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Cleaning in the Metal Industry

By DR. LEONARD GREENBURG
U. S. Public Health Service, Yale Medical School, New Haven, Conn.

My talk is not going to be a complete discussion of the subject, "Cleaning in the Metal Industry" but rather a talk concerning itself only with sand blasting methods in the metal industry.

I don't know whether you are familiar with the fact that some time ago, namely in 1928, the Executive Committee of the National Safety Council authorized the appointment of a committee to inquire into the problem of sand blasting in the metal industry. This committee was empowered to inquire into the importance of the problem of sand blasting hazards in the United States and the desirability of the National Safety Council conducting a study of this problem. In complying with this resolution and under the joint sponsorship of the Engineering and Health Sections, a Sand Blast Committee was formed. There were eight or ten members on that committee.

The first question we tried to answer was, "Does a health hazard exist in general sand blasting operations?" And, second, "If such a hazard exists, what is the general extent of the hazard and, if possible, what is a rough approximation of the persons exposed to such a hazard?" And the final question "Does this committee consider the problem of such importance that the National Safety Council should engage in a study of the problem as a whole?"

This committee after several meetings arrived at an answer to these questions and I should like to briefly read the opinion of this committee to you.

"It is the committee's opinion that wherever sand blasting is conducted a potential silicosis hazard exists and that in most cases workers are exposed to the inhalation of silica dust to a greater or lesser degree depending on the duration of their exposure and the type of process which might, under certain conditions, be injurious to health."

For the second question, a study of silicosis, the committee felt that the National Safety Council was not justified in making a study of the problem of silicosis as such. In South Africa, in Australia and in this country by the United States Bureau of Mines at Joplin, Missouri, and by the United States Public Health Service at other places, considerable data has been accumulated on the production of silicosis and fibrosis from silica dust and it was the feeling of that committee that the National Safety Council would not be justified in studying this problem of silicosis again. But the committee did feel that the problem of sand blasting was of very great importance and that it was justified in recommending to the National Safety Council that a study of sand blasting as a hazard in the United States be made.

Then, as a result of that recommendation, a rather large committee was formed for the study of sand blasting as a hazard in the United States but I won't bore you with a list of its members but I would like to point out the agencies represented. There were three men from universities, several industrial physicians, several safety men, two representatives of insurance interests, three representatives of government agencies, two representatives of the state departments of labor and of health, three representatives of health and medical organizations, two representatives of industry, representatives from each of four large organizations making sand blasting equipment, one representative of fan and blower companies, representatives from three trade organizations and three additional representatives from the National Safety Council coming from the Metals Section, the Foundry Section, and the Steam Railroad Section.

Now, it was thought that this large committee might do justice to all of those persons interested in sand blasting and every effort was made to get their views on the subject and get a contribution from them in the way of information which might help the committee in its work.

The committee got its funds from the National Safety Council (I forget just how

much was set aside but I think it was either five or six thousand dollars, I am not clear on that at the moment).

There was no one available to conduct the research at that time so the United States Public Health Service generously donated the services of Mr. Bloomfield, one of the sanitary engineers who has had many years of experience in the actual work in the field. Thus the United States Public Health Service and the National Safety Council were able to cooperate in the making of the study. The object of the study, I briefly stated, was to make a survey of the sand blasting operations in this country and I will show you just how we attempted to identify the various kinds of equipment with the makers and locate equipment around the country in an effort to get a reliable sample or cross-section of the industry as a whole.

The purpose was to make a study of the sand blasting equipment, comparing the amount of dust in the air with the proper known standards affording health protection. We have these standards from the South African experience, the Australian experience, the Bureau of Mines at Joplin, Missouri, and from the experiences of the United States Public Health Service. There was no necessity of having any further investigation to get knowledge as to how much dust should be permitted in the atmosphere of a workroom. The important thing to determine was just what any given industry disclosed in the way of atmospheric pollution.

