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SAFETY & HEALTH

The growing need for asbestos substitutes

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Asbestos is a wondrous mineral fiber with the strength of steel, the durability of marble, and insulating qualities without equal. But asbestos also poses a serious and widespread health hazard. Health officials predict that within the next 50 years, 400,000 people, mostly former workers, will die of cancer because of their exposure to asbestos. Now the federal government has taken the first step toward a ban on the substance, and manufacturers and users alike are scrambling to find substitutes.

Despite extensive evidence of the adverse health effects of asbestos, especially among shipyard workers, the federal government until recently had taken steps only to minimize occupational exposures (page 94H). But the Environmental Protection Agency, citing its authority under the Toxic Substances Control Act, announced in October its intention to study and regulate all aspects of asbestos—from mining and milling to the manufacture and sale of consumer products. While the EPA's plans still are in a preliminary stage, officials predict that the near-term regulation will include a quota on imports and bans on all "nonessential" uses.



Asbestos: Tiny, deadly fibers are easily inhaled by workers.



Automotive brake linings: Target of the EPA's asbestos regulation. During repairs, sanding releases harmful fibers.

Plans for a ban. EPA officials also have made it clear that they are headed toward a total ban on the material. "Our ultimate goal is to displace asbestos, to displace it gradually, but to do it," says John P. Dekany, the EPA's deputy assistant administrator for chemical control. "This is a signal to industry to make long-range plans to phase out asbestos and a challenge to develop substitutes."

Until asbestos is mined, the mineral is as dense as the rock in which it is encased. As soon as it is released, however, it becomes a mass of tiny fibers that are easily inhaled. The EPA estimates that since the beginning of the century, 30 million tons of asbestos fibers have been used in the U. S.—an average yearly use of 750,000 tons.

While asbestos is found in Arizona, Vermont, and California, the major deposits are in Quebec. As a result, 95% of the asbestos used in the U. S. is mined in Canada. The largest domestic producer of asbestos-related products is Johns-Manville Corp., which also has subsidiaries in Canada and West Germany.

The suggestion of a ban sends shivers through Canadian producers. The U. S. is far and away Canada's biggest customer. In 1978 American companies purchased 40% of the asbestos produced in Canada, business worth more than $200 million. "We're greatly concerned about it, and we'll make every representation that we can," states J. Robert Hutcheson, chairman of Johns-Manville Canada Ltd. The U.S. parent is working closely for now with the EPA, but company officials warn that if the agency's actions are unreasonable, they may test the Toxic Substances Control Act in court.

Many U. S. companies that manufacture products containing asbestos are worried, too. The single largest use of asbestos is in asbestos cement pipe. The asbestos serves as a reinforcing agent, resulting in pipes that are highly resistant to deterioration when used in sewers and water distribution systems. Roofing, sheathing materials, and vinyl floor tiles often contain asbestos because, in addition to its reinforcement qualities, it is fire-resistant. The substance's heat resistance also makes it important to auto and truck manufacturers for brake linings. "In my opinion, there is no substitute" for asbestos in heavy-duty truck brakes, argues Edward J. Sydor, general manager of Kelsey-Hayes Co.'s National Friction Products Div.

Yet the EPA intends to target brake linings, along with asbestos paper products used in sheathing and roofing, in the agency's first regulation. EPA officials point out that there are more than 100 million motor vehicles in the U. S. today. Because most cars and trucks need a new set of brake linings every three or four years, agency officials believe that a considerable amount of material may be released into the environment during normal use, as well as during repairs, threatening both consumers and mechanics.

Phaseout. U. S. auto makers are phasing in disk brake linings in which the asbestos content has been cut from 1 lb. to about 1 oz. GM decided last January to move away from asbestos brake linings after company officials discovered that the average repair person's response to a brake complaint is to sand the linings. "This puts all sorts of harmful fibers in the air," says Stanley B. Fowler, a staff engineer for GM's Buick Div., which spearheads brake design for the corporation. Both GM and Ford say that their suppliers now are seeking ways to eliminate asbestos totally in brakes.

In disk brake linings, asbestos is replaced by a semimetallic friction material built around steel fiber and iron powder. However, this surface must be attached to the brake shoe with an asbes-

Asbestos: A legacy of costly litigation

The public health problem of asbestos-related disease is unprecedented. It is estimated that 18% of all cancer cases expected for the next 25 years in the U.S. will be linked to asbestos exposure. "No matter what we do now, we have this iron, irreversible legacy," says Dr. Irving J. Selikoff, director of Mt. Sinai School of Medicine's Environmental Sciences Laboratory in New York.

Former workers and their families and neighbors who are diseased, or who may become so, are filing lawsuits by the thousands. Johns-Manville Corp., the nation's largest manufacturer of asbestos products, has been the target of about 2,500 legal actions involving more than 4,000 people. Some 490 cases already have been processed, many being settled by payments to workers. Other companies involved in litigation include Pittsburgh-Corning, Owens-Corning Fiberglas, Unarco Industries, GAF, and Raybestos-Manhattan.

