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cover

"Getting Your Head Protection Together," as pictured on the cover, shows a selection of the types of protective headgear offered to industry. For details on implementing a selection program, see the feature article beginning on page 41. Cover graphics by Donald Shelton and Associates.



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ASBESTOS:

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Some Answers

Tiny asbestos fibers inhaled by workers years ago have given rise to lung-related diseases and certain cancers. Now that the problem has been recognized, here are some answers and information on investigations.

IN JANUARY 1972 the Target Health Hazard Program was initiated by OSHA administration "to promote the understanding of five hazardous workplace substances, so that more effective control measures might be taken to prevent the occupational diseases or poisoning associated with them." Asbestos was one of the substances singled out as a target health hazard; the others were cotton dust, carbon monoxide, lead, and silica.

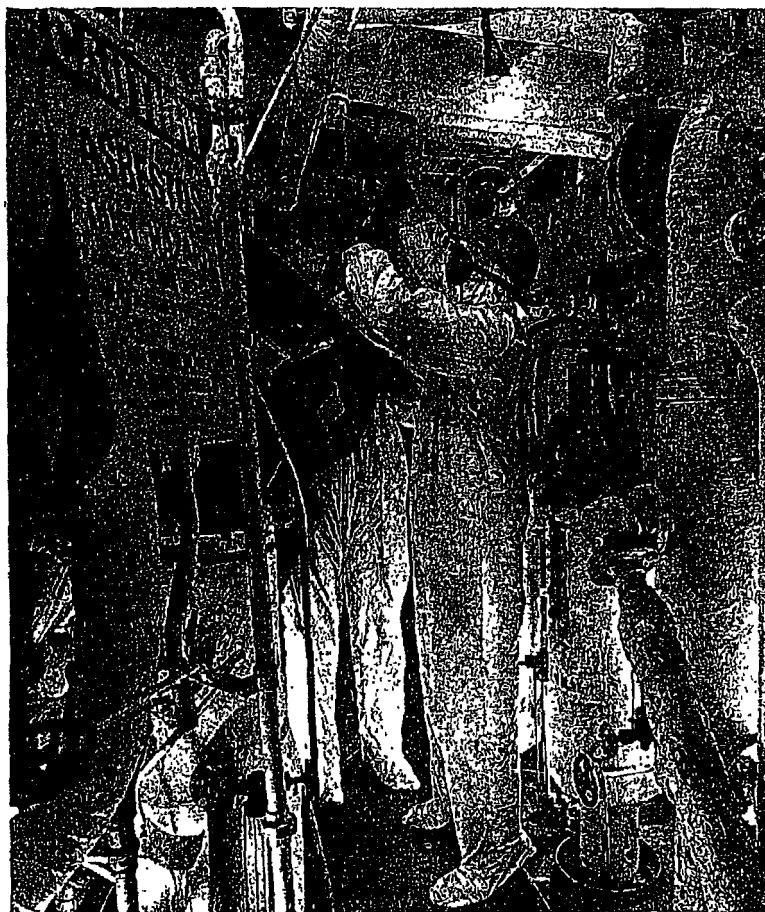
In the ensuing seven years—continuing through several federal administrations—this educational program has continued. Enclosures, local exhaust ventilation, and dust respirators continue to be methods of affording protection in some operations. But since 1972, legislation has been enacted setting limits on the amount of air-borne asbestos fibers permitted in the work place.

The following questions and answers and the article, "Modern Substitutes for Ancient Asbestos" (see page 56) update this part of the original Target Health Hazard Program.

Two techniques recently developed in Britain will facilitate the assessment of air-borne asbestos fibers, more quickly and more accurately than by current manual counting methods. The rapid monitoring equipment can assess con-

ventional samples of air-borne asbestos dust at rates up to 30 per hour, giving digital readout direct in fibers per milliliter of air sam-

pled. The technique involves exposing the collected fibers to a magnetic field, while preparing the membrane filter for examina-



Workers at the Norfolk Shipbuilding & Drydock Corp. remove asbestos from pipe in a ship undergoing repairs. They are protected from possible exposure to asbestos fibers by wearing disposable coveralls and hoods made of Tyvek spun-bonded olefin material, as well as respirators, goggles, and rubber gloves. Arm and neck openings are taped closed. (Photo: Courtesy of DuPont Company).

