

# FORMALDEHYDE

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## introduction

Formaldehyde is an important chemical used widely by industry to manufacture building materials and numerous household products. It is also a byproduct of combustion and certain other natural processes. Thus, it may be present in substantial concentrations both indoors and outdoors.

Sources of formaldehyde in the home include building materials, smoking, household products, and the use of un vented, fuel burning appliances, like gas stoves or kerosene space heaters. Formaldehyde, by itself or in combination with other chemicals, serves a number of purposes in manufactured products. For example, it is used to add permanent press qualities to clothing and draperies, as a component of glues and adhesives, and as a preservative in some paints and coating products.

In homes, the most significant sources of formaldehyde are likely to be pressed wood products made using adhesives that contain urea formaldehyde (UF) resins. Pressed wood products made for indoor use include: particleboard (used as sub flooring and shelving and in cabinetry and furniture); hardwood plywood paneling (used for decorative wall covering and used in cabinets and furniture); and medium density fiberboard (used for drawer fronts, cabinets, and furniture tops). Medium density fiberboard contains a higher resin to wood ratio than any other UF pressed wood product and is generally recognized as being the highest formaldehyde emitting pressed wood product.

Other pressed wood products, such as softwood plywood and flake or oriented strand board, are produced for exterior construction use and contain the dark, or red/black colored phenol formaldehyde (PF) resin. Although formaldehyde is present in both types of resins, pressed woods that contain PF resin generally emit formaldehyde at considerably lower rates than those containing UF resin.

Since 1985, the Department of Housing and Urban Development (HUD) has permitted only the use of plywood and particleboard that conform to specified formaldehyde emission limits in the construction of prefabricated and mobile homes. In the past, some of these homes had elevated levels of formaldehyde because of the large amount of high emitting pressed wood products used in their construction and because of their relatively small interior space. The rate at which products like pressed wood or textiles release formaldehyde can change. Formaldehyde emissions will generally decrease as products age. When the products are new, high indoor temperatures or humidity can cause increased release of formaldehyde from these products.

During the 1970s, many homeowners had urea formaldehyde foam insulation (UFFI) installed in the wall cavities of their homes as an energy conservation measure. However, many of these homes were found to have relatively high indoor concentrations of formaldehyde soon after the UFFI installation. Few homes are now being insulated with this product. Studies show that

formaldehyde emissions from UFFI decline with time; therefore, homes in which UFFI was installed many years ago are unlikely to have high levels of formaldehyde now.

## Sources of Formaldehyde

Pressed wood products (hardwood plywood wall paneling, particleboard, fiberboard) and furniture made with these pressed wood products. Urea formaldehyde foam insulation (UFFI). Combustion sources and environmental tobacco smoke. Durable press drapes, other textiles, and glues.

Formaldehyde serves many purposes in products. It is used as a part of:

- the glue or adhesive in pressed wood products (particleboard, hardwood plywood, and medium density fiberboard (MDF));
- preservatives in some paints, coatings, and cosmetics;
- the coating that provides permanent press quality to fabrics and draperies;
- the finish used to coat paper products;
- certain insulation materials (urea formaldehyde foam and fiberglass insulation).

Formaldehyde is released into the air by burning wood, kerosene or natural gas, by automobiles, and by cigarettes. Formaldehyde can off gas from materials made with it. It is also a naturally occurring substance.

## What are the Major Sources?

**Urea formaldehyde foam insulation:** During the 1970s, many homeowners installed this insulation to save energy. Many of these homes had high levels of formaldehyde soon afterwards. Sale of urea formaldehyde foam insulation has largely stopped. Formaldehyde released from this product decreases rapidly after the first few months and reaches background levels in a few years. Therefore, urea formaldehyde foam insulation installed 5 to 10 years ago is unlikely to still release formaldehyde.

**Durable press fabrics, draperies and coated paper products:** In the early 1960s, there were several reports of allergic reactions to formaldehyde from durable press fabrics and coated paper products. Such reports have declined in recent years as industry has taken steps to reduce formaldehyde levels. Draperies made of formaldehyde treated durable press fabrics may add slightly to indoor formaldehyde levels.

**Cosmetics, paints, coatings, and some wet strength paper products:** The amount of formaldehyde present in these products is small and is of slight concern. However, persons sensitive to formaldehyde may have allergic reactions.

**Pressed wood products:** Pressed wood products, especially those containing urea formaldehyde glues, are a source of formaldehyde. These products include particleboard used as flooring underlayment, shelves, cabinets, and furniture; hardwood plywood wall panels; and medium

density fiberboard used in drawers, cabinets and furniture. When the surfaces and edges of these products are unlaminated or uncoated they have the potential to release more formaldehyde. Manufacturers have reduced formaldehyde emissions from pressed wood products by 80-90% from the levels of the early 1980's.

**Combustion sources:** Burning materials such as wood, kerosene, cigarettes and natural gas, and operating internal combustion engines (e.g. automobiles), produce small quantities of formaldehyde. Combustion sources add small amounts of formaldehyde to indoor air.

**Carpets or gypsum board:** do not contain significant amounts of formaldehyde when new. They may trap formaldehyde emitted from other sources and later release the formaldehyde into the indoor air when the temperature and humidity change.

