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EXPERIENCES WITH ALUMINUM DUST TREATMENTS—SILICA BRICK INDUSTRY

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This presentation is not an endeavor on my part to prove something; it is merely a recital of experience and conclusions that our Industrial Relations Department has come to, based on interpretation of data collected since 1943. It is not presented as a scientific treatise to impress or confound the medical profession. As I see it, its value will be in whatever benefit other industries, confronted with a silica hazard, may glean from the experience that our Company has had with a nine years' trial of aluminum dust treatments. Incidentally, I believe ours was the first industrial installation in the United States. But in spite of this, and at the risk of having it said "he doth protest too much," I repeat that this presentation is not an attempt to prove something.

Our Company became silicosis conscious in 1935 when five civil suits for damages were filed against us. Only one case went to trial; the other four were settled out of court. The total cost of these five cases amounted to $30,000. At that time, silicosis did not come within the scope of the Workmen's Compensation Laws of the states in which we operated. The potentialities of further civil suits had sufficient impact to not only make us silicosis conscious, but impelled us to also take such positive measures as were available to us at the time in the way of dust control.

As a result of these five suits we made a determined effort to settle all suspected cases at all of our silica fire brick plants. Rather than settle on a lump sum basis, we endeavored to provide weekly payments for the duration of the employee's life, and if death occurred before the settlement was paid out, the weekly payments were continued to be paid to the widow. Up to January 1, 1938, at which time silicosis in Pennsylvania and Indiana became compensable, we had settled thirty cases.

Since that time we have processed 136 cases including some classified as total disability, some classified as partial disability and some who were unable to prove disability. The majority of these cases were naturally settled during the first few years that silicosis became compensable. In the past four years we have settled 21 silicosis cases having an average exposure of 24 years.

Retrogressing again for a moment, in 1937 we decided that the potential liability was great enough to take precautionary measures to insure ourselves, insofar as possible, from inheriting already existing silicotics. We felt that pre-employment chest X-rays was one method of doing this, so beginning in January 1937 we required that each new employee submit to and pass a chest X-ray examination (in addition to a complete physical examination) as a condition of employment. This immediately eliminated the possibility of hiring men who were tubercular or silicotics, as well as screening out any others whose chest X-ray and physical examination disclosed other undesirable pathology. The Workmen's Compensation Laws in most states make the last employer having a silica hazard entirely liable for the silicotic (after he has been on the payroll for a very short period of time, which varies from state to state). Regardless of how much silicosis a person may have acquired in prior employment, we have inherited a problem if he is in our employ after a specific period of time. We have no quarrel with the moral, legal or social aspects involved in such cases. However, we feel that when we adopted a policy of pre-employment screening examinations in 1937, it was a very wise move.

In 1943 we enlarged the scope of our X-ray program to cover all employees both new and old. Regular periodic chest surveys were made, aimed at detecting not only new cases of both tuberculosis and silicosis but also to measure the progression or degree of worsening if any, in those employees who no longer had a normal healthy chest.

Also in 1943, under the guidance of Dr. J. W. G. Hannon, of Washington, Pa. (now Medical Director of the McIntyre Research Foundation) and Dr. Paul G. Bovard, consulting roentgenologist, of Tarentum, Pa., we installed the Aluminum Dust Treatment program. I would like to emphasize at this point, that the Aluminum Treatment program was not inaugurated in our silica plants as a substitute for good industrial housekeeping, but to supplement it. It is point two in a two point program to combat the hazard.

In fact, one of the requirements of the McIntyre Research Foundation is the installation and maintenance of adequate dust control measures; a requirement that even its severest critics recognize as being a significant contribution to industrial hygiene. Dust counts were made (both by State Industrial Hygiene Inspectors and by our own personnel) of our silica works and a concentrated endeavor was made to ferret out all of the locations in each plant that fell below prescribed standards. Dust control equipment and methods were introduced into our production processes with varying degrees of success. This cannot be a "one shot" proposition, however. The program has to be a continuing one or the initial impetus becomes valueless. It can be readily appreciated that there is no easy solution to controlling the dust generated by grinding a raw material containing over 98% free silica to a mesh, in many instances, the fineness of flour. We are constantly endeavoring to keep on top of this problem by the use of new methods and new equipment. Dust control is admittedly expensive, but so too, are silicosis claims.

