

Formaldehyde and Cancer: Questions and Answers

Key Points

- Formaldehyde is a colorless, flammable, strong-smelling gas that is used to manufacture building materials and produce many household products (see Question 1).
- Formaldehyde sources in the home include pressed wood products, cigarette smoke, and fuel-burning appliances (see Question 2).
- When exposed to formaldehyde, some individuals may experience various short-term health effects (see Question 3).
- Formaldehyde has been classified as a human carcinogen (cancer-causing substance) by the International Agency for Research on Cancer and as a probable human carcinogen by the U.S. Environmental Protection Agency (see Question 4).
- Research studies of workers exposed to formaldehyde have suggested an association between formaldehyde exposure and cancers of the nasal sinuses, nasopharynx, and brain, and possibly leukemia (see Question 5).

1. What is formaldehyde?

Formaldehyde is a colorless, flammable, strong-smelling gas. It is an important industrial chemical used to manufacture 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.



2. 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. Formaldehyde can also be released by burning wood, kerosene, natural gas, or cigarettes; through automobile emissions; or from natural processes.

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, health care professionals, and mortuary employees may be exposed to higher levels of formaldehyde than the general public. Exposure occurs primarily by inhaling formaldehyde gas or vapor from the air or by absorbing liquids containing formaldehyde through the skin.

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

4. 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 industrial workers have suggested that formaldehyde exposure is associated with nasal cancer and nasopharyngeal cancer, and possibly with leukemia. In 1995, the International Agency for Research on Cancer (IARC) concluded that formaldehyde is a probable human carcinogen. However, in a reevaluation of existing data in June 2004, the IARC reclassified formaldehyde as a known human carcinogen (2).

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

Since 1980, the National Cancer Institute (NCI) 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 the EPA and the Occupational Safety and Health Administration (OSHA) with information to evaluate the potential health effects of workplace exposure to formaldehyde.

Long-term effects of formaldehyde have been evaluated in epidemiological studies (studies that attempt to uncover the patterns and causes of disease in groups of people). One type of study, called a cohort study, looks at populations that have different exposures to a particular factor, such as formaldehyde. A cohort is a group of people who are followed over time to see whether a disease develops. Another kind of study, a case-control study, begins with people diagnosed as having a disease (cases) and compares them to people without the disease (controls).

Several NCI studies have found that anatomists and embalmers, professions with potential exposure to formaldehyde, are at an increased risk for leukemia and brain cancer compared with the general population. In 2003, a number of cohort studies were completed among workers exposed to formaldehyde. One study, conducted by the NCI, analyzed 25,619 workers in formaldehyde industries and estimated each worker's exposure to formaldehyde while at work (3). The analysis found an increased risk of death due to leukemia, particularly myeloid leukemia, among the workers exposed to formaldehyde. This risk was associated with increasing peak and average levels of exposure and the duration of exposure, but not cumulative exposure. Another study of 14,014 textile workers performed by the National Institute for Occupational Safety and Health (NIOSH) also found an association between the duration of exposure to formaldehyde and leukemia deaths. However, an additional cohort study of 11,039 British industry workers found no association between cumulative formaldehyde exposure and leukemia deaths.

Formaldehyde undergoes rapid chemical changes immediately after absorption. Therefore, some scientists think effects of formaldehyde at sites other than the upper respiratory tract are unlikely. However, some laboratory studies suggest that formaldehyde may affect the lymphatic and blood systems. Based on both the epidemiologic data from cohort studies and the experimental data from laboratory research, NCI investigators have concluded that exposure to formaldehyde may cause leukemia, particularly myeloid leukemia, in humans. However, inconsistent results from other studies suggest that further research is needed before definite conclusions are drawn.

Several case-control studies and cohort studies, including analysis of the large NCI cohort, have reported an association between formaldehyde exposure and nasopharyngeal cancer, although others have not. Data from extended follow-up of the NCI study found that the excess of nasopharyngeal cancer observed in the earlier report persisted (4).