## Health Effects

Formaldehyde, a colorless, pungent smelling gas, can cause watery eyes, burning sensations in the eyes and throat, nausea, and difficulty in breathing in some humans exposed at elevated levels (above 0.1 parts per million). High concentrations may trigger attacks in people with asthma. There is evidence that some people can develop a sensitivity to formaldehyde. It has also been shown to cause cancer in animals and may cause cancer in humans. Health effects include eye, nose, and throat irritation; wheezing and coughing; fatigue; skin rash; severe allergic reactions. May cause cancer. May also cause other effects listed under "organic gases." EPA's Integrated Risk Information System profile — <http://www.epa.gov/iris/subst/0419.htm>

### Do You Have Formaldehyde Related Symptoms?

There are several formaldehyde related symptoms, such as watery eyes, runny nose, burning sensation in the eyes, nose, and throat, headaches and fatigue. These symptoms may also occur because of the common cold, the flu or other pollutants that may be present in the indoor air. If these symptoms lessen when you are away from home or office but reappear upon your return, they may be caused by indoor pollutants, including formaldehyde. Examine your environment.

Have you recently moved into a new or different home or office? Have you recently remodeled or installed new cabinets or furniture? Symptoms may be due to formaldehyde exposure.

You should contact your physician and/or state or local health department for help. Your physician can help to determine if the cause of your symptoms is formaldehyde or other pollutants.

### Should You Measure Formaldehyde?

Only trained professionals should measure formaldehyde because they know how to interpret the results. If you become ill, and the illness persists following the purchase of furniture or remodeling with pressed wood products, you might not need to measure formaldehyde. Since these are possible sources, you can take action. You may become ill after painting, sealing, making repairs, and/or applying pest control treatment in your home or office. In such cases,

indoor air pollutants other than formaldehyde may be the cause. If the source is not obvious, you should consult a physician to determine whether or not your symptoms might relate to indoor air quality problems. If your physician believes that you may be sensitive to formaldehyde, you may want to make some measurements. As discussed earlier, many factors can affect the level of formaldehyde on a given day in an office or residence. This is why a professional is best suited to make an accurate measurement of the levels.

Do it yourself formaldehyde measuring devices are available, however these devices can only provide a "ball park" estimate for the formaldehyde level in the area. If you use such a device, carefully follow the instructions.

## How Do You Reduce Formaldehyde Exposure?

Every day you probably use many products that contain formaldehyde. You may not be able to avoid coming in contact with some formaldehyde in your normal daily routine. If you are sensitive to formaldehyde, you will need to avoid many everyday items to reduce symptoms. For most people, a low level exposure to formaldehyde (up to 0.1 ppm) does not produce symptoms. People who suspect they are sensitive to formaldehyde should work closely with a knowledgeable physician to make sure that it is formaldehyde causing their symptoms.

### Tips for avoiding exposure to higher levels

- Purchasing pressed wood products such as particleboard, MDF, or hardwood plywood for construction or remodeling of homes, or for do it yourself projects, that are labeled or stamped to be in conformance with American National Standards Institute (ANSI) criteria.
- Particleboard should be in conformance with ANSI A208.1 1993. For particleboard flooring, look for ANSI grades "PBU", "D2", or "D3" actually stamped on the panel. MDF should be in conformance with ANSI A208.2 1994; and hardwood plywood with ANSI/HPVA HP 1 1994. These standards all specify lower formaldehyde emission levels.
- Purchasing furniture or cabinets that contain a high percentage of panel surface and edges that are laminated or coated. Unlaminated or uncoated (raw) panels of pressed wood products will generally emit more formaldehyde than those that are laminated or coated.
- Using alternative products such as wood panel products not made with urea formaldehyde glues, lumber or metal.
- Avoiding the use of foamed in place insulation containing formaldehyde, especially urea formaldehyde foam insulation.
- Washing durable press fabrics before use.

## How Do You Reduce Existing Formaldehyde Levels?

The choice of methods to reduce formaldehyde is unique to your situation. People who can help you select appropriate methods are your state or local health department, physician, or professional expert in indoor air problems. Here are some of the methods to reduce indoor levels of formaldehyde:

1. Bring large amounts of fresh air into the home. Increase ventilation by opening doors and windows and installing an exhaust fan(s).
2. Seal the surfaces of the formaldehyde containing products that are not already laminated or coated. You may use a vapor barrier such as some paints, varnishes, or a layer of vinyl or polyurethane like materials. Be sure to seal completely, with a material that does not itself contain formaldehyde. Many paints and coatings will emit other VOCs when curing, so be sure to ventilate the area well during and after treatment.
3. Remove from your home the product that is releasing formaldehyde in the indoor air. When other materials in the area such as carpets, gypsum boards, etc., have absorbed formaldehyde, these products may also start releasing it into the air. Overall levels of formaldehyde can be lower if you increase the ventilation over an extended period. One method NOT recommended by CPSC is a chemical treatment with strong ammonia (28-29% ammonia in water) which results in a temporary decrease in formaldehyde levels. We strongly discourage such treatment since ammonia in this strength is extremely dangerous to handle. Ammonia may damage the brass fittings of a natural gas system, adding a fire and explosion danger.