We first studied equipment such as rooms, barrels, cabinets and certain special types. We studied sand as an abrasive and also other materials such as a shot and steel grit. A rather uniform plan of study was followed, making a sanitary survey of every plant visited. For example, if this were the room in which there were two pieces of sand blasting equipment, we would make sketches of the room and all the equipment. We studied the ventilation provided in the room and the construction of the ventilation equipment and then we gathered data on the equipment itself—going so far as to get the size and the number and the maker's name and the age of the installation and its up-keep and all of that. Finally, we made dust counts of the amount of dust in the atmosphere either inside equipment or in the general workroom outside.

For instance, if we were dealing with an ordinary sand blast room, we would make tests of the amount of dust in the room and then we would make tests of the amount of dust in the room in which the particular piece of equipment was housed to get an idea as to the possible effect of this equipment on the health of the workers in the room.

To evaluate the harmfulness of some of these dusts, we took samples and made petrographical analyses of the dust which we obtained in the work room. We also made occupational analyses of the workers with a history of the exposure and a complete history of their occupations. And, lastly, we obtained as many X-ray pictures as we thought might be pertinent to the particular piece of equipment under study.

We were primarily interested in studying silicosis but you can see that some of these X-ray pictures might lead to something of great importance. For example, we found a man who was working around blasting equipment in an atmosphere contaminated to a lesser extent than some of the acceptable standards and that man had been working there for a large number of years and his chest was entirely negative to silicosis. This might be considered as partial proof at least that he was not suffering because of his occupation and that would serve as a check on the standards to which we had compared his occupation. Of course, such an X-ray picture would be of comparatively little value if a man were working in a very dusty atmosphere and had a bad chest because we know that such atmospheres do produce these chests in practically all cases.

Another very important portion of the study was protective devices. We made a survey of the literature on this subject and there is practically nothing available that is of any value. Our first study along this line was made at a well known plant in Bridgeport about six or seven years ago. At that time all the available literature

had failed to reveal anything at all in the way of actual studies on protective value of helmets, respirators and masks.

At the beginning of this study we again went over all the literature that we had and failed to find anything of note and so we included, with our other work, a rather detailed study of some of this equipment, and, finally, we have had the literature of this whole subject under scrutiny for some time and will be prepared to discuss the findings with the other investigators in this country and abroad.

I should like to repeat that there are four general types of equipment, including rooms, barrels, tables and cabinets. In the case of tables, cabinets and barrels the worker usually is outside of the piece of equipment. He may shovel a lot of small castings into a barrel and close the door of the barrel and then be in the general room atmosphere but outside of the equipment. In the case of the sand blasting room, of course, the worker actually is inside of the room where the blasting is being done and in this latter case it is absolutely essential that he be provided with some kind of protective device.

The very first thing we did at the beginning of this study was to find out what kind of safety blasting equipment was in use. We wrote practically all the manufacturers and they kindly sent us lists of all of the equipment they made. From this we computed that approximately 28 per cent of the equipment was in the form of sand blasting rooms, about 44 per cent was in the form of barrels and about 21 per cent in cabinets and about 9 per cent in tables. There is some variation, of course, those figures are rather rough but, in general, those figures express the types of equipment that are being used in the sand blasting industry.

Another important question that came up was "In what kind of industries is this type of equipment to be found?" We found that 65 per cent was in foundries of various kinds including 22 per cent in forges and heat treating shops and about 13 per cent spread over many miscellaneous kinds of jobs. After we had found this we decided to canvass these manufacturers as to what they considered their best equipment, in order to study certain pieces of the best equipment available.

We tried to get approximately 28 per cent of rooms to study and 44 per cent of barrels and about 20 per cent of cabinets, and so on. We tried to see that the work was spread out among the foundries, as a rule, to the extent of about 60 or 70 per cent and to forge and heat-treating shops to the extent of 20 per cent—in other words, we wanted to get a real sample of industry as a whole. Then we made it our business to study several of the best pieces of equipment of each manufacturer.

Now, the objection may be raised that by doing this we avoided the study of the old equipment, but that isn't so at all, for we studied all equipment that came along by a selection which I will explain afterwards but we made it our business to get the whole of this equipment.