Let me now talk about what has happened since the installation of the Aluminum Dust Treatment program. In the first place it should be made clear that our Company discounts to a very great extent the reports received in our clinics pertaining to improvements in subjective symptoms. We are more concerned with the prophylatic value of aluminum. That a man, after taking aluminum treatments feels better, sleeps better, eats better, suffers less from dypsnoea, or has gained weight are, it is true, criteria of the therapeutic value of the treatments; but, it is also true that the mind can sometimes be a great healer. Again, however, we have no dispute with the advocates of this thesis, but prefer to endeavor to evaluate results by some more concrete measurable means. I am told that there are at least two such yardsticks; X-rays and apparatus that measure the percentage of the lungs vital capacity. I must confess that I have had no experience with lung capacity apparatus, and know very little about it. Up to now at least, we have based our conclusions of the effectiveness of aluminum dust treatments solely on annual survey X-rays.

registered nurses, under the supervision of the Company doctor; at the third plant, up until this year, the X-rays were made at a nearby hospital. The pre-employment and annual survey films from the two plants that take their own X-rays are sent to the same roentgenologist; the films for the third plant, taken at the hospital are read by the hospital's roentgenologist. The resultant classification nomenclature has made it difficult from a comparison standpoint. For this reason we have recently purchased our own equipment at the third plant and will soon be able to process the films from this plant in an identical manner with the other two plants—one man will, in the future, interpret all of our films, both pre-employments and surveys.

The data contained in the balance of this presentation was compiled beginning in 1949 (six years after the installation of the Aluminum Dust Treatment program). It is factual and as unbiased as we could possibly make it. It covers an average of 1150 employees in three plants from 1949-1951. The first observation that we made was the ratio of progressions at the three plants.

RATIO OF EMPLOYEE PROGRESSIONS*

* (Progression means advancing to a worse X-ray classification.)

Plant	1949	1950	1951
A	1 out of 35	1 out of 32	1 out of 158
B	1 " " 28	1 " " 25	1 " " 31
C	1 " " 8	1 " " 11	1 " " 16

These statistics spotlight a wide differential in results obtained from our two-point program of combatting the silicosis hazard. The question naturally arises, "Why should Plant C have from 2 to 10 times as many progressions each year (on a comparable ratio basis, which discounts the difference in numbers of employees) as Plants A and B?" We could rightly be questioned on a number of different criteria about Plant C:

1) Are dust conditions and industrial housekeeping worse at Plant C?
2) Does Plant C have more non-white employees who, as a racial group, are more susceptible to pulmonary diseases, according to medical statistics?
3) Is Plant C in a more crowded and highly industrial area?
4) Is the raw material used at Plant C or the manufacturing process more hazardous?

Taking each question in turn we would have to answer to the best of our knowledge that:

1) We employ the same type of dust collecting equipment at each plant and stress the same methods of dust control at each plant. We feel that the local management at each plant is equally cognizant of the hazard and endeavors to meet the standards of good industrial housekeeping. We are aware, however, of the variables that are inherent to industry, particularly the human element.
2) The ratio of non-white employees to white is considerably lower at Plant C but is in conformity to the existing population ratio in the community. Plant A has approximately 75% non-white employees and Plant B has approximately 53% non-white employees.
3) Plant C is in a rural community of less than 5,000 inhabitants with very few industries. Almost 50% of the employees live outside the borough limits in the farm areas. By way of contrast, Plants A and B are both located in large, highly industrialized areas. The employees are drawn, in most instances from concentrated population areas in metropolitan districts.
4) The raw material at all three plants contains over 98% free silica and the manufacturing processes are practically identical.

If the above four points covering 1) standard dust control methods and practices, 2) types of employees, 3) location of plants and 4) materials and processing were not responsible for the wide variation in numbers of X-ray progressions, we knew that we would have to search further for an answer. We proceeded then to examine the degree of participation of each plant in the Aluminum Treatment program and the following facts came to light:

Plant	Average Treatment Per Employee		
	1949	1950	1951
A	11	16	19
B	9	18	19
C	2	8	5

It is to be noted from the two preceding sets of statistics that in each instance the greater ratio of progression per employee took place at Plant C, where the least average number of treatments per employee were administered. Another interesting observation made from the data compiled over this period was the fact that 73% of the employees who progressed into a worse X-ray classification had failed to take treatments.

