Formaldehyde and Cancer Risk

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What is formaldehyde?

Formaldehyde is a common colorless, strong-smelling chemical that is a gas at room temperature. It occurs naturally in the environment, including in some foods (and even inside our bodies), but it is also a widely used chemical in some industries. For example, it is used in making building materials and many household products, including:

- Pressed-wood products, such as particleboard, plywood, and fiberboard
- Glues and adhesives
- Permanent-press fabrics
- Paper product coatings
- Certain insulation materials

When dissolved in water it is called formalin, which is commonly used as an industrial disinfectant and as a preservative in funeral homes and medical labs. It can also be used as a preservative in some products, such as antiseptics, medicines, and cosmetics. Sometimes, even when formaldehyde is not an ingredient in a product, substances that release formaldehyde are. These have been found in cosmetics, soaps, shampoos, lotions and sunscreens, and cleaning products.

While formaldehyde is found naturally in small amounts in some foods (including fruits),
it can also be added as a preservative to food, as well as being produced as a result of cooking and smoking.

Humans and most other living organisms also make small amounts of formaldehyde as part of normal metabolic processes.

**How are people exposed to formaldehyde?**

People can be exposed to formaldehyde by:

- **Inhaling it** (the main way people are exposed)
- **Absorbing it through the skin**
- **Eating foods or drinking liquids containing formaldehyde**

Enzymes in the body break down formaldehyde into formate (formic acid), which can be further broken down into carbon dioxide. Most inhaled formaldehyde is broken down by the cells lining the mouth, nose, throat, and airways, which limits how much is absorbed into the blood.

**Inhaling formaldehyde**

Formaldehyde is normally present at low levels in both indoor and outdoor air, although levels are usually higher indoors. Materials containing formaldehyde can release it as a gas or vapor into the air. Here are some possible sources of exposure:

- **Automobile exhaust** is a major source of formaldehyde in outdoor air.
- **Pressed-wood products** containing formaldehyde resins are often a source of formaldehyde in homes.
- **Using unvented fuel-burning appliances**, such as gas stoves, wood-burning stoves, and kerosene heaters can raise formaldehyde levels indoors.
- **Formaldehyde** is a component of **tobacco smoke**. Both people who smoke and those breathing **secondhand smoke** are exposed to higher levels of formaldehyde.
- **Formaldehyde** and other chemicals that release formaldehyde are sometimes used in low concentrations in **cosmetics and other personal care products** like lotions, shampoos, conditioners, shower gels, and some nail polishes.
- **Professional keratin hair smoothing treatments** can contain formaldehyde or formaldehyde-releasing chemicals. Using these can raise indoor air levels of formaldehyde.
- **During the 1970s**, urea-formaldehyde foam insulation (UFFI) was used in many
homes. But 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.

**Exposure at work**

Workers in industries that make formaldehyde or formaldehyde-containing products, lab technicians, some health care professionals, and funeral home employees may be exposed to higher levels of formaldehyde than the general public. Exposure occurs mainly by inhaling formaldehyde gas or vapor from the air or less often by absorbing liquids containing formaldehyde through the skin.

**Can formaldehyde cause cancer?**

**What studies have found**

Researchers use 2 main types of studies to try to figure out if something causes cancer:

- *Lab studies* (studies done using lab animals or cells in lab dishes)
- *Studies in people*

Exposure to formaldehyde has been shown to cause cancer in lab animals. Exposure to relatively high amounts of formaldehyde in medical and other workplaces has been linked to some types of cancer in humans, but the effect of exposure to small amounts is less clear.

**Studies in the lab**

In rats, inhaled formaldehyde has been linked to cancers inside the nose and to leukemia. Formaldehyde given in drinking water has been linked with an increase in tumors in the stomach and intestines.

Applying formaldehyde to the skin of lab animals has also been linked to quicker development of cancers caused by other chemicals.

**Studies in people**

Some, but not all, studies of people exposed to formaldehyde in the workplace have reported a link between formaldehyde exposure and *cancer of the nasopharynx* (the
upper part of the throat, behind the nose). These studies looked at people who work in places that use or make formaldehyde and formaldehyde resins, as well as at people who work as embalmers.

Studies of people exposed to formaldehyde at work have also found a possible link to cancer of the nasal sinuses.

