MICHIGAN'S occupational health

VOL. 4, NO. 3 MICHIGAN DEPARTMENT OF HEALTH Albert E. Heustis, M.D., Commissioner SPRING, 1959

Health Hazards in Construction

Workers on the Mackinac Bridge, one of the newest and most spectacular construction projects in Michigan, were hospitalized with lead poisoning, one of the oldest and least spectacular occupational health problems.

A workman, finishing a floor in the basement of a house under construction, was overcome by carbon monoxide gas from a gasoline powered trowel, an unspectacular case, but typical of the growing number of carbon monoxide poisonings in Michigan.

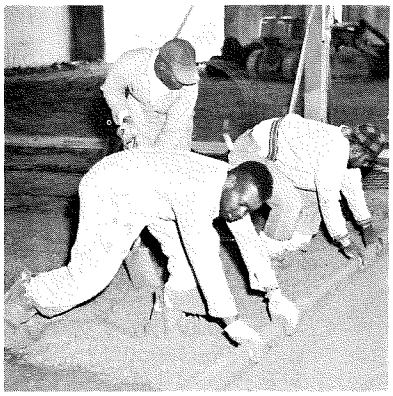


Figure 1. Cement workers, clad in boots, coveralls and gloves, keep out of contact with wet concrete.

The link between these two widely separated, on-the-job health problems is the Division of Occupational Health, Michigan Department of Health. Each year the Division investigates either on request or on its own initiative, potential health hazards on hundreds of construction jobs. Recommendations may range from a suggestion for a minor change in method or material to the design for a complete ventilation system to protect workmen in an oxygen-deficient atmosphere.

The 100,000 men employed in the construction industry in Michigan daily face occupational health hazards, which if they were not controlled, could lead to illness, delay schedules and cause financial loss for employees and employer alike.

Division engineers try to anticipate where there are likely to be health hazards in construction, but the infinite variety of health problems which could be present in the multitude of construction jobs makes it necessary that contractors cooperate by calling for help when they suspect that a particular job could involve hazards to health.

When it is apparent that a construction job, by its very nature, is bound to involve health hazards, staff members take the initiative and call on the contractors before hazards have a chance to become acute.

Mackinac Bridge

However, it is not enough to set up procedures. Employees must follow health regulations or disaster can re-

Figure 2. One of the worst cases of cement dermatitis observed in Michigan. Victim allowed wet concrete to spill on his legs and remain in contact with skin. These painful burns required hospitalization.