In our endeavor to overcome the non-acceptance of the Aluminum Dust Treatment program at Plant C we were (and are) confronted with a difficult but interesting situation:

We met with our local union officers and explained our problem; solicited their support in gaining a greater acceptance of the program—this showed no appreciable result.

Again, we met with our union officers and were invited to address the membership at a local union meeting. The invitation was accepted. Representatives of our Company along with our consulting roentgenologist talked to the membership, stressing the importance of greater acceptance of the program. For several months afterwards we continued to receive reports that the personal physicians of our employees were advising them not to submit to aluminum treatments. Whether true or not, over 50% of the employees who were merely apathetic to the program, now made outright refusals to participate.

Our next move was to write a personal letter to each member of the County Medical Society requesting an opport-

but was also a community problem. This resulted in an invitation from the Medical Society to our Company representatives to address them at one of their regular monthly meetings. Needless to say, we eagerly accepted. The theme of our talk, after fully discussing the Aluminum Treatment program, was this—"If you feel that you can recommend this treatment, will you cooperate with us in endeavoring to obtain better participation?" "If you feel that the program is of no benefit, will you refrain from 'knocking' it, in view of the recently published statement by the American Medical Association that 'aluminum is not harmful to the normal and silicotic lung in amounts given for therapy and prophylaxis of silicosis'." We were well pleased with the courteous and interested reception that our presentation received and with the voluntary statements, on the part of several members of the Society, that we could expect their cooperation. Any results from this project will not be noticeable, however, for sometime in the future.

At about this same time our Company took the progressive step of publishing an eight-page booklet entitled "Silicosis—What It Is and How It Can Be Prevented." This booklet was issued to the employees of our three silica works in an endeavor to overcome the seeming apathy regarding silicosis. This booklet is also given to each new employee at the time of his induction, along with a short discussion on the advisability of participating in the program.

As yet, I am sorry to say, we have been unable to observe any increased participation at this works, other than a brief flurry for a few weeks. We certainly are not happy about the situation, but neither have we given up the idea of trying to break down the resistance that we have met with to date. Some of these promotional endeavors may bring results at a later date. In the meantime, we are interested in discovering some new approach that might prove effective.

The following recapitulation of a typical annual progression distribution that we made may be further indication of the lack of participation on the part of Plant C. The distributions are made in the following categories:

A) By X-ray classification:
   - Class 1+—Average healthy chest
   - Class 2 —minimal degree of nodular fibrosis
   - Class 2+—minimal degree of nodular fibrosis—progressive
   - Class 3 —primary silicosis
   - Class 3+—primary silicosis—progressive
   - Class 4 —secondary silicosis

B) By age groups

C) By years of exposure

PROGRESSION DISTRIBUTION FOR 1951

A) By X-ray Classification

Plant	From 1+ to 2	From 1+ to 3	From 1+ to 4	Total
A	0	0	0	0
B	2	0	0	2
C	13	0	1	14
	15	0	1	16

Plant	From 2 to 2+	From 2 to 3	From 2 to 4	Total
A	0	0	0	0
B	5	1	1	7
C	11	1	0	12
	16	2	1	19

Plant	From 3 to3+	From 3 to 4	Total
A	0	2	2
B	2	1	3
C	3	0	3
	5	3	8

B) By Age Groups

Plant	26-30	31-35	36-40	41+	Total
A	0	0	0	2	2
B	1	2	4	5	12
C	3	6	6	14	29
	4	8	10	21	43

C) By Years of Exposure

Plant	5-10	11-15	16-20	21-25	25+	Total
A	0	0	0	1	1	2
B	6	1	2	2	1	12
C	14	7	3	3	2	29
	20	8	5	6	4	43

From these progression distributions, we see that Plant A had no one who was in Class 1 or Class 2 progress beyond these classifications. It had 2 men in Class 3 progress to Class 4, both of them with more than twenty years of exposure.