One of our committee members raised the question that in certain states the operation might be on a higher and better plane than in others because of labor laws and for that reason we spread our study over some eight states including the state of Wisconsin, which is supposed to be on a very high plane from the point of view of labor supervision, and other leaders.

Now, I am going to pass around a survey form which we used and by means of which we attempted to get all information that might be of any importance in each one of the plants, without overlooking any of them. We planned to make these sanitary surveys, get all the information and all the data pertaining to the equipment and its operation and, finally, close by getting our dust-count and computing it (and this was done in some laboratory, either at the one at the plant or at some nearby plant—the City Health Department or some place of that type) and then, afterwards, to compile our results.

To go back to the study of the question of silicosis, I want to point out that there are really four factors which enter into the production of this pulmonary disease. One of these is the composition of dust and it is now fairly clearly established that

dusts which are high in quartz content are more injurious than those which are low in quartz content. The second is the number of particles of dust and we determine the number of particles of dust by the use of a suitable sampling apparatus which has been developed by the Bureau of Mines and the Public Health Service. We used this standard type of procedure in all of our analyses. It is the same as that used by the Public Health Service and Bureau of Mines. In addition to that we studied the particle size. You see, usually, the large particles of dust do not gain entrance to the lungs and for that reason the determinings of the particle size of these dusts are exceedingly important. We did that by a special technique and we had photomicrographs of that made to present with our final report.

Lastly, we have the factor of duration of exposure. If a man works five years he will inhale twice as much dust, relatively speaking, as a man who has worked two and one-half years will inhale.

As I say, the type of equipment was approximately the same as that we found from the study of the records presented to us by the equipment manufacturers.

Our abrasive studies resulted approximately as follows: In 15 per cent of the equipment, sand was used as the abrasive; in 45 per cent, steel of some kind or other was used as the abrasive (as shot or in broken fragments of some kind); and in approximately 4 per cent, steel and sand mixed were used.

So far as personal protection is concerned, in forty-one per cent of the cases, positive-pressure helmets of some kind were provided. In twenty-six per cent of the cases, respirators were provided and in approximately thirty-three per cent of the cases no protective equipment was provided.

So far as the dust was concerned, we found the picture to be about as follows: When steel grit or steel shot is used we found the silica content in the dust of the air very low—usually less than 5 per cent. When a mixture of sand and steel is used, the silica content may vary from 25 to 50 or 60 per cent. And, finally, when sand alone is used, the silica content is usually around 80 or 95 or 100 per cent. It becomes obvious from this that the use of steel shot or steel grit is certainly to be advocated over the use of sand—all other things being equal.

Relative to size of dust particles, our studies showed that practically all of the dust in the air as caught by our sampling apparatus was of a dangerous size. Practically 100 per cent of it was less than five microns in size and that is a size that can easily get into the lung tissue. The most frequent size of all the dust particles was around one and one-half microns. In general, it can be said that sand blasting, is accompanied by the production of certain amounts of dusts which may be high in free silica (whether sand or steel grit or steel shot is used) and is hazardous to a greater or lesser degree.

I have a few slides which will summarize some of the results which we have obtained.

(Slide No. 1) This slide shows the result of our dust determinations (in all we have two hundred fifty-five counts on the various types of equipment). These are selected samples, the others having been taken out because they represent certain special conditions and in the final report they will, of course, all be presented. We have twenty samples here in which the man was protected by positive-pressure helmets and respirators taken in rooms, in some cases the minimum amount of dust was one-tenth of a million articles per cubic foot of air. It is well to have in mind the figure of ten million particles which is approximately the standard which might be used in this industry (on this point the committee has not voiced its final opinion and I only say that with reservations). At any rate, in certain cases the worker is protected in that he is only subjected to the inhalation of one-tenth of a million particles but in other cases he gets approximately five million and in some cases he gets twenty-five million particles but only approximately five million where positive pressure helmets and respirators are used. Curiously enough, the worker under those conditions is only getting five million particles but in the types of equipment which

ordinarily have been considered as safe, namely, barrels and tables, the worker is exposed to a greater amount of dust, for example the worker gets almost twice as much dust as in the case of barrels and six times as much in the case of sand blast tables. We are convinced, as a result of this study that in many cases the use of sand blast barrels and tables is far more injurious than the use of sand blast rooms where the worker is provided with a positive-pressure helmet of a satisfactory type.

