

1072

Target Health Hazards

Asbestos: Airborne Danger

by Nancy L. Nelson

Two thousand years ago when the first use of asbestos was recorded, it was a sacred object, a curiosity of kings and nobles, a magic mineral. The Greeks, who used asbestos for the wicks of their temple lamps, were enthralled when flames did not consume it, but burned unceasingly. Amazed, they called it *asbesta*, which meant the "unquenchable," the "inextinguishable."

Now that asbestos has been integrated into our industrial world—from fireproof drapery and floor tiles to the corrugated steel used in heavy construction—the term used by the Greeks has been found to apply to another attribute of this mineral. No cure now exists for the diseases caused by inhaling asbestos fibers: once established, these disorders, too, have so far proved to be inextinguishable.

In the last few years, asbestos has been recognized as one of the most hazardous of air contaminants in the workplace. Employees exposed to asbestos include an estimated 100,000 insulation workers, 50,000 workers in manufacturing products, 60,000 using end products, and uncounted thousands in construction. Labor unions have

pushed for stricter standards governing its usage, and the Occupational Safety and Health Administration has listed it as one of five target health hazards in a new program aimed to crack down on health hazards in the workplace.

Recent studies, such as those conducted by the Mount Sinai School of Medicine and the National Research Council, have produced some disturbing statistics on the mortality rates of workers using asbestos. Dr. Irving J. Selikoff of the Mount Sinai School of Medicine discussed the implications of these studies: "At present, one in every five deaths among insulation workers is due to lung cancer, one in ten to cancer of the pleura or peritoneum, one in ten to scarred lungs of asbestosis." Since insulation workers receive relatively light exposures to asbestos compared to some other occupational groups, these results are even more sombre.

What disturbs researchers about diseases linked to asbestos is that many cases they are presently encountering result from exposures dating back to the 1930's, when asbestos was not used as extensively as it is today. Thirty years ago world production was approximately 50,000 tons annually; today it has skyrocketed to 3 million tons. The effects of exposures occurring in the 1970's probably

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Front cover: In recent years asbestos has been recognized as one of the most dangerous contaminants in the workplace. The asbestos worker on the front cover empties a bag of asbestos mix into a container and raises a cloud of asbestos dust that endangers others on the worksite.

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ARTICLES

2—Asbestos: Airborne Danger

New regulation cuts risks for workers. First in a series on Target Health Hazards.

8—Prospects Bright in Occupational Nursing

Needed: more nurses on the jobsite.

12—NIOSH Team Sets Goals

An interview with Dr. Marcus Key, Director, National Institute for Occupational Safety and Health; and Edward J. Baier, Deputy Director.

16—OSHA Opens Training Institute

School for safety officers sets high standards.

18—Alice Hamilton: Industrial Health Pioneer

Profile of the woman who crusaded for employees' right to a healthful workplace.

22—They Take Their Safety Straight

Construction firm overcomes bad terrain, sets good safety record.

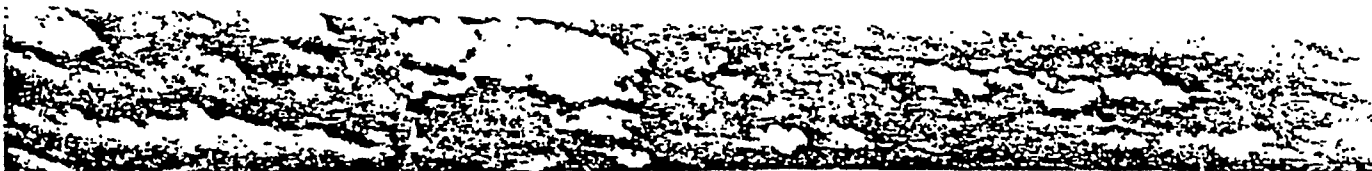
DEPARTMENTS

26—Safety Spotlight

28—For the Record

31—News from NIOSH

32—Publications



will not be known until the end of the century; but the high mortality rates of today suggest what may be expected in the future. If working conditions are not significantly altered, asbestos exposure can lead to 17,000 deaths from lung cancer, 10,000 deaths from cancer of the pleura and peritoneum, and 10,000 deaths from asbestosis, according to projections by Dr. E. Cuyler Hammond of the American Cancer Society.

The first case of asbestosis did not come under medical attention until 1900, 22 years after asbestos was mined on a large-scale basis. The victim, a British textile worker, had inhaled the asbestos dust stirred up by the carding machine he had operated for 14 years. Ten other men had been his co-workers in the carding room. All died before their thirtieth birthdays.