Several studies have found that embalmers and medical professionals who use formaldehyde have an increased risk of leukemia, particularly myeloid leukemia. Some studies of industrial workers exposed to formaldehyde have also found increased risks of leukemia, but not all studies have shown an increased risk. One study found that workers exposed to formaldehyde had higher than normal levels of chromosome changes in early forms of white blood cells in their bone marrow. This finding supports the possible link between formaldehyde exposure and leukemia.

Studies looking at possible links between workplace exposure to formaldehyde and other types of cancer have not found a consistent link.

What expert agencies say

Several national and international agencies study different substances in the environment to determine if they can cause cancer. (A substance that causes cancer or helps cancer grow is called a carcinogen.) The American Cancer Society looks to these organizations to evaluate the risks based on evidence from lab, animal, and human research studies.

Based on the available evidence, some of these expert agencies have evaluated the cancer-causing potential of formaldehyde.

The International Agency for Research on Cancer (IARC) is part of the World Health Organization (WHO). One of its major goals is to identify causes of cancer. IARC has concluded that formaldehyde is "carcinogenic to humans" based on sufficient evidence it can cause nasopharyngeal cancer and leukemia.

The US National Toxicology Program (NTP) is formed from parts of several different US government agencies, including the National Institutes of Health (NIH), the Centers for Disease Control and Prevention (CDC), and the Food and Drug Administration (FDA). The NTP lists formaldehyde as "known to be a human carcinogen."

The US Environmental Protection Agency (EPA) maintains the Integrated Risk Information System (IRIS), an electronic database that contains information on human health effects from exposure to various substances in the environment. The EPA has
classified formaldehyde as a "probable human carcinogen."

(For more information on the classification systems used by some of these agencies, see Known and Probable Human Carcinogens.)

**Does formaldehyde cause any other health problems?**

When formaldehyde is present in the air at levels higher than 0.1 parts per million (ppm), some people may have health effects, such as:

- Watery eyes
- Burning sensations of the eyes, nose, and throat
- Coughing
- Wheezing
- Nausea
- Skin irritation

Some people are very sensitive to formaldehyde, while others might have no reaction to the same level of exposure.

Formaldehyde in consumer products such as cosmetics and lotions can cause an allergic reaction in the skin (allergic contact dermatitis), which can lead to an itchy, red rash that may become raised or develop blisters.

**How can I limit my exposure to formaldehyde?**

**In the home**

The EPA recommends using "exterior-grade" pressed-wood products to limit formaldehyde exposure in the home. These products give off less formaldehyde because they contain phenol resins, not urea resins. Before buying pressed-wood products, including building materials, cabinetry, and furniture, buyers should ask about the formaldehyde content of these products.

The EPA has issued a rule that all composite wood products (hardwood plywood, medium-density fiberboard, and particleboard) sold in the United States need to be labeled as TSCA Title VI compliant, meaning they have been tested and meet acceptable formaldehyde emission standards.
Formaldehyde levels in homes can also be reduced by not allowing smoking inside and by ensuring adequate ventilation (such as using your stove vent fan), moderate temperatures, and reduced humidity levels through the use of air conditioners and dehumidifiers.

People who are concerned about formaldehyde exposure from personal care products and cosmetics can avoid using products that contain or release formaldehyde. Still, because the amount of formaldehyde released from these products is low, it isn’t clear if this will provide any health benefit.

Formaldehyde can be listed on a product label by many other names, such as:

- Formalin
- Formic aldehyde
- Methanal
- Methyl aldehyde
- Methylene glycol
- Methylene oxide

Some chemicals that are used as preservatives can release formaldehyde, such as:

- Benzylhemiformal
- 2-bromo-2-nitropropane-1,3-diol
- 5-bromo-5-nitro-1,3-dioxane
- Diazolidinyl urea
- 1,3-dimethylol-5,5-dimethylhydantoin (or DMDM hydantoin)
- Imidazolidinyl urea
- Sodium hydroxymethylglycinate
- Quaternium-15

In the workplace

The US Occupational Safety and Health Administration (OSHA) has established limits for the amount of formaldehyde that workers can be exposed to at their place of work. At present the limit is at 0.75 ppm on average over an 8-hour workday. The highest concentration that a worker can be exposed to is 2 ppm, and that can only occur over 15 minutes.

Employers must monitor formaldehyde levels and provide respirators and protective
clothing as needed to limit exposure. This includes any workplace where formaldehyde exposure is likely, including hair salons that use commercial hair smoothing products that release formaldehyde.

References


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