Editor's Note: Material for this article has been adapted from *Asbestos Exposure—What It Means; What to Do*, (DHEW Publication No. (NIH) 78-1594), and *Asbestos Exposure—A Desk Reference for Communicators*, (DHEW Publication No. (NIH) 78-1622). (See Bibliography).

tion. This aligns the fibers either parallel or normal to the field. The sample is then examined under a specified modified microscope (see Figure 1), and the light-scatter peaks produced are assessed with the aid of a microprocessor. The second new technique automatically detects and counts individual asbestos fibers. It also measures the individual length and width of fibers, providing essential information for monitoring. The method employs a computerized image-analysis system (see Figure 2). The two techniques were developed for Vickers, Ltd., with financial support provided by Britain's Asbestosis Research Council.

Some Answers

• What is asbestos?

Asbestos is the common name for a group of natural minerals that occur as masses of compact or relatively long, silky fibers. Six fibrous minerals, members of a family called silicates, are recognized as asbestos: *chrysotile* (white asbestos), *actinolite*, *amosite* (brown asbestos), *anthophyllite*, *crocidolite* (blue asbestos), *tremolite*.

Commercially, *chrysotile* is the most important form of asbestos, with most of it used in the U.S. being imported from Canada. All forms have a tendency to break into a dust of tiny fibers that can float in the air and be inhaled or swallowed.

• How is it used?

Asbestos has been used for thousands of years. It has about 3,000 different uses, with about two-thirds used in the construction industry as various building products, insulation, friction materials, textiles. Manufactured products have included reinforced asbestos cement sheets and pipes, patching and taping compounds, floor and ceiling tiles, paints, coatings, and sealants containing asbestos as reinforcing fillers, pipe linings, and fillers for various liquids. Friction products include clutch facings and brake linings for automobiles, railroad cars, airplanes, industrial machinery. Other uses include theater curtains, fire-proof blankets, filtration materials.

Once incorporated into manufactured items, the hazard resulting

from asbestos is less serious, as long as the substance is not disrupted in any way. However, the fibers are nearly indestructible. A potential health risk arises whenever asbestos fibers are set free, resulting in asbestos dust.

• How has asbestos been used in shipyards?

It has been used extensively to cover pipes and surfaces in new construction, repair, and refitting. Major sources of exposure to asbestos in shipyards have been in fabrication of asbestos materials (such as pipe coverings), their installation, and their removal during repair.

Asbestos also has been included in insulation materials such as boards, mattresses, and cloth for engines, hulls, and decks, covering of ventilation and water pipes, coatings for cables and electric wires, wall boards and tiles, and in putties, caulks, paints, joint fillers, and cement products, as well as in gaskets, rings, tape, tubing, twine, webbing, washers, and coated electric wires.

• How much is used?

Modern industrial use in the U.S. dates from about 1880, when mining of the Quebec *chrysotile* deposits began. Gradual increases in the production and use occurred, during the next 50 years, followed by accelerated use more recently. From 1970 to 1975, the amount of asbestos fiber used in the U.S. averaged some 800,000 tons annually, according to the U.S. Bureau of Mines. *Amosite* from South Africa has been used in the U.S. in smaller quantities in industries such as shipbuilding.

• Who may be at risk of developing asbestos-related diseases?