Now cabinets are widely used in this industry but they form a smaller part of the equipment and, as a general rule, are used more intermittently than the other types but in certain cases, even with cabinets, there is an exposure of nearly eleven million particles of dust per cubic foot of air.

(Slide No. 2) This picture shows the technique which we employed in studying the value of some of the masks and respirators. Our apparatus is so arranged that we can do three things at one time. We have a control device for sampling the dust and this other one is the device which samples the dust of the blasting room itself and with the device (c) here we take a sample of the air from under the helmet and sample it in the apparatus marked "A". While the worker is sand blasting materials, therefore, we have been able to measure the dust concentration in the sand blasting room and at the same time test the air under the helmet with which he is provided, and, finally, by the use of this apparatus marked "B" we have been able to measure the actual amount of air which he breathes—the outdoor air with which the helmet is supplied. I would like to show you the results of this special study which we made on the provision of fresh air to helmets and its effect on the dust concentration under the helmet.

(Slide No. 3) This shows one such study made in the sand blasting room. The blasting caused five hundred million particles per cubic foot. The worker was provided with a helmet to which the air was supplied. This air contained three-tenths of a million particles per cubic foot, that is, about three hundred thousand particles per cubic foot were going to the helmet itself. Now then, under those conditions, by varying the amount of air going to the helmet, we tried to find the relationship between the amount of air going to the helmet, (which, as I said, varied from two to six cubic feet,) and the amount of dust under the helmet. Our results were extremely erratic. We wondered why that was until we realized and took into account the fact that this helmet was provided with a metal screen in front of the eyes of the worker. This screen was open and, of course, at six cubic feet, a good deal of air would be blown out through that double screen in the front part of the helmet. However, at other times the worker might direct the stream of sand in such a way that it might hit one of the castings and bounce back and strike the double screen in front of his helmet and actually some of the dust would enter the front part of the helmet. We tested this theory out and found that that was the case and I am going to show you the results of the second series of observations made when the double screen eye-shield was replaced by a suitable piece of glass.

(Slide No. 4) Here we have the double screen replaced by a glass eye-shield in the helmet with approximately six hundred sixty-five million particles of dust per cubic foot of air and where the air pumped into the helmet contained three hundred thousand particles of dust. Under these conditions a very orderly arrangement resulted between the amount of dust under the helmet and the amount of dust in the air supply (you will notice that the air supply was six cubic feet of air). It would seem from such observations that it would be reasonable to conclude that the amount of air that should be supplied to one of those positive-pressure helmets is approximately six cubic feet. Now that particular helmet was an ordinary heavy canvas-type without any fancy fittings of any kind and I think the explanation is simple enough—that when you supply approximately that much air, it can only come out through the bottom of the helmet—around the base where it fits to the man's neck and shoulders and there is very little opportunity for any dust to infiltrate in this manner.

(Slide No. 5) Our next endeavor was to see whether the amount of air in the sand blast room would have any influence on the amount of dust under the helmet. We maintained the air supply to the helmet constantly at six cubic feet and the air coming into the helmet contained three hundred thousand particles again and this time, by interfering with the ventilation in the sand blast room, we managed to increase the number of particles to nearly four billion particles of dust per cubic foot and under the helmet at that time we got about three million particles, in fact about 2,970,000—well below any reasonable standard—so it is certainly safe to say that with a helmet of this type, even with the amount of dust in the sand blast room far above anything that ordinarily would be found, the air under the helmet would be very low in actual dust count.

(Slide No. 6) This curve (on the chart) shows graphically the results of our experiments and shows that with the same small amount of air supplied to the helmet you get a normally high count—between forty and sixty million—and when you have six cubic feet of air supplied to the helmet the dust count is pratically as low as you can reasonably hope to get it.