Earlier analysis of the NCI cohort found increased lung cancer deaths among industrial workers compared with the general U.S. population. However, the rate of lung cancer deaths did not increase with higher levels of formaldehyde exposure. This observation led the researchers to conclude that factors other than formaldehyde exposure might have caused the increased deaths. New data on lung cancer from the extended follow-up did not find any relationship between formaldehyde exposure and lung cancer mortality.

6. What has been done to protect workers from formaldehyde?

In 1987, OSHA passed a law that reduced the amount of formaldehyde to which workers can be exposed over an 8-hour work day from 3 ppm to 1 ppm. In May 1992, the law was amended, and the formaldehyde exposure limit was further reduced to 0.75 ppm.

7. How can people limit formaldehyde exposure in their homes?

The EPA recommends the use of “exterior-grade” pressed wood products to limit formaldehyde exposure in the home. Before purchasing pressed wood products, including building materials, cabinetry, and furniture, buyers should ask about the formaldehyde content of these products. Formaldehyde levels in homes can also be reduced by ensuring adequate ventilation, moderate temperatures, and reduced humidity levels through the use of air conditioners and dehumidifiers.

8. Where can people find more information about formaldehyde?

The following organizations can provide additional resources that readers may find helpful:

The U.S. Consumer Product Safety Commission (CPSC) has information about household products that contain formaldehyde. The CPSC can be contacted at:

Address: U.S. Consumer Product Safety Commission
4330 East-West Highway
Bethesda, MD 20814-4408
Telephone: 1-800-638-CPSC (1-800-638-2772)
TTY: 1-800-638-8270
E-mail: info@cpsc.gov
Web site: <http://www.cpsc.gov>

The U.S. Food and Drug Administration (FDA) maintains information about cosmetics and drugs that contain formaldehyde. The FDA can be contacted at:

Address: U.S. Food and Drug Administration
5600 Fishers Lane
Rockville, MD 20857-0001
Telephone: 1-888-INFO-FDA (1-888-463-6332)
Web site: <http://www.fda.gov>

The Occupational Safety and Health Administration (OSHA) has information about occupational exposure limits for formaldehyde. OSHA can be contacted at:

Address: U.S. Department of Labor
Occupational Safety and Health Administration
200 Constitution Avenue
Washington, DC 20210
Telephone: 1-800-321-OSHA (1-800-321-6742)
Web site: <http://www.osha.gov>

Selected References

1. U.S. Environmental Protection Agency, Office of Air and Radiation. *Report to Congress on Indoor Air Quality, Volume II: Assessment and Control of Indoor Air Pollution*, 1989.
2. International Agency for Research on Cancer (June 2004). *IARC Classifies Formaldehyde as Carcinogenic to Humans*. Retrieved June 30, 2004, from: http://www.iarc.fr/ENG/Press_Releases/archives/pr153a.html.
3. Hauptmann M, Lubin JH, Stewart PA, Hayes RB, Blair A. Mortality from lymphohematopoietic malignancies among workers in formaldehyde industries. *Journal of the National Cancer Institute* 2003; 95(21): 1615-1623.
4. Hauptmann M, Lubin JH, Stewart PA, Hayes RB, Blair A. Mortality from solid cancers among workers in formaldehyde industries. *American Journal of Epidemiology* 2004; 159(12): 1117-1130.

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Related Resources

Publications (available at <http://www.cancer.gov/publications>)

- *Cancer and the Environment: What You Need To Know, What You Can Do*
- *What You Need To Know About™ Cancer*

National Cancer Institute (NCI) Resources

Cancer Information Service (toll-free)

Telephone: 1-800-4-CANCER (1-800-422-6237)
TTY: 1-800-332-8615

Online

NCI's Web site: <http://www.cancer.gov>

LiveHelp, NCI's live online assistance:

<https://cissecure.nci.nih.gov/livehelp/welcome.asp>

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