Since the recognition of asbestosis 72 years ago, the disease has been widely studied the world over, from the mines of South Africa to the mills of Quebec. Today experts believe that asbestosis is one of the most debilitating of the pneumoconioses—lung diseases caused by dust inhalation. Erupting 20 to 30 years after the exposure period, the disease exhibits no warning symptoms to mark its early stages. Many studies have uncovered cases of the disease in which the exposure was relatively light and did not continue over an extended period of time.

Although four varieties of asbestos are used commercially, chrysotile asbestos, mined primarily in Quebec, accounts for 95 percent of world production. Under high magnification, chrysotile fibers resemble fine polished wire or strands of silk. Strong, soft and flexible, they can be woven into fabric.

Chrysotile, however, is dangerous medically. When inhaled, the needle-like fibers become trapped in the lower bronchioles of the lungs. Normally, protective cells called phagocytes destroy



The asbestos worker mixing cement is partially protected by a respirator. The asbestos fibers in the air, however, endanger his fellow employees, just as his dust-laden clothes are a menace to his family. New OSHA standards require that asbestos materials be mixed in closed containers.

"The effects of exposures occurring in the 1970's probably will not be known until the end of the century; but the high mortality rates of today suggest what may be expected in the future."

such irritants. But asbestos fibers are indestructible in lung tissue. The phagocytes form a heavy coating around the fibers. In time, a dumb-bell shaped structure known as a ferruginous body begins to form.

Asbestosis develops when the scar tissue that forms around asbestos fibers slowly spreads throughout the lung and pulls it out of shape. The working space for air exchange is reduced, and blood flowing through the lungs is not replenished with a sufficient amount of oxygen. Breathlessness becomes pronounced, and in advanced stages can be disabling. Other symptoms are loss of weight, coughing, weakness, and pain in the chest or between the shoulders. The strain on the heart caused by the lack of oxygen may cause heart failure.

Recent studies indicate that asbestos also may be a potent carcinogenic, or cancer-producing agent. A major stumbling block to researchers in establishing the connection between asbestos and cancer has been the length of time between exposure to the substance and the appearance of cancer symptoms. But in the last few years, studies have shown that workers exposed to asbestos die

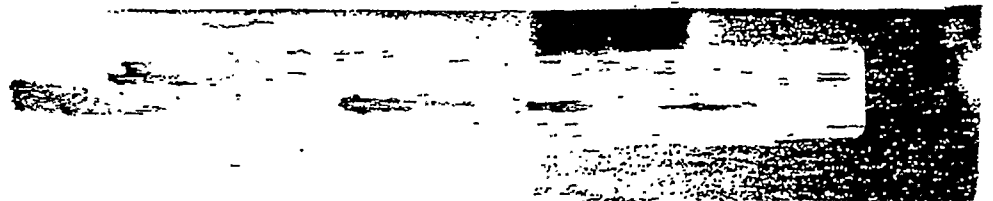
of lung cancer at more than five times the expected rate. Although most cancers linked to asbestos develop in the lower portions of the lungs, where the concentration of fibers is heaviest, cancer may also develop in the gastrointestinal tract.

The peril of lung cancer from asbestos exposure is increased by smoking. Tests conducted by Selikoff and Hammond have shown that asbestos insulation workers who smoke have 90 times the incidence of lung cancer compared to smokers with no asbestos exposure.

Mesothelioma, formerly a rare cancer afflicting only one out of 10,000 people, is now appearing at an unprecedented rate. Researchers are linking it to asbestos exposure, however slight. This fatal cancer attacks the pleura (the membrane lining the lung and chest cavity) or the peritoneum (the lining of the abdominal cavity). In his study, Selikoff noted that 10 out of 124 deaths of insulation workers were caused by mesothelioma.

Workers in many occupations encounter serious asbestos exposures. Among the establishments most likely to have asbestos risks are those manufacturing asbestos textiles, value packings, asbestos

Wrong: Spraying asbestos mixtures on steel girders releases vast amounts of asbestos dust into the atmosphere. Asbestos insulators who smoke have 90 times more lung cancer than smokers with no asbestos exposure.



"Since the recognition of asbestosis 72 years ago, the disease has been widely studied the world over, from the mines of South Africa to the mills of Quebec. Today experts believe that asbestosis is one of the most debilitating of the pneumoconioses—lung diseases caused by dust inhalation."

sheets, brake linings, boiler blankets, building materials and appliance cords.