Finally, one more word about maintenance. As a result of our study we certainly have arrived at the opinion that most sand blasting equipment is rather poorly maintained for general practice. Most of the protective devices are very poorly maintained and certainly the adequacy of any of these protective devices and the adequacy of any of the equipment, particularly barrels and tables, which are important factors in the prevention of general atmospheric pollution should be given more attention than our view discloses has been given up to this time.

A word in closing. We have not had a meeting of the committee on sand blasting hazards for some time. We have not had a meeting since we have collected all this material and the next step in our plan is simply to draft a tentative report to the committee and to have all their changes noted and made and finally to get a report out with which everybody will be satisfied and contented and then, perhaps, present it to the Council for approval.

CHAIRMAN BENNETT: Dr. Greenburg, we thank you very much for this excellent, definite and clean-cut paper on this important subject relating to our industry.

We have a little time now for discussion.

MR. SHANNON (Fort Pitt Malleable Iron Co., Pittsburgh, Pa.): I would like to know the opinion of Dr. Greenburg on how long a man could work at sand blasting with an air-equipped helmet—how long could you safely keep a man on that class of work?

DR. GREENBURG: It is clear enough that if a man has a good piece of protective equipment which you know to be in good condition and he is supplied with sufficient amount of air, I think he could work indefinitely. The best thing to do would be to look him over every six months with X-ray pictures. With some means like that you can actually see whether he is in good health. With a good supply of air, he should be able to work indefinitely in my opinion. That is what the result of our study would indicate.

C. W. WAGNER (U. S. F. & G. Insurance Company): Dr. Greenburg, what do you think of the possibility of silicosis to the operators on sand blasting operations on buildings? They don't have any helmets.

DR. GREENBURG: I think they should be given helmets. I think they have a real exposure.

MR. WAGNER: But they would laugh at anyone who suggested that they wear a helmet.

DR. GREENBURG: I won't say exactly but I don't think there is any argument there.

CHAIRMAN BENNETT: Of course you understand that Dr. Greenburg is relating scientific facts from scientific findings and it is up to us to use them as diplomatically as we can to bring about the use of protective devices.

I should like to bring to your attention one of the important statements made by Dr. Greenburg at the close of his remarks on the up-keep of protective devices. It is similar to the up-keep of your first-aid devices. Perhaps your plant is completely equipped but in six months time you are not—or perhaps even in six days.

SEYMOUR W. DORAN (Pratt & Letchworth Co., Buffalo, New York): Dr. Greenburg, in taking those tests showing the relative values of the room against the barrel and the table type of sand blast, are those results of tests taken over a period of time or at one particular time? For instance, in the barrel type, were they taken while the barrel was being dumped, and isn't it a fact that most of the dust would be accumulated at that particular time?

DR. GREENBURG: Those tests were taken for all the time that the piece of equipment was in operation. I didn't explain the slide that goes to show this sampling apparatus and I judge that you got your ideas from the one picture. In general, we fasten the apparatus around the worker's neck and let him wear it while he filled the barrel and while he dumped it and during the entire time while the barrel was turning. In other words, we tried to approximate as closely as possible the actual exposure.

MR. DORAN: I don't believe it is customary for the barrel operator to wear any protection except a respirator.

DR. GREENBURG: It isn't customary to wear any protective equipment. That is what made the study so interesting from a preventive point of view. It shows that we have been thinking that these people have been well taken care of while, in many cases, they have not. I think the answer is simple enough. It means that the manufacturer of this equipment should look at these barrels in a more critical way and make them so dust tight that no dust can get out of them.

MR. DORAN: That is the point I wanted to bring out. Could we use air-tight equipment in barrel operations?

DR. GREENBURG: I think it can be developed.

DR. A. S. GRAY (State Dept. of Health, Conn.): I would like to say in connection with the study of maintenance that I have seen this study made in Connecticut and many splendid pieces of equipment were lending hazards to situations because they were not properly maintained. And these, too, had been used for heaven knew how long! Good helmets, because they were not in good repair, were subjecting individuals to definite hazards and so far as sand blasting was concerned, most of the barrel hazards that we found were due to the fact that the barrels were not properly maintained. Most of the ventilation lines were in bad condition and good equipment, just because it had not been kept in good condition, was adding hazards in many instances.