Workers in many occupations, particularly in asbestos mining and processing, shipyards, construction, and in automotive brake lining repair commonly are exposed to asbestos, and may inhale or swallow dusts contaminated with concentrations of this substance. Risks of disease due to asbestos exposure have not been defined clearly for all occupational groups known to have significant exposure. Firm

scientific data are available only for heavily exposed workers employed in asbestos mixing, manufacture, and insulation. Over the past several years, evidence has accumulated that asbestos insulation workers previously employed in shipyards and elsewhere are experiencing asbestosis and markedly increased rates of cancer. Workers who manufactured the asbestos insulation materials used in shipyards also have increased asbestos-related disease.

• What diseases may be caused by asbestos?

Asbestos can cause asbestosis and certain forms of cancer. Among some groups of workers who were heavily exposed to asbestos, as much as 20 to 25 per cent of all deaths are due to lung cancer. In the general adult population, about four to five per cent of all deaths are due to lung cancer. In addition, asbestos workers are at increased risk of mesothelioma, an otherwise uncommon type of cancer not associated with smoking, and rarely observed in the general population. Above-average rates of cancer of the digestive system (esophagus, stomach, colon, rectum) have been found in groups of asbestos workers.

• What is the role of cigarette smoking?

Asbestos and smoking together produce more lung cancer than either factor acting alone. Some investigators have found that asbestos workers who smoke have a risk of lung cancer eight times that of smokers in the general population. Cigarette smoking also increases the risk of other types of cancer and disabling lung diseases (emphysema, bronchitis). Some information suggests that quitting smoking can reduce this extremely high risk in asbestos workers.

Although non-smoking asbestos workers have more lung cancer than non-smokers in general, they do not experience the extremely high risk of lung cancer of asbestos workers who smoke. However, they still are at increased risk of other asbestos-induced diseases, including asbestosis, mesothelioma,

and gastrointestinal cancers.

• How does asbestos cause disease?

The answer is not known. Asbestos fibers too fine to be seen by the human eye become airborne during various industrial processes and are inhaled and subsequently may be swallowed. Scientists believe that the most harmful fibers are so fine that an electron microscope is needed to see them. Because of their size and shape, asbestos fibers can penetrate body tissues. Because of their durability, they remain in the body for many years after entry.

• How much asbestos exposure is hazardous?

The answer is not known. In the case of asbestosis and lung cancer, the risk increases with increasing amount of exposure. Asbestos-induced disease is not likely to appear until 15 to 35 or more years after first exposure. The time between first exposure and the appearance of disease appears related both to the amount and duration of exposure; more intense exposure sometimes results in asbestos-related disease within 15 years. However, one study of workers in an asbestos plant showed that some workers who were exposed only a month or two have developed asbestos-related diseases many years later. Typically, the first 10 to 15 years after initial exposure are free of signs or symptoms. Early X-ray changes may appear in lung tissue after 10 to 15 years, but may not be accompanied by other significant symptoms. Some investigators have reported evidence of impaired lung function in workers with less than 10 years of exposure to asbestos.

• What specific diseases may increase in risk through exposure to asbestos on the job?

Asbestosis—This is a chronic lung ailment that can produce shortness of breath and lung damage. The disease results from inhalation of asbestos dust;

Lung cancer—There is a close association between asbestos exposure and increased occurrence of lung cancer;

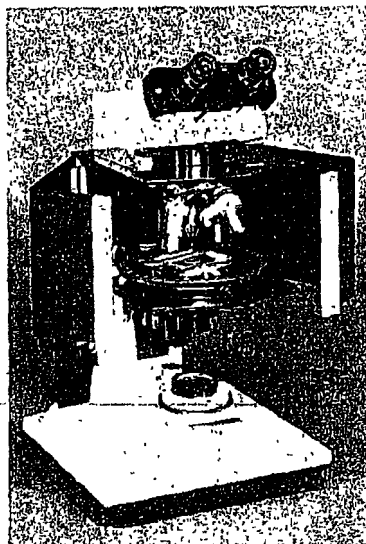


Figure 1 shows the special microscope developed to examine asbestos fibers, which have been exposed to a magnetic field in order to align the samples.