Plant B had 2 men progress beyond Class 1, 7 men progress beyond Class 2 and 3 men progress beyond Class 3. Six of these 9 men, hired during the war years when we were of necessity accepting new employees who were already in Class 2, had less than 10 years of exposure.

Plant C had 14 men progress beyond Class 1, 12 men progress beyond Class 2 and 3 men progress beyond Class 3. Again, 14 of these men, hired during the period when it was necessary for us to relax our physical standards, had less than 10 years of exposure.

Summing up the progressions of men with less than 20 years of exposure; Plant A had none, Plant B had 9 and Plant C had 24.

CONCLUSIONS

1) We firmly believe that Aluminum Dust Treatments have a real prophylactic value in industries' fight to combat the silicosis hazard.
2) Aluminum Dust Treatments have to be supplemented by constant, positive attention to modern dust control equipment and practices.
3) A continuing program of education that reaches from top management to the common laborer has to be maintained if any preventative program is to be successful.

Questions and Answers

Q. Must you have as much as 98% free silica to have a silicosis hazard?

A. It depends upon whether you are talking legally or medically. I don't feel qualified to speak from a medical standpoint. I think, from a legal standpoint, any time you have any free silica in the air at all, you can be accused of having the hazard, whether your employees contract silicosis or not. You are open to liability as long as they can prove there is at least a hazard. Any time you have any free silica at all, whether it is forty or fifty per cent or less you have a legal hazard.

Q. Does it have to be free silica to constitute a hazard?

A. Yes.

Q. Do chest X-rays always show the presence of silicosis if it is there?

A. Every case of silicosis that we have had where a man has been awarded compensation, the X-ray has shown it.

Q. Could a man have silicosis and it not show up on an X-ray?

A. In every case where a man has received a silicosis award, it has shown up on the X-ray. I think that is one of the reasons they are now talking about Vital Capacity apparatus. It is thought that it might give us more of a clue, more than just an X-ray.

Q. I understand you give these treatments to your employees whether they show any signs of silicosis or not, is that right?

A. Yes, we use it as a preventative. We have a new plant in operation, less than a year, where we started those employees on the treatments immediately.

Q. Do you extend that to your non-silica plants?

A. No.

Q. Can you comment on that subject as to clay plants?

A. I believe there have been claims, and one or two awards, where a person working in a clay plant on various operations that make use of silica sand was able to say, "There is a hazard there."

Q. What thought has been given to making treatments and X-rays a condition of employment?

A. In the 1950 report one of my recommendations was that we endeavor to discuss with the union the necessity of making aluminum treatments and survey X-rays a condition of employment. We have in Plant C the difficulty of getting people to come in for their survey X-ray. In 1951, as an example, only one-third of the people at this plant came in for their annual X-ray so we could determine whether they progressed or not.

Q. Are there any statistics that show in which part of the plant there is the most hazard for silicosis?

A. Yes. We find we have two main spots, our grinding and our burned brick. Strangely enough, in some places the burned brick is more hazardous. The reason is in the burning process silica becomes cristobalite. We find in burned brick departments, and particularly in periodic kilns, these particles under five microns in size become suspended in air and are more readily inhaled.

Q. Is that actually a mechanical condition or a physical condition?

A. It isn't mechanical at all. What happens is that particles of silica get into the lungs and go into solution of silicic acid. Of course aluminum has an opposite electrical charge to silica. They are attracted to each other and the aluminum particles completely coat the particles of silica and prevent the silica from becoming silicic acid. It is similar to coating a lump of sugar with

ACCIDENT PREVENTION AND CONTROL

By Lee B. Hawthorne, Jr.,

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About a month ago the A. P. Green Company received an "Award of Honor" from the National Safety Council in recognition of their 1952 accident experience. As this award is the highest granted by the National Safety Council we were more than a little amazed for last year we had 14 disabling, or lost time, injuries—an improvement over previous years experience but hardly an outstanding record. A little reading of the Safety Council award plan soon revealed why we had received the recognition. The honor award goes to any company with a record of 3,000,000 or more manhours worked without a lost time injury, or to one who shows a vastly improved record both over its own previous years experience and in comparison with the industry's average accident rate. We fell in the latter category; receiving the award partly because of our own improved accident rates, but mainly because the average rates for the entire brick and tile industry were so poor. As a result our frequency rate was 78% and our severity rate 41% better than the industry par computed by the National Safety Council.