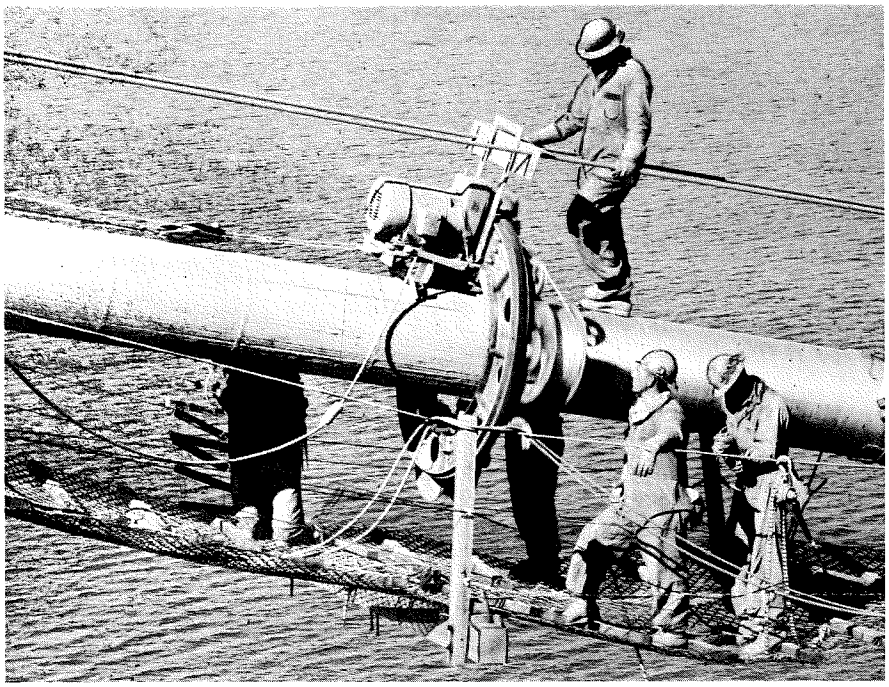


Figure 3. In color, this picture would show the portion of the cable left of the wrapping machine as a brilliant orange-red. Workers' coveralls were also bright red with red lead paste, which they were daubing into the voids between the strands of the cable. Four of the eight workers on this phase of the Mackinac Bridge construction were hospitalized with lead poisoning.—Photo courtesy Mackinac Bridge Authority.

sult. An example of what can happen when an employee fails to follow health regulations occurred during the Mackinac Bridge project. The engineer had visited the project and checked on what was to be done to protect the health of underwater divers. All were experienced men and the engineer found that diving was according to Navy regulations, which the Division takes as its minimum standards. Both the contractor and the divers were advised of the necessity of following the time limits and decompression schedules for the various depths in which work would be done on the bridge foundation.

One diver, in spite of warnings from the attendants on the service barge, remained under water for longer than the maximum limits for the depth. He failed to follow the recommended time limits for ascending to the surface, choosing to "blow" out of the water rapidly by inflating his diving suit. He was rushed to the decompression chamber located on another barge a few minutes away, but suffered "bends" enroute. He died hours later while undergoing decompression. Other divers on the project followed recommended health procedures and no additional injuries were reported.

Another group of workmen, who daubed red lead paste into the voids between cable strands on the suspension cables of the bridge, failed to follow health recommendations for protecting themselves against lead poisoning. Of the eight men on this particular job, four suffered lead poisoning because they violated some basic lead handling techniques. Each man was equipped with protective gloves and overalls, but apparently the four allowed their clothes to become soaked with red lead, smoked with lead contaminated hands, and allowed lead to collect on their faces. A picture in a national magazine shows the workers, wearing brilliant orange-red coveralls, silhouetted against the bright blue water. One man is smoking.

It is interesting to note that four of the eight men who worked side by side on the project suffered lead poisoning, while the other four, some of whom had more time on the job, had no sign of lead poisoning. This group apparently followed all recommended health procedures. And experience is no real teacher. One of the men who suffered lead poisoning while working on the suspension cable, later on contracted the same disease while spray painting inside one of the towers.

Scraping Red Lead

Another of the cases of lead poisoning was discovered when an employee of a painting contractor was hospitalized with an undiagnosed ailment. When a fellow worker offered a blood transfusion, a routine check of his blood showed damage to his blood cells. The physician asked the nature of the job they were doing and found out that the men were scraping leaded paint from the inside of a large, elevated water tank. Both hand and mechanical scraping was being done