But the workers hold the government equally responsible. More than 400 workers or former workers in asbestos manufacturing plants have filed suits against the Health, Education & Welfare Dept. and the Navy, which supervised workers handling asbestos in shipyards during World War II.

Heavy settlements. A few cases have been settled, including a $20 million payment by PPG Industries Inc., Corning Glass Works, the federal government, and others to 445 former workers in Tyler, Tex. The first of several cases against eight suppliers to Newport News Shipbuilding & Dry Dock Co. was settled for about $220,000. According to Dennis J. Markusson, associate general counsel for health, safety, and environment at Johns-Manville, the few settlements involving that company have averaged $16,000 each.

The crux of the cases is who knew what and when about asbestos-related hazards. The key question is who was responsible for warning workers about the dangers. Attorneys for the workers have charged that asbestos company officials exchanged correspondence during the 1930s in an attempt to keep asbestos



Dr. Selikoff: "No matter what we do now, we have this iron, irreversible legacy."

hazards from appearing in the press or professional journals.

Johns-Manville's Markusson denies that there was any cover-up. The company's position, he says, is that it warned workers when any hazard was "reasonably foreseeable." Johns-Manville has progressively lowered its dust levels for its own asbestos workers since the 1940s, but it did not put warning labels on its insulation products, such as those used in shipyards, until Selikoff published the first study of insulation workers in 1964.

Asbestos may cause any of three diseases, which may appear 15 to 40 years after a person is exposed. These include asbestosis, a chronic, debilitating lung disease that reduces the lung's capacity to exchange carbon monoxide for oxygen; lung cancer, concentrated when asbestos exposure is combined with smoking; and two types of mesothelioma, a cancer that affects the membranous linings of the chest and abdomen.

High disease rate. While worker exposure to asbestos is believed to have decreased in recent years, researchers agree that past exposures were high. A 1978 study of 17,800 asbestos insulation workers done by Selikoff and E. Cuyler Hammond, special research consultant for the American Cancer Society, shows that 20% died of lung cancer, 6% to 7% of pleural or peritoneal mesotheliomas, and a significant percentage from stomach and colon-rectum cancer—all higher than would be expected in a normal population sample.

In addition, there are disturbing early results from a study being conducted by the University of Texas Health Center at Tyler, Tex., among 564 people who formerly worked at a Pittsburgh-Corning insulation manufacturing operation which operated near Tyler from 1954 to 1972. Jerry W. McLarty, chief of epidemiology and biomathematics at the center, reports that 19 lung cancer deaths have already occurred instead of the 5 he says would have been expected in a control group. Of the participants still living, 13 are known to have cancer and 37 are suspected of having the disease.

The findings about asbestos-related disease are qualified by the lack of information on workers' smoking habits. Selikoff and Hammond even suggest that lung cancer is uncommon among nonsmoking workers, although there is still a risk of death from asbestosis. Johns-Manville has recognized this link and refuses to hire smokers.

More legislation. By all indications, industry and the government have not seen the last of lawsuits. The $20 million settlement in the Tyler case is being followed by "Tyler II," in which nearly 3,000 people, from former workers to short-time visitors to the Tyler factory, are filing a range of claims. The asbestos industry has endorsed current congressional attempts to create a workers' compensation fund for asbestos-exposed workers. The bills, however, are moving slowly.

While the legislation and litigation grind on, the government continues to try to track down the potential victims of past exposure, and to pinpoint those who may come down with cancer. "Over the next three decades," says Dr. David P. Rall, director of the National Institute for Environmental Health Sciences, "we're talking about hundreds of thousands of people."

tos backing material, which serves as a noise and heat shield while providing additional strength. "We are working very hard to come up with a material to replace" this last bit of asbestos, says Charles M. Brunhofer, director of engineering for Bendix Corp.'s Friction Materials Div.

On drum brakes, there is a problem finding a suitable material that will hold the curved shape that such brake linings require. But Rockwell International Corp., which makes 60% of the brakes used in heavy trucks, says it has a major development effort under way. "We will be in a position [to market non-asbestos brakes] in a reasonable amount of time," claims Leonard C. Buckland, director of engineering and product planning for Rockwell's Highway Brake Div.

Asbestos still is used in shingles and in roofing felt, a component of so-called "built-up" roofing for flat roofs. The National Roofing Contractors Assn. (NRCA) estimates that about 10% of industrial and commercial flat roofs contain asbestos. But the trade group notes that such use of asbestos is declining. In 1978 asbestos felt was used as a fireproofing agent in 16% of roofs, a decline

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from the 24% recorded the previous four years. There are a number of acceptable substitutes for asbestos in built-up roofing, including fiber glass and organic felt, which consists of treated rags and newspapers.