Mesothelioma—A cancer that involves the thin membrane lining the chest and abdomen. Most mesotheliomas can be traced to prior asbestos exposure;

Other cancers—Several studies have indicated a link between asbestos exposure and increased occurrence of cancers of the esophagus (food tube leading to the stomach), colon, stomach, and rectum.

• What are the signs and symptoms of asbestosis?

Asbestosis is a chronic lung disease whose signs and symptoms result from permanent changes in lung tissue due to asbestos exposure. The earliest and most prominent sign is shortness of breath on exertion. It rarely becomes apparent until at least a decade after first exposure. The disease process usually has to be rather advanced to produce shortness of breath. A dry, crackling sound (*rales*), coming from the lungs during inhalation, is the most characteristic physical sign of asbestosis. Clubbing of the fingers is sometimes found, usually later in the disease. A bluish discoloration of the skin and the lining of the mouth and of the tongue also may occur in the later stages of the disease. A physical exam with X-rays will show diffuse scar-



Figure 2 shows the computerized image analysis system that automatically detects and counts individual asbestos fibers within each sample.

ring of the lungs as asbestosis develops, and lung function tests will show impairment of the maximum volume of air a worker can inhale.

• Does asbestosis lead to lung cancer?

Scientists do not believe asbestosis necessarily leads to lung cancer, but the presence of this disease does indicate that a worker received considerable asbestos exposure and has a greater risk of developing asbestos-associated cancers than an unexposed person. Both types of disease can be caused by the same environmental agent, and the development of each may be independent of the other.

• What are the symptoms of lung cancer?

A cough, or a change in cough habit, is found in most lung cancer patients. Chest pain is the second most common symptom. It usually is felt as a persistent ache unrelated to cough and is commonly experienced on the side on which the tumor is located. Blood-streaked sputum, coughed up from the lungs, is the initial symptom of a small per cent of lung cancers.

• How is lung cancer diagnosed?

Initial diagnosis is by chest X-ray examination. Confirmation is by means of medical procedures such as sputum cytology, or biopsy by means of fiberoptic bronchoscopy, mediastinoscopy, or by thoracotomy.

• **What is mesothelioma?**

Mesothelioma is an extremely rare cancer in the general population, but is more common among asbestos workers. It affects the pleura, a membrane lining the chest cavity, or the peritoneum, a similar membrane lining the abdominal cavity. A large proportion of mesothelioma cases can be traced to prior asbestos exposure.

• **How is mesothelioma detected and diagnosed?**

The most common first symptoms may be shortness of breath or pain in the wall of the chest, aggravated by deep breathing; or abdominal pain, which may vary from vague discomfort to severe spasms. These spasms are sometimes located in the upper right region of the abdomen. Occasionally, this pain is accompanied by a need to urinate or defecate. Although chest X-ray is of some help in diagnosing mesothelioma when it occurs in the lining of the lung, precise diagnosis of this unusual cancer is difficult and requires an exploratory operation of the chest or abdomen, depending on the patient's symptoms, to provide tissue for microscopic examination.

• **What can be done to treat asbestos-related diseases?**

Treatment of all diseases and cancer is individually tailored and may include surgery, drugs, radiation, or combinations of these therapies. Typical treatment includes:

Asbestosis—Most deaths from asbestosis are due to super-imposed respiratory infections such as pneumonia and bronchitis, rather than to direct effects of the disease itself. These infections usually can be treated, but it is important to get medical attention early.

Lung and esophageal cancer—Treatment of these cancers depends on the type and amount of tissue af-

fected. Lung cancer may be treated by surgery, drugs, radiation, or combinations of these treatments. Esophageal cancer is treated most often with radiation. As with most cancers, the treatment must be tailored to the individual patient.

Cancer of the colon and rectum—Surgery is curative in many cases; early diagnosis increases the likelihood of cure. Methods are available to improve the frequency of early diagnosis.

Mesothelioma of the pleura or peritoneum—Effective treatment is not yet available. Research is under way in the U.S., Great Britain, and France.

