two resolutions were formally presented and adopted by the Section delegates.

The first was a resolution of condolence upon the death of J. Flanagin, Manager, Safety Department, Chicago, Milwaukee, St. Paul & Pacific Railroad.

The second resolution acknowledged with thanks and appreciation efforts of all who had participated in making the Washington Congress Session successful.

Report of the Nominating Committee

The report of the tellers who canvassed the election of officers for the Section, was made by J. J. Heavey, The Erie Railroad, and announcement was made of the election as follows:

Chairman of the Section—Charles E. Hill, General Safety Agent, New York Central Lines.

First Vice-Chairman—C. L. LaFountaine, General Safety Supervisor, Great Northern Railway.

Second Vice-Chairman—H. A. Parish, Assistant to General Manager, Chicago & North Western Railway.

Members selected for the Committee of Directions for the Ensuing Year:

Eastern Territory—F. Hartenstein, Assistant to General Manager, Lehigh Valley Railroad; H. A. Rowe, Manager, Claims Department, Delaware, Lackawanna and Western Railroad.

New England Territory—C. N. Woodward, Assistant to General Manager, New York, New Haven & Hartford Railroad.

Southern Territory—Robert Scott, Director Insurance & Safety, Atlantic Coast Line Railroad.

Canadian Territory—A. O. Beck, Director, First Aid & Accident Prevention, Canadian National Railways.

Members of the *Committee on Nomination* for the ensuing year: F. W. Curtis, Supervisor, Safety & Fire Prevention, Denver & Rio Grande Western Railroad, Chairman; E. G. Evans, Superintendent of Safety, Louisville & Nashville Railroad; C. F. Larson, Superintendent of Safety, Missouri Pacific Railroad; F. M. Metcalfe, Superintendent of Safety, Northern Pacific Railway; J. C. Pratt, Supervisor of Safety, The Redding Company.

The closing minutes of the session were devoted to the introduction of the new chairman, Charles E. Hill, and to appreciative and eulogistic remarks concerning the services rendered by officers of the section during the past year.

ADJOURNMENT