DR. J. P. LEAKE (United States Public Health Service): I should like to ask Dr. Greenburg if there is any hope of getting away from using silica for this purpose?

DR. GREENBURG: I think not completely. At least, not at the present time.

I was very much interested and gratified to meet one of the executives of a plant where I was temporarily engaged and he explained to me how they had been using steel grit instead of sand and I think that in the future probably a great deal more of the steel will be used and, from the point of view of safety, it is a very satisfactory solution of the problem.

MR. DORAN: Dr. Greenburg, in connection with that last question, I would like to say that, so far, we have not discovered anything that will make a mould like sand and I guess we can't get away from that entirely.

DR. GREENBURG: That is an interesting point. When we began this study we intended to go into the different castings like clean castings and dirty castings but, unfortunately, some of the other factors so far overshadowed the amount of sand on the castings that we didn't have any clear results along those lines. Now, in spite of that, I think that a dirty casting, that is a casting with a good deal of sand adhering to the casting, does pollute the atmosphere to some extent but I think the use

steel shot or steel grit instead of sand is really a big step in the solution of the problem.

A. C. SCHULTZ (Bucyrus Erie Company, So. Milwaukee, Wis.): I would like to give you an outline of what we are doing to protect our sand blast men at our plant. We have about fifteen or twenty sand blast men and they are on the job and off the job for about two weeks. At the end of each two weeks, X-ray pictures are taken of them and before they go on the job they are examined and after they come off the job they are examined again.

CHAIRMAN BENNETT: Do you mean that your men are examined at the end of every two weeks?

MR. SCHULTZ: Yes, every time they go off the sand blasting job.

I have also been wondering if there is any real good way of checking up on sand blasting?

DR. GREENBURG: Well, certainly X-ray pictures are an excellent way of checking up on the conditions under which the men work. There is no question about the study of the amount of dust in the atmosphere and the use of good equipment being a good protective check. That is probably the best thing to do and also to use the best equipment you can get.

MR. SCHULTZ: We do use the best equipment we can get.

DR. GREENBURG: If you do that and then check up the workers by means of the pictures every four or six months you are playing pretty safe.

CHAIRMAN BENNETT: Dr. Winslow, would you care to make some comment on this paper?

DR. C.-E. A. WINSLOW (Yale Medical School, New Haven, Conn.): I am enormously pleased to hear this paper. I have been, for some years now, the Vice President for Health of the Council and have had to bear some of the reactions from earlier studies and it is a particular pleasure to meet with this one. It is a pleasure to me to see that these investigations of sand blasting operations are not only sound and scientific but seem to yield results which will be highly satisfactory. It seems to point the way to controlling one of the most serious problems in industry. I think the Section and the Council and the other Sections concerned can be very proud of this investigation.

CHAIRMAN BENNETT: It has been the custom in the Metals Section to show pictures of some recent changes in mechanical equipment and safe practices in our industry. Mr. Oartel, who has always looked after this feature, has kindly consented to show us a film relating to the foundry industry.

Developments of Safety In Foundries

By JOHN A. OARTEL
Chief of Safety Bureau, Carnegie Steel Company, Pittsburgh, Pa.

(The following list of slides showing safety devices was produced by Mr. Oartel, with, in some cases, a brief description.—Ed.)

American Steel Foundries, Chicago, Illinois

1. Results of poorly designed and defective trunnions on early type of steel flasks. This shows an accident due to defective trunnions.

2. Poorly constructed and unsafe flask trunnions. This shows defects in the construction of the trunnions.

3. Carrying large grab bucket with improper kind of chain which did not have a hook.

The entire weight of load is dependent on the small gagger iron, which broke causing bucket to fall on workman. Proper chains were available but chainmen neglected to make change.

Steam Railroad Section

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Tuesday Morning Session
October 13, 1931

GEORGE H. WARFEL, Chairman
Union Pacific System, Omaha, Neb.

The first session of the Steam Railroad Section convened with General Chairman George H. Warfel presiding.

CHAIRMAN WARFEL: Gentlemen, the annual convention of the Steam Railroad Section

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.
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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