Cancer of the stomach—Detection has been improved by the development of the flexible gastroscope and gastric camera. Treatment usually is by surgery. New treatment regimens using drugs are improving the outlook for patients with this cancer.

Cancers of the kidney, larynx, and oropharynx—Physician awareness of the possibility of occurrence improves chances for early diagnosis. These cancers often can be treated effectively by surgery or radiation therapy.

• **How can current workers protect themselves?**

Employers are required to follow regulations issued by OSHA dealing with asbestos exposure on the job, including engineering for the removal and collection of asbestos in the air, and issuance of personal protective equipment. Limits have been set for the amount of asbestos permitted in the atmosphere. Use all protective equipment, follow all proscribed work practices and safety procedures your employer provides.

If you have any questions or are concerned about asbestos exposure in your workplace, discuss the situation with an industrial hygienist. If necessary, OSHA can give you more information or make an inspection.

• **What federal agencies are concerned with the effects of asbestos exposure?**

The National Cancer Institute

(NCI) and the National Institute of Environmental Health Sciences (NIEHS) are conducting or sponsoring research on the health hazards of asbestos.

NIOSH, also, is responsible for research on the documentation of hazards, and operates an information service to answer workers' questions about occupational safety.

OSHA regulates worker exposure.

The Environmental Protection Agency (EPA) is charged with monitoring levels of asbestos in air and water.

The Food and Drug Administration (FDA), a part of the U.S. Department of Health, Education and Welfare (DHEW), is concerned with asbestos contamination of foods, drugs, and cosmetics, such as might occur during their manufacturing process.

The Consumer Product Safety Commission (CPSC) recently has banned the use of asbestos as artificial ash for ceramic logs in gas-burning fireplaces, consumer clothing made of untreated asbestos, and the manufacture of dry-wall patching compounds containing asbestos.

An Asbestos Subcommittee of the Armed Forces Epidemiology Board has been established and is reviewing programs that might be recommended to the Secretary of Defense concerning asbestos-related disease among civilian employees of the Armed Forces, as well as veterans and men and women currently in service. Additional information is being gathered to assess the health risks of shipyard workers in various U.S. locations.

Investigators of the Environmental Sciences Laboratory, Mount Sinai School of Medicine of the City University of New York, and the American Cancer Society are collaborating in a number of studies of shipyard workers, funded partly by NIEHS. NIEHS also is sponsoring a study, with partial support from EPA, in rodents on ingestion of asbestos minerals.

An educational program for physicians and the public is being developed by DHEW in cooperation with the voluntary health agencies, concerned unions, and the asbestos industry.

• Will the government provide examinations or treatment, or will the government pay for these? What about insurance coverage?

Medical services related to asbestos exposure are available through the government only for certain groups of eligible individuals. In general, medical services are available through non-governmental doctors and facilities and paid for by the individuals affected, unless they are covered by private or government health insurance programs. Check your policies. Medicare will reimburse people with symptoms of asbestos-related diseases for the costs of appropriate diagnosis and treatment.

Victims of asbestos-related disease also may qualify for financial aid, including medical payments, under state worker compensation laws. Eligibility requirements vary from state to state, so contact the state worker compensation program in the state where last exposure occurred.

If exposure resulted from employment in a federal agency (military or civilian), those affected may be covered for medical expenses and other compensation by the Federal Employees' Compensation Act (FECA).

Shipyard private employer employees may be covered under the *Longshoremen and Harbor Workers Compensation Act*. For information about eligibility for these two compensation programs, contact the U.S. Department of labor, Office of Workers Compensation Program, Employment Standards Administration, 200 Constitution Ave., N.W., Washington, DC 20210.

Military and eligible dependents may receive health care at any Department of Defense medical facility. If no such facility is available within 40 miles of home, care may be obtained at a Veterans Administration or Public Health Service hospital. Where no federal facility is available, seek care at a civilian facility under the Civilian Health and Medical Program for the Uniformed Services (CHAMPUS). Those more than 65 years of age must obtain medical care through Medicare.