## Why Should You Be Concerned?

Formaldehyde is a colorless, strong smelling gas. When present in the air at levels above 0.1 ppm (parts in a million parts of air), it can cause watery eyes, burning sensations in the eyes, nose and throat, nausea, coughing, chest tightness, wheezing, skin rashes, and allergic reactions.

It also has been observed to cause cancer in scientific studies using laboratory animals and may cause cancer in humans. Typical exposures to humans are much lower; thus any risk of causing cancer is believed to be small at the level at which humans are exposed.

Formaldehyde can affect people differently. Some people are very sensitive to formaldehyde while others may not have any noticeable reaction to the same level.

Persons have developed allergic reactions (allergic skin disease and hives) to formaldehyde through skin contact with solutions of formaldehyde or durable press clothing containing formaldehyde. Others have developed asthmatic reactions and skin rashes from exposure to formaldehyde.

Formaldehyde is just one of several gases present indoors that may cause illnesses. Many of these gases, as well as colds and flu, cause similar symptoms.

## Levels in Homes

Average concentrations in older homes without UFFI are generally well below 0.1 (ppm). In homes with significant amounts of new pressed wood products, levels can be greater than 0.3 ppm.

## What Levels of Formaldehyde Are Normal?

Formaldehyde is normally present at low levels, usually less than 0.03 ppm, in both outdoor and indoor air. The outdoor air in rural areas has lower concentrations while urban areas have higher concentrations.

Residences or offices that contain products that release formaldehyde to the air can have formaldehyde levels of greater than 0.03 ppm. Products that may add formaldehyde to the air include particleboard used as flooring underlayment, shelving, furniture and cabinets; MDF in cabinets and furniture; hardwood plywood wall panels, and urea formaldehyde foam used as insulation. As formaldehyde levels increase, illness or discomfort is more likely to occur and may be more serious.

Efforts have been made by both the government and industry to reduce exposure to formaldehyde. CPSC voted to ban urea formaldehyde foam insulation in 1982. That ban was over turned in the courts, but this action greatly reduced the residential use of the insulation product. CPSC, the Department of Housing and Urban Development (HUD) and other federal agencies have historically worked with the pressed wood industry to further reduce the release of the chemical from their products. A 1985 HUD regulation covering the use of pressed wood products in manufactured housing was designed to ensure that indoor levels are below 0.4 ppm. However, it would be unrealistic to expect to completely remove formaldehyde from the air. Some persons who are extremely sensitive to formaldehyde may need to reduce or stop using these products.

## What Affects Formaldehyde Levels?

Formaldehyde levels in the indoor air depend mainly on what is releasing the formaldehyde (the source), the temperature, the humidity, and the air exchange rate (the amount of outdoor air entering or leaving the indoor area). Increasing the flow of outdoor air to the inside decreases the formaldehyde levels. Decreasing this flow of outdoor air by sealing the residence or office increases the formaldehyde level in the indoor air.

As the temperature rises, more formaldehyde is emitted from the product. The reverse is also true; less formaldehyde is emitted at lower temperature. Humidity also affects the release of formaldehyde from the product. As humidity rises more formaldehyde is released. The formaldehyde levels in a residence change with the season and from day to day and day to night. Levels may be high on a hot and humid day and low on a cool, dry day.

Understanding these factors is important when you consider measuring the levels of formaldehyde. Some sources such as pressed wood products containing ureaformaldehyde glues, urea formaldehyde foam insulation, durable press fabrics, and draperies release more formaldehyde when new. As they age, the formaldehyde release decreases.

## Steps to Reduce Exposure

- Use "exterior grade" pressed wood products (lower emitting because they contain phenol resins, not urea resins).
- Use air conditioning and dehumidifiers to maintain moderate temperature and reduce humidity levels.
- Increase ventilation, particularly after bringing new sources of formaldehyde into the home.

## Additional Resources

**[An Update on Formaldehyde](#)**: 1997 Revision (CPSC document #725). **[U.S. Consumer Product Safety Commission](#)**

The **U.S. Consumer Safety Commission** has produced this booklet to tell you about formaldehyde found in the indoor air. This booklet tells you where you may come in contact with formaldehyde, how it may affect your health, and how you might reduce your exposure to formaldehyde.

**[Indoor Air Quality Guideline Formaldehyde in the Home](#)**  
**State of California Air Resource Board**, #1, September 1991.

**National Cancer Institute** Fact Sheet "Formaldehyde and Cancer: Questions and Answers" **[http://cis.nci.nih.gov/fact/3\\_8.htm](http://cis.nci.nih.gov/fact/3_8.htm)**

**Occupational Safety and Health Administration's** fact sheet on Formaldehyde  
**[www.osha.gov/SLTC/formaldehyde/](http://www.osha.gov/SLTC/formaldehyde/)**

**The National Safety Council's** Environmental Health Center **[fact sheet on Formaldehyde](#)**

### **[American Lung Association](#)**

1740 Broadway  
New York, NY 10019 4374  
(local ALA offices also have information)