

1951

GENERAL SESSIONS

1951 National Safety Congress

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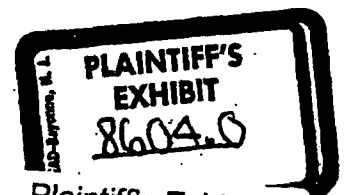
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39th National Safety Congress



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NATIONAL SAFETY COUNCIL
425 No. Michigan Avenue • Chicago 11, Ill.



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As presented in the
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1951

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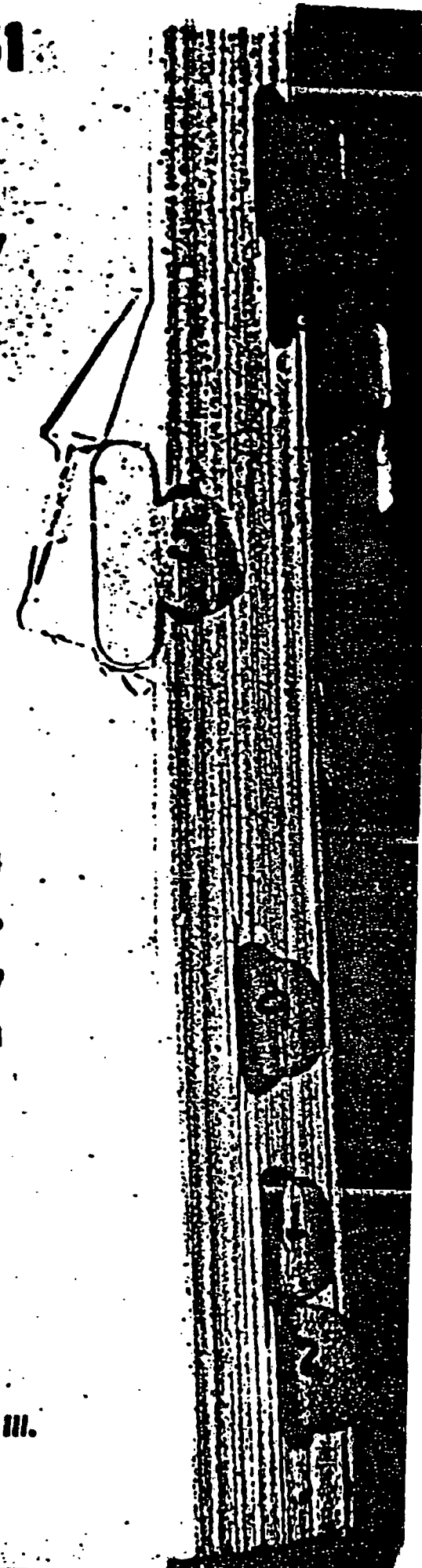
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Industrial Hygiene

Industrial Dusts—What Every Supervisor Should Know

By L. E. HAMLIN, M.D.

Medical Dir., American Brake Shoe Company, Chicago, Ill.

Most manufacturing procedures are capable of generating varying amounts of dust which may be visible, invisible, dangerous or inert. It is therefore important that these substances be properly classified in order to protect the health of employees and provide safe environments in which they may carry on their daily occupations.

Obviously the supervisor should have some knowledge of industrial dusts since the responsibility for enforcing measures instituted for their control usually falls upon his shoulders. Unless he has a good idea of the actual risks confronting him, he will be at a disadvantage in securing cooperation from those under his direction. Ability to answer questions concerning plant hazards in a convincing manner is a very important factor in any dust control program, and if the supervisor cannot explain the necessity of avoiding exposure to toxic materials the worker under his charge is very unlikely to pay attention to it.

On the other hand, a brief explanation that carries the ring of sincerity and truth can frequently correct unnecessary misunderstanding. For example, a capable young employee was worried about contracting silicosis because he worked in a plant where at times there appeared to be considerable dust in the atmosphere. He did not know that this dust was free from silica or other harmful ingredient, but his foreman did.

Knowledge of his own department enabled the supervisor to convince the workman that not only was the dust inert but also plans were under way for the installation of new ventilating equipment which would remove the particles that were already present. The man was satisfied and the company was able to retain the services of a good employee.

What then are some of the fundamental things a supervisor should know about in-

dustrial dusts? Dust is formed by reducing earthy materials to small size. Processes like grinding, crushing, blasting, and drilling produce dust particles of sizes from the sub-microscopic to the visible.

Fumes are formed from combustion, sublimation and condensation. Those from burning or melting lead or zinc are typical examples. The size of the particles is generally below one micron. (A micron is 1/25,000th of an inch.)