I bring up this award business, not so much because we are proud of it (of course we are!), but to show how low the industry rates in accident prevention. The latest National Safety Council figures available are for the year 1951. In that year, of about 41 industry classifications listed, only two had higher frequency rates than the Brick & Tile Industry. The lumber and coal mining industries were the two with higher frequency records. Nor is this poor industry showing confined to National Safety Council records. The Bureau of Labor Statistics shows the 1952 frequency rate for the structural clay products industry to be 34 disabling injuries per million manhours worked, while the all industry average was 14. Actually, then, we fall in an industry classification that has more than twice as many disabling injuries as the average company in the United States. Should we be concerned, and, if we are, can we do something about it? I think the answer is "Yes" to both questions.

To check these off in reverse order, it is possible to reduce the number of accidents. No doubt, most of you are aware that analysis of accident causes has shown that 2% of accidents are due to vagaries of nature, such as wind or lightning; 13% are due to mechanical failures; and 85% due to human failures. Most accidents, then, can be prevented. They can be controlled. Other industries have set a good example and many companies in our own industry have established good safety records through formal programs.

No doubt some of you are responsible for good records in your particular plants. Gladding, McBean & Company, for example, has had some excellent records in the past, and Harbison-Walker can point with pride to the results of their accident prevention work. Others of you undoubtedly fit in the same category, but the fact remains that the brick and tile industry as a whole is not safety conscious. We know from our own experience that a definite program reduces accidents. In 1930 we actually had an accident frequency rate of 103. One year later, after an accident prevention program had been set up, our frequency dropped to 22—a 79% decrease in one year. There is no question but that we can control accidents.

As to whether or not we should show concern about our poor record, again, I think the answer is obvious. Actually, industry is becoming more safety conscious year by year. There are three main reasons for this, I think, which I would like to cover briefly: (1) costs, (2) increasing awareness of responsibility for the workers' welfare, and (3) human relations benefits.

There isn't much need to elaborate on this first point. We all realize the tremendous cost in lost time, medical expenses, overhead insurance, production delays, damaged equipment and materials, etc. The National Safety Council estimates a cost of $40 per worker to industry. For example, if a company employs 500 workers, disabling injuries would cost that company $20,000 a year, if it were an average company. As our industry has a frequency rate twice that of the average for all industry, then, the cost of accidents to our fellow members, whose frequency rates are highest, must be terrific.

The second reason, which is assuming ever-increasing importance, is reflected in Justice Brandeis often quoted words, "All business now operates in the public interest." G. A. Price, President of Westinghouse Electric, wrote in Advanced Management, "To survive corporations must carry in ever-increasing amounts what economists call the 'social burden of non-economic enterprises'." Henry Ford II recognized this trend in 1946 when he said, "We have not yet solved the problems of mass production, for our failure in human engineering is creating waste and inefficiency which handicap the very purpose of mass production." Recognition of the human factor, human engineering, human maintenance, then, has become vital to industry. Awareness of responsibility for employees' welfare is becoming more widespread every day. One of the duPont Companies in West Virginia, I am told, tells new employees that working safely comes ahead of production, costs, or anything else. Add an aggressive safety program to this policy and you realize why they have completed 8½ years without a single disabling injury and there are approximately 1200 employees in that plant. That company really believes in their responsibility for employee welfare.

This concern for employee welfare runs us right into the third reason for accident prevention emphasis. Companies with good safety records know that the success of their programs is due primarily to the good relations between their supervisors and workmen. Sincere interest in an employee's welfare develops this relationship. As a result the communication line so necessary for the successful operation of all phases of business is opened up. A recent article in the Cement & Quarry newsletter developed the theme that a new supervisor, well versed in the administration of a good safety program, will gain the respect and confidence of his employees more quickly than the supervisor who is not so concerned.

(3) medical, (4) occupational disease control, and (5) fire prevention and control.

Of these, the first is probably most important. Our experience shows that 80% of our accidents, as we classify them, occur as a result of the injured employee's carelessness. The remainder result from the carelessness of fellow workmen and unsafe conditions. This, then, is the toughest nut to crack.