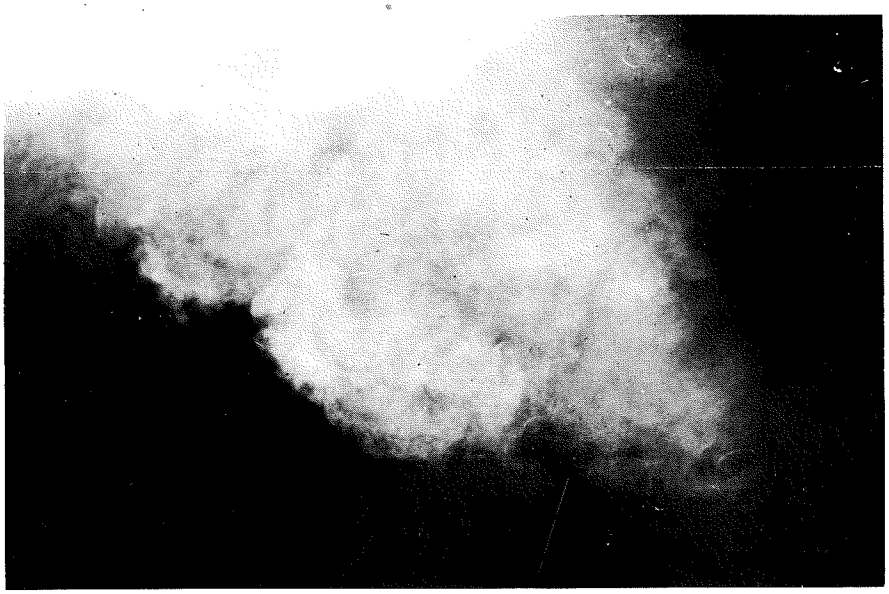


Figure 4. Beam of light illuminates a cloud of dust raised during scraping operation inside a water tank. Workers who prepared the interior of this tank for painting were exposed to dust containing 57 per cent lead.

and no precautions were being taken to protect the health of the workers. A check on the blood of the hospitalized man showed he had lead poisoning. Division engineers showed the contractor how to scrape and repaint tanks without endangering his employees.

Lead poisoning has been a well-known industrial hazard since man has used this versatile metal. But there are materials coming into use in construction so new that they require special skill to determine just when and under what circumstances a health hazard can be present.

New Materials

One of these new materials is foamed-in-place polyurethane plastic used as an insulation material. The diisocyanate compound used with urethane to make the plastic foam is extremely poisonous. No contractor should start using this material unless control measures have been taken to insure that the concentration of diisocyanate in the air is low enough to prevent damaging workers' health. This may require the taking of air samples during the work as one of the checks of the adequacy of controls. The material is so toxic that it must be controlled to less than one-fourth the least amount detectable by the nose, a measurement which must necessarily be taken with air sampling equipment.

As this material is further developed for construction, air supplied respirators and positive ventilation will probably be recommended by the Division for most applications.

Other well known insulating materials can cause health problems. Glass fibers, in particular, can cause dermatitis, or glass itch. Others can cause allergies.

Adhesives

One of the problems of handling rigid types of insulation is the health hazard which may be present in the adhesive used to fasten the material in place. Adhesives pose two problems—internal damage from solvents and dermatitis from solvents or other material in the adhesive. Adequate ventilation will prevent the first, and the second can usually be avoided if workers keep the adhesive off their skin by wearing gloves, using protective hand creams, and by washing or using hand cleaners frequently.