Smoke is usually of organic origin from such things as burning tobacco, wood, oil or coal. The particle size is usually below a half micron.

Mists or fogs are formed by condensation of water vapor and the particle or droplet size varies widely.

The most important item to the supervisor is the realization that he may be dealing with a dust which can produce bodily harm. His first consideration should be "How is the man himself affected? Is the dust present in sufficient amounts in the air to be a source of danger? Does it exist in the pure state or is it mixed with other dusts? What is the actual count of particles per cubic foot of air, and what percentage of these is of respirable size (below 10 microns and especially those below three microns? How long does it take to develop occupational disease of the lungs from exposure to dust?"

All this may appear to be outside the scope of the supervisor's activities since after all his job is concerned primarily with production. However, most industries place the responsibility for carrying out safety measures on the foreman and it is apparent that his department will suffer if these are not properly enforced. Safety therefore includes precautions against occupational disease as well as accidents so that some knowledge of methods for controlling exposure from dangerous dusts, toxic fumes or other

safety in steel warehousing where the variety of sizes, types, grades and finishes of the steel carried in regular inventory is particularly great.

Problem number four was the employee's mental attitude in relation to the work pattern of the industry. The high degree of

flexibility in daily job assignments, bringing about a constant change in duties and industrial environment, demands a general safety knowledge of the warehouse operation. This is difficult to establish except through experience gained during an extended employment period.

The Use of Wetting Agents to Control Dust in Industries

By G. A. MAU

Vice Pres., Johnson March Corp., Philadelphia, Pa.

Within the past two decades chemists have developed materials with properties similar to soap but without the limitations, resulting in a large number of compounds with remarkable physical properties. The behavior of these materials has suggested their use in a wide variety of industrial fields.

These materials are known as Surface Active Agents since their primary effect is at the boundaries or surfaces between two phases.

Reduction of interfacial tension, lowering of surface tension, increase of wetting power, deflocculation and emulsification are some of the results of this activity. The synthetic surface active agents first came into use in this country about 1930. In the few years since their introduction, they have become numerous and varied, and have found many uses in diverse fields. The surface active agents can be subdivided into five groups. Wetting agents, penetrating agents, dispersing agents, emulsifying agents and foaming agents.

Reference will be directed particularly to the first and second groups. Namely, wetting agents; producing increased wetting or spreading of an aqueous solution or suspension over a repellent surface and the second group, penetrating agents, providing more rapid passage of a liquid into a porous solid.

With the above brief discussion on surface active agents, or as I will refer to them from now on as wetting agents or compound, I intend to discuss the use of wetting agents to control dust in industry and particularly, the foundry.

I like the popular definition of a wetting agent, which merely states that a wetting agent added to water makes it wetter. Perhaps, we should state for the purpose of keeping the chemical terminology straight, that a wetting agent is a material which, when added to water, or to any other liquid, will cause considerable reduction in surface tension. Safety and health have been benefited by the use of wetting compounds in many industries. Safety—in providing better visibility around plant and equipment, health by preventing the absorption or inhalation of dust.

Dusts, whether toxic or not, are harmful and an attempt to group dusts under the headings "active" and "inert" (with reference to effect on health) has proved unsatisfactory. Investigations have proven that practically all dusts may be harmful if breathed in large amounts over long periods.

In this country, dust diseases usually designated as "silicosis" is more or less common among workers in the mining, grinding, granite and foundry industries. According to Lanza and Vane, the estimated number of men exposed to Silica-Bearing Dust in various industries are as follows:

Process	Percentage of All Employees	Number Exposed
Metal mining	100	62,000
Anthracite coal mining	20	30,000
Quarrying of granite, gneiss, sandstone, etc.	100	22,000
Smelting & refining	100	18,000
Foundry workers	100	200,000
Potteries, glass works, stone products ..	50	70,000
Grinders, buffers, sand blasters, vitreous enamellers		62,000
Estimated total for mining, quarrying and manufacturing industries.		490,000

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In addition to these there are "thousands of workmen who have been exposed to silica dust in these various occupations and are now engaged in other forms of work."

In order that we may better understand the purpose of this discussion on wetting agents for dust control it will be necessary to discuss the dangerous dust particle size and the wetting effect of saw water compared to wet water with the proper surface tension and group combination.

Not all of the particles of inhaled dust gain access or are retained by the human lungs. For these reasons, the size of the dust present in the industrial atmosphere should be determined.

