

## Formaldehyde and Cancer Risk



### What is formaldehyde?

Formaldehyde is a colorless, flammable, strong-smelling chemical that is used in building materials and to produce many household products. It is used in pressed-wood products, such as particleboard, plywood, and fiberboard; glues and adhesives; permanent-press fabrics; paper product coatings; and certain insulation materials. In addition, formaldehyde is commonly used as an industrial fungicide, germicide, and disinfectant, and as a preservative in mortuaries and medical laboratories. Formaldehyde also occurs naturally in the environment. It is produced in small amounts by most living organisms as part of normal metabolic processes.

### How is the general population exposed to formaldehyde?

According to a 1997 report by the U.S. Consumer Product Safety Commission, formaldehyde is normally present in both indoor and outdoor air at low levels, usually less than 0.03 parts of formaldehyde per million parts of air (ppm). Materials containing formaldehyde can release formaldehyde gas or vapor into the air. One source of

formaldehyde exposure in the air is automobile tailpipe emissions.

During the 1970s, urea-formaldehyde foam insulation (UFFI) was used in many homes. However, few homes are now insulated with UFFI. Homes in which UFFI was installed many years ago are not likely to have high formaldehyde levels now. Pressed-wood products containing formaldehyde resins are often a significant source of formaldehyde in homes. Other potential indoor sources of formaldehyde include cigarette smoke and the use of unvented fuel-burning appliances, such as gas stoves, wood-burning stoves, and kerosene heaters.

Industrial workers who produce formaldehyde or formaldehyde-containing products, laboratory technicians, certain health care professionals, and mortuary employees may be exposed to higher levels of formaldehyde than the general public.

### What are the short-term health effects of formaldehyde exposure?

When formaldehyde is present in the air at levels exceeding 0.1 ppm, some individuals may experience adverse effects

such as watery eyes; burning sensations in the eyes, nose, and throat; coughing; wheezing; nausea; and skin irritation. Some people are very sensitive to formaldehyde, whereas others have no reaction to the same level of exposure.

### Can formaldehyde cause cancer?

Although the short-term health effects of formaldehyde exposure are well known, less is known about its potential long-term health effects. In 1980, laboratory studies showed that exposure to formaldehyde could cause nasal cancer in rats. This finding raised the question of whether formaldehyde exposure could also cause cancer in humans. In 1987, the U.S. Environmental Protection Agency (EPA) classified formaldehyde as a probable human carcinogen under conditions of unusually high or prolonged exposure (1). Since that time, some studies of humans have suggested that formaldehyde exposure is associated with certain types of cancer. The International Agency for Research on Cancer (IARC) classifies formaldehyde as a human carcinogen (2). In 2011, the National Toxicology Program, an inter-agency program of the Department of



Health and Human Services, named formaldehyde as a known human carcinogen in its 12th Report on Carcinogens (3).

### What have scientists learned about the relationship between formaldehyde and cancer?

Since the 1980s, the National Cancer Institute (NCI), a component of the National Institutes of Health (NIH), has conducted studies to determine whether there is an association between occupational exposure to formaldehyde and an increase in the risk of cancer. The results of this research have provided EPA and the Occupational Safety and Health Administration (OSHA) with information to evaluate the potential health effects of workplace exposure to formaldehyde.

Several NCI surveys of professionals who are potentially exposed to formaldehyde in their work, such as anatomists and embalmers, have suggested that these individuals are at an increased risk of leukemia and brain cancer compared with the general population. However, specific work practices and exposures were not characterized in these studies. An NCI case-control study among funeral industry workers that characterized exposure to formaldehyde also found an association between increasing formaldehyde exposure and mortality from myeloid leukemia (4).

A number of cohort studies involving workers exposed to formaldehyde have recently been completed. One study, conducted by NCI, looked at 25,619 workers in industries with the potential for occupational formaldehyde exposure and estimated each worker's exposure to the chemical while at work (5). The results showed an increased risk of death

due to leukemia, particularly myeloid leukemia, among workers exposed to formaldehyde. This risk was associated with increasing peak and average levels of exposure, as well as with the duration of exposure, but it was not associated with cumulative exposure. An additional 10 years of data on the same workers were used in a follow-up study published in 2009 (6). This analysis continued to show a possible link between formaldehyde exposure and cancers of the hematopoietic and lymphatic systems, particularly myeloid leukemia. As in the initial study, the risk was highest earlier in the follow-up period. Risks declined steadily over time, such that the cumulative excess risk of myeloid leukemia was no longer statistically significant at the end of the follow-up period. The researchers noted that similar patterns of risks over time had been seen for other agents known to cause leukemia.

Formaldehyde undergoes rapid chemical changes immediately after absorption. Therefore, some scientists think that formaldehyde is unlikely to have effects at sites other than the upper respiratory tract. However, some laboratory studies suggest that formaldehyde may affect the lymphatic and hematopoietic systems. Based on both the epidemiologic data from cohort and case-control studies and the experimental data from laboratory research, NCI investigators have concluded that exposure to formaldehyde may cause leukemia, particularly myeloid leukemia, in humans.

#### Selected References

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**Source:** National Cancer Institute. ■