NRCA's general manager, William A. Good, admits that awareness of the environmental problems that may be created by asbestos in buildings is part of the reason its use is falling. A major use of asbestos from World War II through the early 1970s, insulation, has been almost completely eliminated. Asbestos has been almost completely replaced for that use by such substances as calcium silicate, cellular glass, mineral wool, fiber glass, and expanded perlite.

In addition, the EPA has prohibited since 1978 the spraying of asbestos on the walls or ceilings of buildings. The agency's original concern was the exposure of workers and others to the fibers during the spraying process, but the problem of sprayed asbestos, it turns out, is not that ephemeral. The Environmental Defense Fund recently sued the EPA to force it to take action to protect school children attending classes in aging buildings where asbestos insulation was flaking off the walls and ceilings. The EPA now intends to make mandatory its existing voluntary program, which requires school districts to seal in or replace asbestos in such structures. The agency estimates that 10% to 15% of all school buildings contain asbestos.

However, other construction users of asbestos insist that the substance is safe in their applications. Manufacturers of asbestos cement pipe, for instance, claim that their products do not pose a danger to the public because the asbestos is embedded in cement and the pipe is buried 4 ft. to 12 ft. underground. "We think our application of asbestos . . . is safe and that the government feels basically the same way," says William A. Krivsky, senior vice-president of piping products at CertainTeed Corp. But in fact, EPA officials are worried that the asbestos fibers may become loosened by years of rushing water.

Trying glass. While CertainTeed, with $100 million in asbestos cement pipe sales, appears optimistic that any EPA restrictions will not affect its operations, the company is busily studying possible substitutes. Glass fibers normally are attacked by the cement because of its alkalinity, but there is promise in fiber glass specially formulated to be alkali resistant. One such fiber, called Cemfil AR, was developed years ago under license from Britain's National Research & Development Corp., a self-financing public corporation, and has been sold commercially worldwide since 1971 by Pilkington Bros Ltd. Both faster and longer than asbestos fibers, *Cemfil* AR has proved to be a strong reinforcement. And it has not shown any of asbestos' harmful effects, although its inventor, A. J. Majumdar, reports "minor skin complaints."



Steelworker wearing Preox. The high-carbon fiber is an asbestos substitute.

Owens-Corning Fiberglas Corp., a U. S. licensee for the technology, is also working hard on glass as a substitute. "I don't think any one material will universally replace asbestos," says Robert C. Doban, senior vice-president for science and technology. But he is optimistic about glass' potential.

Part of the problem with glass is its tendency to soften at high temperatures; asbestos remains rigid until it reaches its melting point. Therefore, glass could not easily be substituted for the asbestos that is still used to reinforce the concrete sprayed on steelwork in most buildings—a measure taken to prevent the steel from buckling from heat in case of fire.

Smaller companies also are vying for a corner of the asbestos-substitute market. Gentex Corp., of Carbondale, Pa., which manufactures metal-coated fabric for protective garments, recently introduced Preox, a heat-resistant fabric made of stabilized polyacrylonitrile. The fiber, called Celiox and developed by Celanese Corp., has a high carbon content that enables it to resist heat. Protective garments of this sort are worn by firemen and by iron and steel workers to protect them from the splash of molten metal. Eugene Alexandroff, general manager of the Gentex Textile Div., is interested in other applications, too. The company is exploring the possibility of entering the ship construction and maintenance markets, where asbestos is still used to wrap pipes.

Partial substitutes. In Bangor, Mich., American Filler & Abrasives Inc. has been marketing an asbestos substitute called Kay-O-Cel since April. It is made of calcium and clay wastes and other materials and is being tested in brake linings. Company President Edwin F. Neckermann claims that the product is price-competitive with asbestos and should pose no health problems. "All the materials in Kay-O-Cel themselves are recognized as being safe," he says.

Earlier this year, 3M Co. moved to expand marketing of its substitute, Nextel—a cloth made of ceramic fiber that can withstand heat up to 2,600F. The company turned over substantial sales rights to equipment builder Babcock & Wilcox Co., which serves the steel, glass, and utility industries.

"We are seeing many companies, often with full-time corporate engineers working on the problem, coming to us asking if Nextel can be used as an asbestos substitute," says Arlen J. Rivard, sales and marketing manager in 3M's ceramic fibers project. Nextel can be used as high-temperature insulation in and around furnaces, but its relatively high price—$25 a lb. vs. $2 a lb. for fiber glass and less than $1 a lb. for asbestos—makes it an unlikely replacement for asbestos in that application.

Despite the surge in substitute development, it could be a long time before an effective alternative is found for asbestos in all uses. And Johns-Manville, the industry leader, is relying on that while the EPA begins its studies. "If the EPA ban on asbestos goes into effect, that would put us out of the asbestos business," says a JM source. "But there are enough essential uses of asbestos, and the scientific and medical research do not justify a ban." ■

A proposed EPA ban sends shivers through the largely Canadian producers