Investigations have proven that particles greater than 10 microns in longest dimension are very seldom found in the lungs, and that the particle size found most commonly in lungs were three to five microns. Due to gravity which causes rapid settling of suspensions and due to the protective action of the mucous surfaces of the upper respiratory tract, the larger particles do not penetrate to the terminal portions of the lungs.

Therefore, it is obvious that attention should be given chiefly to those particles which are less than 10 microns in longest dimension and which can enter the lungs.

This group particle size is very difficult to wet, and requires not only a low surface tension liquid but a fine atomizing spray nozzle. Dust control by wetting depends for its effectiveness upon the fact that, once the dust has been trapped in water or some other liquid, the particles are not easily dispersed again in the air, until proper disposal has been made.

Dust control by wet methods is attractive from the standpoint of cost but has not been highly successful in certain industries, with raw water. Many articles have been written quoting not too good results in such applications as grinding wheels, rock drilling, mining, etc.

Dust control with water is better than no wetting at all, but would not reduce the dust count sufficiently to be safe, and in the case of some dusts, could not be wetted at all, especially the sizes 10 microns or less.

To obtain better wetting, experimentation led to the use of wetting agents.

The physics of wetting is not entirely un-

derstood. The phenomenon is basically one of adsorption since a film of liquid must be adsorbed upon the solid before wetting can occur. A liquid will spread on a solid if the surface tension of the latter is greater than the sum of the interfacial tension between the solid and liquid and the surface tension of the liquid.

Therefore, the wetting power of a liquid increases with a decrease in its surface tension. Many dusts are wetted only with great difficulty because of the presence of another film already absorbed on the surface. This film might be adsorbed air, which occurs in a dust cloud. Then wetting will not take place unless the spreading force of the liquid is great enough to drive off the air layer.

A wetting agent or compound of surface active agent groups will in most cases furnish the spreading force of the liquid to drive off the air layer and wet the dust.

Time will not permit a discussion of other than the high points of dust control in the foundry industry.

About three years ago, I was handed some foundry dust that was collected around the miller, and asked whether it could be wetted with a wetting agent. Much to my surprise, it was a combination of foundry dusts that did not respond to water or any single type of group of wetting agents known at that time. We finally found a compound of surface active agents that would actively wet this dust. Dusts difficult to wet can be wetted if the proper wetting compound is used and the application correct. One without the other will not work.

So far we have touched on a discussion of the types of wetting agents, that a liquid with low surface tension is best for wetting, providing the dust and liquid are compatible, that the size dust particle we should be most interested in is three to five microns or generally particle size less than 10 microns. This size compares to fog particle sizes.

The efficiency of wet dust control is dependent upon the degree to which the particles are wetted. Important factors that determine wettability of dusts are the proper wetting compound and the application of the proper particle size spray solution with nozzles designed for the application and spray pressures to create proper spray droplet size and pattern.

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Another big factor for efficient wet dust control is the selection of proper type nozzles. It is common practice to employ "a nozzle" whether a solid or hollow cone or flat sheet spray. No matter how efficient the wetting compound may be, if the proper nozzle with proper spray pattern and angle are not at the right location, results cannot be obtained.

The methods usually employed to obtain fine atomization are high pump pressures, liquid with air misting nozzles and very low capacity nozzles.

High pressures are not desirable for dust wetting. The high pressure spray causes the dust to disperse beyond the spray area.

Liquid air misting nozzles are very satisfactory for spraying areas 10-20 ft. from the nozzles. A very fine fog or mist spray can be obtained with these nozzles provided sufficient nozzles are used for the spray pattern. These nozzles are recommended for top spraying of shakeouts, sand conditioning, crane shakeout, etc.

Low capacity nozzles can be grouped and used on medium pressures (40-70 psi) to obtain fine particle atomization, for close proximity dust concentrations near equipment or conveyor transfer points, etc. These nozzles are now available in capacities of 2 to 24 gallons per hour.

Most wetting agents are shipped in concentrated form and require dilution when used for spraying. Efficient, durable, automatic proportioning equipment is required for successful wet dust control. Proportioners meeting these conditions over a period of years are now available.

Wetting Compounds are of great benefit to foundries, not only for dust control but for such things as fire fighting, core knock-out, cleaning castings, core wash, reconditioning the moulding sand, cupola smoke control, sand tempering, etc.

Dust control at crane and machine shakeouts, mullers, floors, sand conditioning, grinding and cleaning departments are the areas where foundries have proven wetting compounds very successful.