Plasterers who spray an asbestos mix on the steel foundations of buildings have heavy exposures to asbestos. A thermal insulation and fireproofing agent, the asbestos mix prevents the steel from buckling in case of fire. Plasterers can apply it without interrupting construction activities, and the asbestos mixture hardens in eight hours without cracking or shrinking. Not only steel buildings, but ships and boats are treated in this manner.

Now that asbestos has been recognized as a major health hazard, the alarming facts about this practice are being reviewed. Three million pounds of the fireproofing mixture, 30 percent of which is chrysotile asbestos, was sprayed in 1970. Twenty-five percent of the material sprayed does not adhere to the steel, but goes directly into the atmosphere. The plasterers manning the spray guns, as well as the construction workers toiling near-by, inhale excessive amounts of asbestos during this operation—up to 50 million fibers in an eight hour day. But the hazard does not end with construction. A large amount of asbestos is expected

to be set free during demolition of the buildings and ships treated in this manner.

Asbestos spraying has been banned in some cities, but continues unabated in others. The use of alternate methods of application—trowelling a wet mixture of asbestos on the foundation or wrapping insulation around the steel in the form of blankets—is being encouraged to reduce the hazard.

Brake mechanics must also cope with significant levels of airborne asbestos. Valuable because of its resistance to heat and its ability to withstand abrasive force, chrysotile asbestos makes up 50 percent of brake lining material. However, the friction breaks asbestos fibers away from the fabric. Many mechanics remove the asbestos fibers that have accumulated around the brake drums and assemblies with a compressed air hose. This produces a cloud of asbestos dust around the mechanic and anyone in his working area. Alternate cleaning methods are needed; for example, a vacuum cleaning device reduced the hazard in recent tests in England.

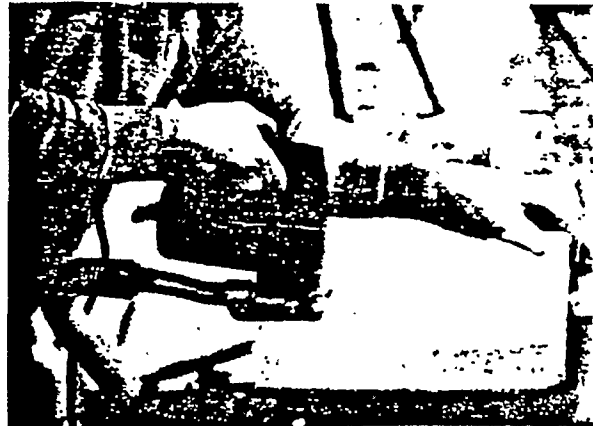
Insulation workers are the largest single occupational group to handle asbestos on the job. Their



Right: Troweling a wet asbestos mix on pipes for insulation purposes effectively reduces the hazards.



Wrong: Sawing asbestos materials creates dust in the work environment. The respirator affords the employee some protection, but the accumulation of dust remains a threat to others on the worksite.



Right: A saw with a local ventilation system sucks up asbestos dust into a container. The OSHA standard specifies that hand or power-operated tools that produce asbestos dust must be equipped with local exhaust ventilation and dust collectors.

exposures, however, are relatively light. In most types of insulation, asbestos is used primarily as a binding agent and makes up only 15 percent of the material. Then, too, insulators working with asbestos on a daily basis are encouraged to take precautions: good housekeeping measures, tools equipped with local ventilation systems, and respirators for dusty work are safety precautions stressed by their union.

When insulation workers install materials containing a high percentage of asbestos, they often use a water spray on the cloth while unrolling it or uncovering it. Some insulation workers even cut asbestos on disposable tarpaulins in order to allow the excess material to be discarded without stirring up dust. This eliminates the need to sweep up insulation debris after a job. Usually a dusty process, sweeping is discouraged because it holds a risk for the workers still on the construction site.

Bricklayers, carpenters, sheet metal workers and boiler makers also install insulation at various times, but often they fail to take the precautions used by workers who handle asbestos on a daily basis. The licensing of workers who install insulation, much like the licensing of plumbers and electricians, has been suggested as a safeguard to insure that asbestos handlers are both informed and equipped to work safely.

Asbestos contamination holds an increasing threat to the general public. Both the dusty manufacturing processes and the spraying of structural steel emit vast amounts of asbestos fibers into the atmosphere, threatening those living near asbestos factories. Unsuspecting passers-by in the vicinity of construction sites or families of workers who return home with dusty clothing are among those exposed to this hazard.