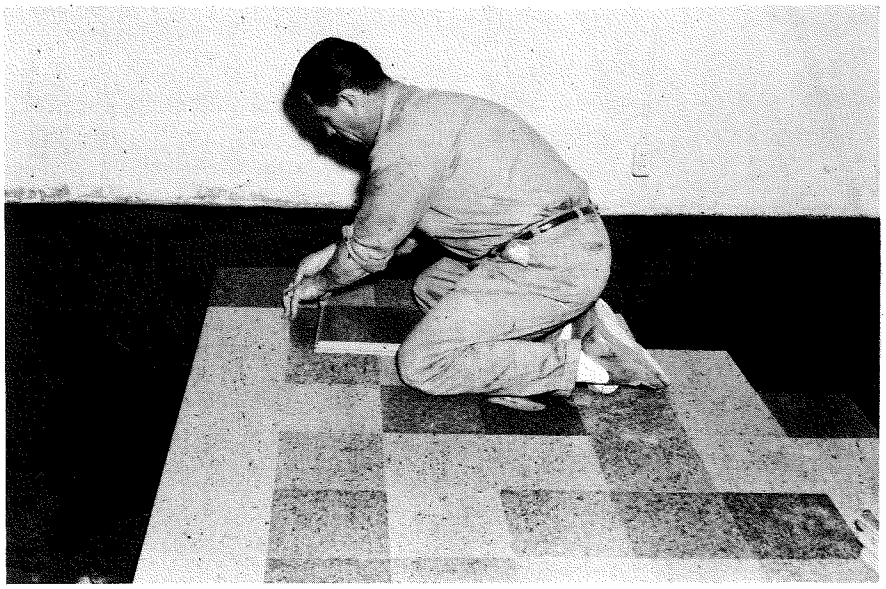


Figure 5. Solvent vapors from certain mastics used to lay asphalt tile could pose a serious health and fire hazard if adequate ventilation is not provided.

Recently an investigation was requested at a construction job where workers installing insulation were becoming ill. The job involved cementing the rigid insulation on large wall areas, using an organic solvent based adhesive. Solvent vapors were quickly recognized by the engineer as the probable culprit. Upon measurement, it was found that the vapor level was not only high enough to account for the illness, it was high enough to cause an explosion. The engineer arranged for proper ventilation immediately. The ventilation ended the complaints of illness from the workers and probably prevented a serious explosion.

Cement and Concrete

Cement and concrete, basic to nearly every construction project, present problems with dermatitis (skin rash) well known to experienced cement workers. Cement reacts on the skin just the way that would be expected of any strong alkaline solution. The amount of cement, water and length of time the mixture is in contact with the skin determines the amount of damage that will be caused.

To keep cement and concrete from harming the skin, keep it off the skin. Workers, especially cement finishers, should keep out of wet concrete. Clothes should be kept dry, hands should be protected by dry gloves or a protective cream, and all concrete spilled on the skin should be washed off immediately. Hands are most often affected by cement dermatitis because they most often get in the mixture, but it is not uncommon to find cement dermatitis on the knees from kneeling in wet concrete. In fact, it can be found on any part of the body on which wet concrete can spill.

Dry cement, at times, may be a nuisance. If workers loading or unloading cement are bothered by the

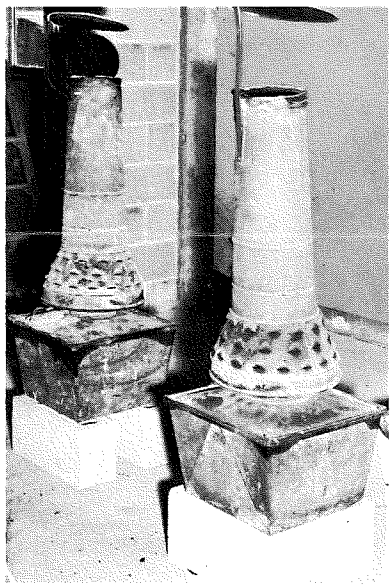


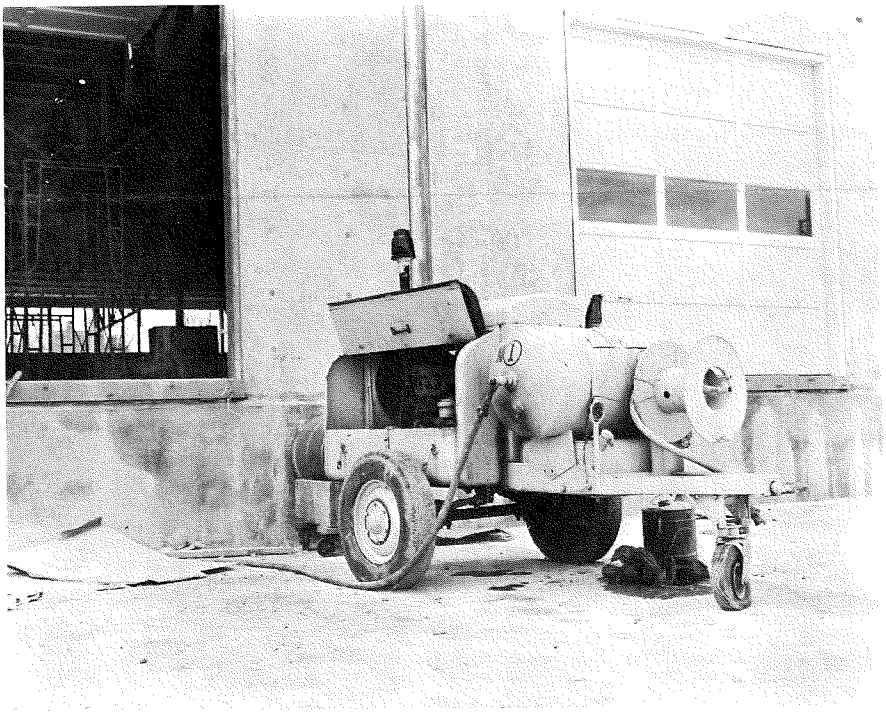
Figure 6. Not visitors from outer space, but potential sources of trouble are these unvented devices for producing temporary heat. Salamanders such as these should never be used in unventilated areas.