The application of wetting compounds on foundry floors or walks, prevents dust arising when rolling equipment or men travel over them. It keeps the floating dust particles from becoming airborne. For general use, where the sand is accumulating over

large areas and is not regularly removed, wetting compounds are infinitely more effective than spraying with water.

Plain water wets the surfaces of the floor sand, causing mud, or may run to lower levels causing puddles and excess surface moisture in spots.

Because very little penetration takes place air currents absorb the moisture rapidly, allowing the sand to dry and become dusty shortly after the water application.

When applying wetting compounds to the floor a flat cutting spray nozzle has been found most effective.

Wetting compounds permit the wetting of floors in the melting and pouring areas because of quick deep penetration of the moisture in the sand and much less possibility that sand near the surface will be wet enough to cause spattering of metal. Penetration with water is difficult and evaporates quickly.

Crane shake out of castings usually involve large areas in the main bays of many foundries. While the shakeout periods might be confined to night or early morning hours, when few employees are in the area, most of the foundry becomes contaminated with airborne dust that is easily vibrated loose from the building structure and equipment when the full force of workmen are at work. A fine atomized solid cone spray applied from nozzles attached to the crane bridge over the shakeout area has been used successfully at a foundry.

At another foundry, a special portable stand was built with the fog air misting nozzles, which, is placed in a position at opposite sides of the working which might be 25 feet or more in diameter. This type nozzle is also used for spraying over the shakeout table.

The fog air misting nozzle is used successfully to supplement exhaust systems on shakeout machines. If the table is large and the dust is not being properly exhausted, the air fog misting nozzle has successfully controlled the dust in areas not exhausted. It might be over the ends of extra large work extending over the table, or due to sand not leaving underneath the shakeout fast enough.

The amount of dust produced by sand conditioning equipment is influenced largely by whether the sand is hand-dry or moist. The sand should be moistened with wetting

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compounds to eliminate dust before processing.

Wherever sand is thrown from conditioning machines, direct pressure nozzles with capacities considerably larger than the average dust nozzles are recommended. This nozzle must have a fine atomized spray because wetting of the sand is necessary to properly control the atmospheric dust. Dependent upon bin capacity, we also recommend for large bins air fog misting nozzles over the storage area to control the dust and to revive the treatment in the event the sand stands long enough to become dry and dusty.

Wetting compounds are being successfully used to control dust arising during ship at hand loading of miller operations, which are not exhausted. Small capacity nozzles mounted over the miller bowl will wet the floating dust particles with very little or controlled moisture. If tempering of sand is required, the wetting agent is introduced in the water line.

Core knockouts may produce even greater

variations in dustiness than shakcoats. Pneumatic chipping on large or small, irregularly shaped castings disperses enormous amounts of dust. Wetting compounds are effective in softening cores, making them dustless and much easier to remove from the castings.

There are many other applications for wetting compounds to control foundry dust, and there are certainly many more uses, such as tempering and penetrating agents. The few applications mentioned are merely to show the possibilities.

I trust I have explained: 1. The purpose of wetting agents, that practically any dust can be controlled with the proper wetting compound. 2. That dust particle sizes of three to five microns or sizes less than 10 microns require low surface tension liquids compatible with the dust. 3. That a wetting compound must be atomized to fine micron size droplets for dust control. 4. That correct nozzles for tempering and general wetting, and fool-proof equipment are necessary, automatic proportioning and nozzle control to make wet dust control a success.

The Administration of Safety Programs

By A. C. BECKSTEAD

Dir., Safety and Technical Employment, American Smelting and Refining Co., Salt Lake City, Utah

In order to properly administer a safety program, it is first necessary to establish the proper organization. This organization must have the support of all individuals in the company from the chairman of the board and president to the newest pay roll employee.

Second, a definite safety policy must be formulated by all levels of management in conjunction with all members of the safety organization. This policy should be flexible enough to meet changing conditions and emergencies without causing confusion or trouble.

Third, it is necessary that the importance and proper emphasis to safety be recognized by all levels of management and by every employee in the company including employees just being hired.

Fourth, a definite follow-up and check system through reports and on-the-spot in-

spection should be conducted constantly to follow the progress of the safety program and to prevent bad practices from developing and enlarging.

Fifth, individual plant safety departments must be provided with trained personnel and provided with the authority and equipment to do the job expected.

The following outlines the organization for the administration of a safety program as it is presently set up in the American Smelting and Refining Company. Here, safety is recognized with the same importance as production by all levels of management.

The committee on safety and technical employment is composed of the top executives of the company including the chairman of the board, the president, the operating vice presidents, and representatives from the financial and legal departments. The direc-

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1951

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