The emergency OSHA standard for asbestos, issued on December 7, 1971, lowers the permissible concentration of asbestos fibers in the work atmosphere from 12 fibers to five fibers greater than five microns in length per milliliter. This is based on the average exposure during the eight-hour work day. Concentrations of asbestos that range from five fibers per milliliter to 10 are permissible for 15 minutes every hour, but the sum total of such exposure must not exceed five hours in an eight-hour work day.

The standard also lists engineering controls—enclosures, vacuum sweeping and local exhaust ventilation. When these measures are not feasible or do not reduce the asbestos concentration to permissible levels, the standard requires that workers be provided with personal protective devices. Protective respiratory devices must be worn by workers exposed to the spraying of asbestos, or

to the demolition of pipes, structures or equipment previously sprayed with asbestos.

The emergency standard requires that the employer check the respiratory devices for proper fit and train employees in their correct use. Periodic inspections, proper cleaning, repairing and storing of the respiratory devices are responsibilities of the employer.

The standard also specifies that hand or power-operated tools that produce asbestos dust—saws, scorers, abrasive wheels, and drills—must be equipped with local exhaust ventilation and dust collectors. When asbestos is mixed with other products—such as cement, mortar, grout or plastic—the mixing must be done in closed containers. Cleaning up the debris by dry sweeping or blowing it away is prohibited. Any accumulation of asbestos dust must be removed rapidly by vacuum cleaners. Asbestos waste must be disposed of in sealed containers.

The OSHA Standards Advisory Committee for Asbestos has recommended an exposure limit of two fibers greater than 5 microns in length per cubic centimeter. This proposal, based on a NIOSH criteria document, would not be effective for two years, in order to allow the installation of

the necessary engineering controls. The committee, representing government, labor and industry, also suggested that the future standard include a program of comprehensive medical surveillance requiring pre-employment medical examinations of applicants, periodic medical evaluations of workers, and medical records to be kept by employers for the use of OSHA and NIOSH.

The research and mortality studies of today have tarnished the reputation of this magic mineral, once the object of fabulous tales. One legend revolves around the tablecloth of Charlemagne, the eighth-century ruler of the Holy Roman Empire. When the cloth woven from asbestos fibers was thrown into the flames, it was withdrawn not only intact, but whiter and cleaner than before. Charlemagne used this piece of "witchcraft" to mystify his guests as well as to intimidate his enemies in order to win psychological battles.

The jump from ancient legend to contemporary knowledge about asbestos is a tremendous advance—except in one area. Our ability to combat the disastrous effects of asbestos on the human system is still negligible. The mystery surrounding asbestos continues today, but the price is not in lost battles but in lost working lives. □



Wrong: Asbestos dust collects with other debris on a construction site. The cleaning and sweeping process raises clouds of asbestos dust, endangering the employees and the community.



Right: The new OSHA standard requires that asbestos debris be removed in closed containers or plastic bags.

Job Safety and Health

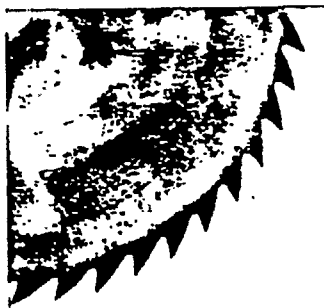
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Adverts

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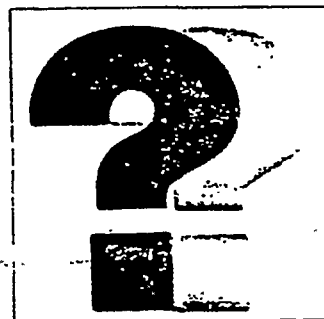
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11



18



24

Articles

Tips offered for safety in asbestos-sprayed spaces

For protection in asbestos-sprayed plenum spaces, insulators or other workers should observe the following precautions, offered by the insulation industry hygiene research program, which Irving Selikoff, M.D., directs.

- Wet and remove any fireproofing that might be dislodged during maintenance work.
- Exercise care not to disturb remaining fireproofing material.
- Vacuum any loose asbestos material that may have fallen on ducts, ceiling tiles, or other service facilities before and after work.
- Wear approved respirator during work and cleanup.

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Departments

- 2 OSHA News Briefs
- 32 Review Commission
- 33 Historical Hazards
- 34 News from NIOSH
- 35 Spotlight
- 36 Readers' Forum, Publications