dust, a nuisance dust type respirator may be the answer. (See Michigan's Occupational Health, Winter 1958.)

Many construction jobs can be continued right through Michigan winters, but not without some additional problems. Temporary heat is one of the most important and is not confined in this climate to winter work. All commonly used fuels give off carbon monoxide when they are burned. CO is the cause of 46 per cent of the deaths from accidental poisonings in Michigan.

Figure 7. This steam cleaning device produces steam by burning kerosene. The unvented burner could produce sufficient quantities of carbon monoxide to seriously affect the worker's health, if it is operated in an unventilated area. As a rule, no machine which burns fuel should be operated unless positive ventilation is provided.

Figure 8. The compressor here is properly located outside of the building and the carbon monoxide hazard is minimized. The steam cleaner shown above could also have been operated out of doors with only the hose and steam brought inside the building.



For example, two workmen lighted an unvented charcoal fire in the basement of the house where they were working. As could be expected, they were overcome by carbon monoxide. Charcoal fires in unvented grills are also becoming problems in homes. Backyard chefs tempt fate when they move their unvented grills into houses, reports reveal.

The Division is concerned about the number of portable, oil fired heaters for construction projects now on the market. Many of these are represented as not needing a flue or vent to the outside.

Dirty, improperly adjusted burners on many of these devices are highly efficient producers of carbon monoxide. Because carbon monoxide cannot be detected without special equipment, headaches and other illnesses are seldom blamed on heating equipment unless there is also an odor nuisance. Gas detection equipment is not found on the usual construction job, although such equipment is available. Good practice dictates that all temporary heating devices must be vented to the outside.

Gasoline Engines

While the dangers of running an automobile in a closed garage are known to many, the same danger in regard to other gasoline powered motors is not nearly so often recognized. A report indicates that the illness and nausea suffered by a worker operating a gasoline powered cement finishing machine in a new basement was caused by carbon monoxide. Luckily for him, getting to fresh air brought about his recovery.

Gasoline powered engines have been real labor and man saving devices in the construction industry. Pumps, welding generators, self-propelled wheelbarrows, tampers, compressors and even ventilating fans are a few of the many pieces of equipment powered by small gasoline motors. Most of these tools are provided with thoughtful instructions which warn against their operation in poorly ventilated areas. But assuming that these instructions remain with the tool and remain readable, what is adequate ventilation? Opening windows should help, but how

many windows? Where? For how long? Will wind direction matter? All are questions which have to be weighed for each case. Too often the decision on adequacy errs on the side of danger.

For instance, in the case of the cement finisher working in the basement, a window and stairwell were both open, but still he was overcome by carbon monoxide. As a rule, gasoline powered equipment should not be operated indoors unless provision is made to vent the exhaust to the outside or a positive source of ventilation is provided. The Division of Occupational Health can be called on for assistance in recommending ventilation in cases where gasoline powered equipment must be operated in confined areas. Each case is usually a unique problem in itself.