Former military who believe they may have a service-related

medical problem, can inquire about care at a Veterans Administration facility or telephone the local Veterans Administration office.

Workers also may wish to contact their international unions or the Industrial Union or Metal Trades Departments of the AFL-CIO, 815 16th St., N.W., Washington, DC 20006 for information on other sources of medical help and insurance matters.

For information about non-occupational exposure from foods, drugs, and cosmetic products possibly contaminated with asbestos particles, write to Consumer Inquiries, FDA, 5600 Fishers Lane, HFJ-10, Rockville, MD 20857.

For questions about the potential hazards of commercial products, contact CPSC at (800) 638-2666 or (800) 492-2937.

Inquiries about air and water contamination should be made to the Public Information Center, PM-215, 401 M St., S.W., Washington, DC 20460.

Cancer Information Services (CIS) offices around the nation provide toll-free telephone answers to questions about cancer and other asbestos-related diseases, their causes, prevention, diagnosis, and treatment. Check with local telephone operators for the nearest CIS office.

For further information from labor or industry sources, contact:

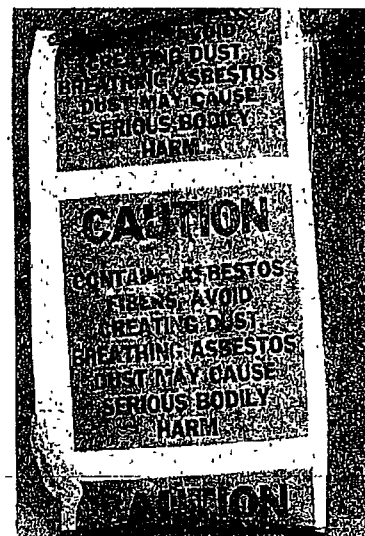
Labor—international union, or the Industrial Union or Metal Trades Departments of the AFL-CIO, 815-16th St., N.W., Washington, DC 20006;

Industry—Asbestos Information Association, North America, 1745 Jefferson Davis Highway, Arlington, VA 22202.

Other sources of information on lung disease, cancer, and how to quit smoking are provided by local offices of the American Lung Association and the American Lung Society. These organizations have offices throughout the United States. □

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This imprinted polyethylene bag is a workable solution to the problem of labelling asbestos waste, in conformance with OSHA regulation 1910.1001 (formerly .93a), and aids in complying with EPA Emission Standard 61.22. (Photo: Courtesy of Nancel Enterprises, Inc.).

Asbestos Exposure—A Desk Reference for Communicators, DHEW Publication No. (NIH) 78-1622. National Cancer Institute, Bethesda, MD 20014.

Standard on Worker Exposure to Asbestos, Occupational Safety and Health Administration, Office of Information, Washington, DC 20210.

Cancer and the Worker, New York Academy of Sciences, 2 E. 63rd St., New York 10021. (\$2).

Good Practices Manual, Clearinghouse for Occupational Safety and Health Information, NIOSH, 4667 Columbia Parkway, Cincinnati 45226.

Sprayed Asbestos-Containing Materials in Buildings, Standards Development Branch, EPA, Research Triangle Park, NC 27711.

"Asbestos," NATIONAL SAFETY NEWS, National Safety Council, 444 N. Michigan Ave., Chicago 60611. Vol. 108, No. 2, August 1973, pp. 54-60. Also available as a reprint; see page 128 of this issue.

RECOMMENDED READING

USPHS/NIOSH Membrane Filter Method for Evaluating Airborne Asbestos Fibers (NIOSH Report No. 79-127). NIOSH Publications Dissemination, 4676 Columbia Parkway, Cincinnati 45226. The report describes the recommended method for sampling and evaluating airborne asbestos fibers. The report details the equipment and procedures for collecting, mounting, sizing, and counting asbestos fibers on cellulose ester membrane filters for the evaluation of personal samples.