

the larynx are attributable to asbestos. Although the use of, and exposure to, asbestos is being reduced in this country, the related cancer rate is not expected to decline until the 21st century, because of the latency period.

As with other carcinogens, the greater the amount and duration of the exposure to asbestos, the greater the apparent chances for cancer to develop. But research indicates even relatively brief exposures to asbestos can cause cancer. Occupational mortality studies show high lung-cancer rates in those who worked with asbestos only a few years—and some only a few months—while building ships during World War II.

Usually, the latency period for asbestos-induced lung cancer is 20 or more years; for mesothelioma it is longer. But latency periods of less than five years have been recorded, particularly with heavy exposures to crocidolite, considered more carcinogenic than other asbestos fibers.

Asbestos, from the Greek word for "incombustible," has more than 3,000 commercial uses in this country, primarily for insulation. Asbestos-cement pipe covers more than 200,000 miles across the 50 states. Though use is declining, about 35,000 American workers in the asbestos manufacturing sector still risk direct exposure, while another 2.5 million are potentially exposed in other occupations, according to NIOSH. Asbestos exposure is the most hazardous during operations that circulate the fibers into the immediate air, as in asbestos removal, mining, drilling, cutting, spraying, or when materials containing asbestos begin to decompose.

Along with asbestos manufacturers and fabricators, insulators, asbestos-cement workers, shipbuilders, construction workers performing demolition and renovation work, and auto workers servicing brakes and clutches all are at high risk for contracting asbestos-related cancer. Also, high rates of asbestos-related cancer among families of asbestos workers indicate that even work clothing or other asbestos-contaminated material routinely brought into the home may be hazardous.

Further recognizing the risks posed by asbestos, in 1986 OSHA reduced the 8-hour time-weighted-average (TWA) PEL from 2 fibers per cubic centimeter (f/cc) to 0.2 f/cc. Late last year, OSHA reinforced asbestos protection by mandating that even within the 0.2 TWA, asbestos exposures should not exceed 1 f/cc for any given 30-minute period.

Vinyl Chloride

Angiosarcoma of the liver is an extremely rare affliction. That is why the heads of medical researchers turned so fast when three cases arose from the same vinyl chloride plant in Kentucky 15 years ago.

Subsequently, NIOSH performed follow-up studies on 1,294 workers with five or more years' vinyl chloride exposure from four separate plants. Along with "higher-than-expected" rates for liver cancer, NIOSH also detected high rates of leukemia, and cancers of the brain, central nervous system and respiratory system. (These findings were backed up by similar studies in Europe

and Canada.) The 11 angiosarcoma deaths detected in the study were all linked to heavy exposure to vinyl chloride. The NIOSH study also found that the chances of cancer developing in vinyl chloride workers increased with each passing year after the initial exposure.

In another study, NIOSH examined death certificates for 29,139 former workers at three chemical plants in West Virginia. Twelve liver cancer deaths were reported in those working routinely with vinyl chloride—10 times the number expected in the general population. The survey also found a high correlation between years of exposure and the disease.

Altogether, 1974-84 research on more than 10,000 workers from the United States, Canada, Great Britain and Scandinavia found liver cancer occurring among vinyl chloride workers at nearly five times the expected rate for the general population. Thirty-seven cases were observed, while only seven were expected.

Other studies show elevated cancer rates in those living within a mile of vinyl chloride plants. In a 1970-73 survey of Ohioans (age 45 and older) living in the vicinity of a vinyl chloride plant, the cancer rate among males was nearly twice the expected rate. Twenty-seven were observed with only 14 expected. The same survey also found an increase of congenital abnormalities, especially pertaining to the central nervous system, in babies born in that area.

Vinyl chloride, also known as chloroethylene, is a colorless, pleasant-smelling gas, usually in the form of a cool liquid. It functions as a chemical intermediate and a solvent, and is used primarily in the manufacture of plastics, polyvinyl chloride and other resins. Industries where exposure is likely to be highest include plastics, rubber, polyvinyl-resin manufacture and organic chemical synthesis.

Both the U.S. Environmental Protection Agency (EPA) and the Food and Drug Administration have banned vinyl chloride as an aerosol propellant, eliminating exposure to as many as 5 million Americans. But roughly 3.5 million U.S. workers remain potentially exposed. The OSHA PEL is 1.0 part per million (ppm) for an 8-hour TWA, not to exceed 5 ppm for any 15-minute period. Though cancer risk appears highest with heavy exposures to vinyl chloride, there is as yet no evidence of an exposure level below which no increased cancer risk would occur, according to the IARC.

Exposure occurs mainly through inhalation. Effects of overexposure may resemble mild alcohol intoxicification, including symptoms of lightheadedness and nausea. Vinyl chloride can also be absorbed through the skin. It is a skin irritant and may cause frostbite after evaporation. Vinyl chloride is especially hazardous to the eyes.

Benzene

Benzene, a clear, colorless and highly flammable liquid, is derived from petroleum and is commonly used as a gasoline additive, a chemical intermediate, and formerly was used as a solvent for rubber, plastics, inks, oils, paints and adhesives. It is also used in the