Carbon Tetrachloride

Recently, an engineer was asked to discuss carbon tetrachloride hazards with an electrical contractor who was concerned about the use of the poisonous fluid to clean electrical contacts before soldering. He advised him to use another solvent.

The use of carbon tetrachloride by persons ignorant of its extreme toxicity is a recurrent problem. Intoxication from breathing carbon tetrachloride vapor has brought on death, even though exposure was not particularly large. In even relatively small concentrations, carbon tetrachloride can cause serious damage to internal organs. The usual means of overexposure is inhalation of vapors, but it can also be absorbed through the skin and if swallowed, is a powerful poison.

In the presence of sufficient heat, carbon tetrachloride breaks down to even more hazardous compounds. This increases the hazard of using carbon tetrachloride-type fire extinguishers indoors. A measure of the extreme toxicity of this fluid was highlighted recently when three separate incidents of illness resulted from using carbon tetrachloride extinguishers out of doors to put out fires in the engines of motor vehicles.

No matter the intended use, there is a better and less hazardous substance available. A list of these materials is available upon request from the Division. However, all degreasing solvents require caution in their use. Ventilation may be required. Division engi-

Figure 9. Degreasing parts in maintenance poses several health hazards in this shop. Carbon tetrachloride, used as degreasing agent, is highly toxic when inhaled and can be absorbed through the skin. Gasoline, seen in cans in background, could be ignited by spark from grinder. Engine on bench will produce carbon monoxide.

Figure 10. Equipment that is portable and easily operated and maintained is available to test manholes and other underground areas for gas before entering. It should be used.

neers are available to discuss methods of ventilating particular jobs.

Underground Work

Every year, several workers in Michigan are overcome and die in sewers and tunnels. Methane, hydrogen sulphide, carbon dioxide and carbon monoxide are often found in sewers, tunnels and other underground locations. Gasoline vapors, although usually recognized immediately, have also been known to seep into underground work areas. One Michigan utility, as a matter of routine, requires testing for gas before any manhole is entered. Recently, the procedure was tightened to require testing for gas before the cover is lifted. Equipment that is portable and easily operated and maintained is available. It should be used.

Lack of oxygen has been blamed for some incidents in underground areas which may well have been caused by an excess of carbon dioxide. In the absence of tests, workers should view with alarm any shortening of breath or increased breathing rate and get out of the hole and stay out until tests can be run for gases. If testing equipment is purchased, it should be kept on the job, not 80 miles away as the Division discovered on one job recently.

Rescue Equipment

When gas contaminated areas must be entered, respirators must be worn, unless the area can be cleared of gas by ventilation. Respirators, however, are of no value unless they are the proper type, are available on the job when needed, are properly fitted and unless the worker knows how to use them.

A tunnel worker died last year (Michigan's Occupational Health, Fall, 1958), and three rescue workers were overcome because respiratory protective equipment had not been unpacked and no one knew how to use it. In another case, the rescue equipment was available, but was too big to fit into the manhole. In this case, the worker who had been overcome by sewer gas and one of his would-be rescuers died during the rescue attempt.

A few years ago, a hand pumped air-supplied hose mask failed to protect a rescuer, either because the mask did not fit or because it was faulty through long disuse. Others tried the

Figure 11. This picture, taken in a tunnel more than 100 feet below ground, illustrates that when a gas-laden atmosphere is encountered, proper precautions must be taken to protect the health of employees. Because of the hydrogen sulphide in the air, each worker breathes through an approved respirator. Power tools are operated by compressed air. The large duct at the upper left is part of the fresh air supply system. Health precautions were prescribed by the Division of Occupational Health.

same rescue with smoke masks, and failed because the masks provided no oxygen in the deficient atmosphere.

Noise and Vibration

An increasingly apparent problem in construction and industry is high noise levels and vibration produced by some tools and machines. Continual exposure to high levels of noise can result in hearing loss. Vibration from handling such tools as pneumatic hammers, calkers and rock drills can cause damage to hands and arms.