Naturally, our entire program is designed to create individual safety-mindedness or, to put it another way, develop a subconscious safety attitude. We have heard a lot about the effect Russian propaganda has on the peoples of that country. Through constant reiteration, for example, they actually believe that all Americans are monsters. Over there a lie repeated often enough becomes stamped in peoples subconsciousness. It becomes a fact and influences their every reaction. We shoot for the same thing in our program only we are dealing with true facts and not propaganda. For example, talk about, demonstrate, show pictures, etc., of the proper way to lift heavy objects often enough for it to soak into their subconscious mind and eventually it will become habit to lift correctly whether at work or at home. Working on this theory, then, we try to develop safe attitudes through an educational program which covers: (1) monthly meetings on company time led by the unit supervisor, (2) bulletin board poster and publicity, (3) accident investigation followed by publication of facts, (4) orientation of new employees, (5) suggestion plan and slogan contest, (6) safety parties for units completing a safe year.

The second portion of our program falls under the general heading of working conditions. I'll include under this category (1) machine guards, (2) preventive maintenance program, (3) good housekeeping, (4) protective clothing and equipment—prescription goggles, safety shoes, respirators, asbestos suits coated with aluminum foil, etc.

Our medical service is the third and one of the most important parts of our program: (1) all supervisors are graduates of a Red Cross first aid course, all other employees are encouraged to attend these classes (we feel that every participant in a first aid course immediately becomes more safety conscious), (2) a dispensary with nurse and doctor available, (3) first aid cabinets in each department for minor injuries, (4) emergency first aid stations for major injuries.

Under occupational disease control, dust is, of course, our chief problem. Our program includes (1) dust collection and elimination, (2) dust counts, (3) aluminum therapy, (4) periodic X-rays of exposed personnel.

Then tied into our safety program, but actually separate, is fire prevention and control. This program covers (1) constant maintenance of fire fighting equipment, (2) fire stations with hose reels in startegic locations, (3) supervisors and leadmen trained in the use of fire fighting equipment, (4) each employee taught the location and use of the fire extinguishers in his working area, (5) periodic inspections.

This program as outlined would become static without the continued interest of all levels of management or without a change of pace or variety in the handling of the program to keep it interesting. We are constantly seeking ways to improve it so as to keep accident prevention and control a fresh and rewarding part of our operations.

If we can gain the cooperation and confidence of our employees, discharge our responsibilities to the community by providing a safe place to work, and reduce the costs arising from accidents, we feel amply repaid. The success of this program depends to a great deal on the initiative and cooperation of the operative supervisors. All employees, however, can enjoy a sense of pride and accomplishment when the company enjoys a safe year.

THE IMPORTANCE OF MATERIAL HANDLING IN MANUFACTURING INDUSTRY

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1. THE SCOPE OF MATERIAL HANDLING IN INDUSTRY

Material handling in manufacturing industry covers all movement and storage of material from the time it enters the plant until it leaves as a finished product. It does not usually embrace the handling of materials in mining, construction, or transportation by public carriers such as railroads, highway trucks, cargo vessels, or cargo planes.

Material handling within the plant may be defined as the transportation and movement of material, whether raw, worked, or finished, on the plant premises.

Each time the material is lifted or laid down, piled or unpiled, loaded or unloaded, transported vertically or horizontally from one position or location to another, fed into or removed from a machine, placed into or removed from storage, or moved in any way whatever, it undergoes a handling.

The line of flow of material in processing a product, when all movements have been measured, runs into several miles in many plants. It is not uncommon to shorten this line of flow by 50 per cent or 75 per cent through better layout. The balance of the handling not eliminated by better layout can then be studied for possibilities of economical mechanization.

The number of times a material unit is handled during the course of a manufacturing cycle varies with each type of unit and with each system of material handling. As many as 150 handlings are given relatively simple units in some plants.

In a representative flow, the material may be handled as follows:

1. Unloaded from a freight car or motor truck.
2. Placed on skids.
3. Moved by fork truck to an inspection point.
4. Unloaded for inspection.
5. Reloaded onto the skid.
6. Lifted by fork truck.