

Table 9-2 Human Diseases Associated with Occupational Exposures

Organ/System	Effect	Toxicant
Cardiovascular system	Heart disease	Carbon monoxide, lead, solvents, cobalt, cadmium
Respiratory system	Nasal cancer Lung cancer Chronic obstructive lung disease Hypersensitivity Irritation Fibrosis	Isopropyl alcohol, wood dust Radon, asbestos, silica, bis(chloromethyl)ether, nickel, arsenic, chromium, mustard gas, uranium Grain dust, coal dust, cadmium Beryllium, isocyanates Ammonia, sulfur oxides, formaldehyde Silica, asbestos, cobalt
Nervous system	Peripheral neuropathies Ataxic gait Central nervous system depression Cataracts	Solvents, acrylamide, methyl chloride, mercury, lead, arsenic, DDT Chlordane, toluene, acrylamide, mercury Alcohols, ketones, aldehydes, solvents Ultraviolet radiation
Urinary system	Renal toxicity Bladder cancer	Mercury, lead, glycol ethers, solvents Naphthylamines, 4-aminobiphenyl, benzidine, rubber products
Reproductive system	Male infertility Female infertility/stillbirths Teratogenesis	Lead, phthalate plasticizers, cadmium Lead, mercury Mercury, polychlorinated biphenyls
Hematopoietic system	Leukemia	Benzene
Skin	Folliculitis and acneiform dermatosis Cancer	Polychlorinated biphenyls, dioxins, herbicides Ultraviolet radiation
Gastrointestinal tract	Liver angiosarcoma	Vinyl chloride

Data from Leigh JP, et al: Occupational injury and illness in the United States. Estimates of costs, morbidity, and mortality, Arch Intern Med 157:1557, 1997; Mitchell FL: Hazardous waste. In Rom WN (ed): Environmental and Occupational Medicine, 2nd ed. Boston, Little, Brown, 1992, p 1275; and Levi PE: Classes of toxic chemicals. In Hodgson E, Levi PE (eds): A Textbook of Modern Toxicology. Stamford, CT, Appleton & Lange, 1997, p 229.

on the list of recommended insecticides for indoor uses in areas in which malaria is endemic. PCB (another banned substance), dioxin, and PBDEs (polybrominated diphenyl ethers used as flame retardants) are also detectable in a large proportion of the U.S. population. Most organochlorines disrupt hormonal balance because of antiestrogenic or antiandrogenic activity.

- *Dioxins* and *PCBs* can cause skin disorders such as folliculitis and a dermatosis known as *chloracne* that is characterized by acne, cyst formation, hyperpigmentation, and hyperkeratosis, generally around the face and behind the ears. These toxins can also cause abnormalities in the liver and CNS. Because PCBs induce CYPs, workers exposed to these substances may show abnormal drug metabolism. Environmental disasters in Japan and China in the late 1960s caused by the consumption of rice oil contaminated by PCBs during its production poisoned about 2000 people in each episode. The primary manifestation of the disease (Yusho in Japan; Yu-Cheng in China) was chloracne and hyperpigmentation of the skin and nails. Aficionados of political intrigues may recall that Viktor Yushenko, a former President of Ukraine, was poisoned by dioxins and suffered severe disfigurement as a result.
- Inhalation of mineral dusts causes chronic, nonneoplastic lung diseases known as *pneumoconioses*. This term also includes diseases induced by organic and inorganic particulates, and chemical fume- and vapor-induced nonneoplastic lung diseases. The most common pneumoconioses are caused by exposures to *coal dust* (e.g., mining of hard coal), *silica* (e.g., sandblasting, stone cutting), *asbestos* (e.g., mining, fabrication, insulation work), and *beryllium* (e.g., mining, fabrication). Exposure to these agents nearly always occurs in the workplace. However, the increased risk of cancer as a result of

asbestos exposure extends to the family members of asbestos workers and to other individuals exposed outside the workplace. Pneumoconioses and their pathogenesis are discussed in Chapter 15.

- Exposure to *vinyl chloride* used in the synthesis of polyvinyl resins leads to the development of angiosarcoma of the liver, an uncommon type of hepatic tumor.
- *Bisphenol A* (BPA) is used in the synthesis of polycarbonate food and water containers and of epoxy resins that line almost all food bottles and cans; as a result, exposure to BPA is virtually ubiquitous in humans. BPA has long been known as a potential endocrine disruptor. Several large retrospective studies have linked elevated urinary BPA levels to heart disease in adult populations. In addition, infants who drink from BPA-containing containers may be particularly susceptible to its endocrine effects. In 2010, Canada was the first country to list BPA as a toxic substance, and the largest makers of baby bottles and “sippy” cups have stopped using BPA in the manufacturing process. The extent of the human health risks associated with BPA remains uncertain, however, and requires further study.

Effects of Tobacco

Smoking is the most readily preventable cause of death in humans. The main culprit is cigarette smoking, but smokeless tobacco (e.g., snuff, chewing tobacco) is also harmful to health and an important cause of oral cancer. The use of tobacco products not only creates personal risks, but passive tobacco inhalation from the environment (“*second-hand smoke*”) can cause lung cancer in non-smokers. Two thirds of smokers live in 10 countries, led by China, which accounts for nearly 30%, and India with about 10%, followed by Indonesia, Russia, the United States, Japan, Brazil, Bangladesh, Germany, and Turkey. In