Portable vibrating tools are of two main types — piston operated pneumatic tools such as jack hammers and rock drills, chipping and riveting hammers, and the newer rotating tools which consist of polishing, cutting or grinding heads on a rotating spindle driven by electric or compressed air motors.

The most common health problem with piston driven tools is a disturbance of the blood vessels in the fingers resulting in a "dead" or numb feeling in the fingers. "Dead" fingers may develop in two years, but usually take longer. In some cases, damage to joints or bursitis may also occur.

During World War II, about 12 per cent of the workers using high speed rotating tools developed burning, throbbing pain in the fingers holding the tools, sharp pains up the forearm and stiffness and weakness in the hands. The condition developed from one to 72 weeks after starting on the job. Little improvement was made in the condition as long as a year after changing jobs.

Other Problems

Because of the wide variety of materials used and conditions experienced on construction jobs, any of the known potential occupational health hazards may be encountered. Here are a few not previously mentioned.

Poison ivy, poison oak, poison sumac and sunburn — Could be found on almost any kind of outdoor construction job, particularly highway and surveying and pole line work. Avoidance is the only prevention.

Silicosis — From exposure to silica dust, which can be found where sand blasting, demolition, stone cutting, brick sawing or concrete polishing is part of the job. Respirators may be the answer.

Allergies — Wood dermatitis is a problem with certain individuals. When discovered, these workers must be transferred to operations where they can avoid wood.

Metal fume fever — Zinc chills, another name for metal fume fever, can be caused by cutting or welding galvanized metal. Other welding hazards include flash burns from ultra violet exposure of the eyes and lead fumes from leaded parts.

Asthma, bronchial difficulties — There is a safe limit for all dusts, including the so-called nuisance dusts which are not considered toxic. However, if these limits are exceeded, claims for aggravation of asthma and bronchial difficulties can be expected.

Compressed air disease — When-

Figure 12. Vibration and noise from tools such as this jack hammer can be a hazard to health. "Dead" fingers and in some cases bursitis can be caused by these piston driven tools.

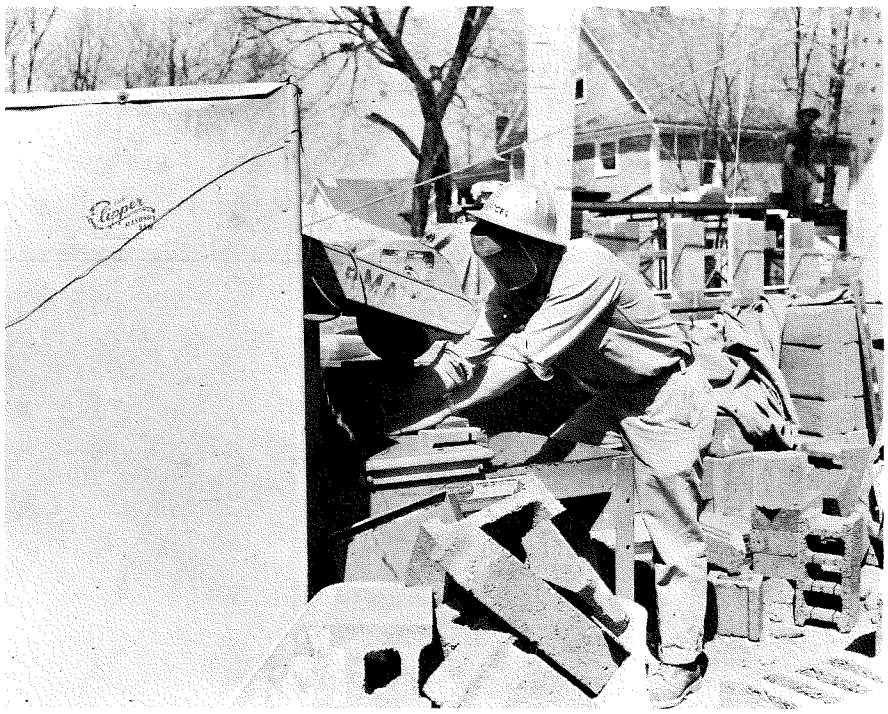


Figure 13. Cutting stone and block could cause excessive exposure to dust. Ventilation control should be provided.

ever workers are put under air pressure in tunneling, caisson work, diving —special care must be taken to prevent compressed air disease. The Division will make specific recommendations for protecting the health of workers who have to be kept under air pressure.

Selecting Workers

Many occupational health problems can be avoided by careful selection of workers. Certain workers, because of their past work history, are less likely to develop occupational diseases. For instance, a man with no history of skin disease would be a better possibility for working with solvents, than a man with skin problems. Careful selection of the work force is credited as the reason one air base project has gone three years without a lost time disease or injury claim against the prime contractor.

Adequate Washing Facilities

Many skin and other health problems will disappear if adequate washing facilities are conveniently located at all construction jobs. Solvents and gasoline and kerosene should never be used for cleaning hands, but in order to obey easily quoted rules like these, it is necessary to have a good hand-cleaner and lots of water available. Some of the waterless hand cleaners are very effective in removing heavy soils, including paint, and may serve an excellent purpose, too, in remote locations where water may be unavailable.

Adequate washing facilities cannot be limited to just hand washing equipment on some jobs. Where severe dusts and other contaminants are involved, facilities might well include showers, lockers and a change room. Clean work clothes are a must for all workers.

Recently, the need for personal cleanliness was illustrated in Michigan. An asphalt crew worker had worn the same oil soaked trousers for several days—until he developed a severe case of oil dermatitis. With clean clothes, he probably would not have been disabled.

Drinking Water

The term, adequate washing facilities, implies that the water is safe to drink. However, attention should also be paid to water temperature, or workers are apt to resort to a tub, a lump of ice and a dipper. Drinking water should be kept between 40-80 degrees, preferably between 45 and 50. The morale aspect alone of providing a good supply of cool drinking water to the working crew is well worth considering. The health aspect of providing safe water should be apparent to all.

In summer, sunstroke and heat exhaustion are problems that require planning to prevent. Not only adequate supplies of safe, cool water, but also salt tablets and the company physician's explanation and recommendation for their use should be provided well before the summer temperatures rise. Accident frequency rates, which rise in the summer, may be caused in part by heat stress and fatigue.

Toilet Facilities

In order to keep the working environment sanitary and to prevent nuisance and odor, adequate toilet facilities must be provided. And planning is necessary. For instance, picture a highway job with a dozen or so men grading, then suddenly a hundred-man paving crew moves in. Toilet facilities just must be planned in advance.

First Aid

First aid requirements vary with jobs, work forces and locations. Whatever first aid facilities are provided should be available when needed. Workers should realize the importance of getting first aid for injuries. The Division has been informed that a sewer worker in the Upper Peninsula will lose his hand because of a condition which began with a scratch on the thumb.

Where To Get Help

The construction industry, because of the magnitude of many projects, can be dealing simultaneously with materials which present old and well known health hazards; while on the same site, other workers using a new material or process may be exposed to a health hazard not readily understood by other than trained occupational health engineers.

The Division of Occupational Health does not want to suggest that the use of every potentially hazardous material be forbidden. On the contrary, in most cases, appropriate preventive and control measures can be designed so that work can continue normally and economically. Perhaps the best method of insuring a healthful working environment is to pay attention to possible sources of harm and call for help when unfamiliar problems arise.

The services of the Division of Occupational Health can be requested by letter or telephone call.—R.S.

VOL. 4, NO. 3 SPRING, 1959

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Published Quarterly by the Division of Occupational Health, Michigan Department of Health, Lansing 4, Michigan.