

## 1. PUBLIC HEALTH STATEMENT

This public health statement tells you about formaldehyde and the effects of exposure.

The Environmental Protection Agency (EPA) identifies the most serious hazardous waste sites in the nation. These sites make up the National Priorities List (NPL) and are the sites targeted for long-term federal cleanup activities. Formaldehyde has been found in at least 26 of the 1,428 current or former NPL sites. However, it's unknown how many NPL sites have been evaluated for this substance. As more sites are evaluated, the sites with formaldehyde may increase. This is important because exposure to this substance may harm you and because these sites may be sources of exposure.

When a substance is released from a large area, such as an industrial plant, or from a container, such as a drum or bottle, it enters the environment. This release does not always lead to exposure. You are exposed to a substance only when you come in contact with it. You may be exposed by breathing, eating, or drinking the substance or by skin contact.

If you are exposed to formaldehyde, many factors determine whether you'll be harmed. These factors include the dose (how much), the duration (how long), and how you come in contact with it. You must also consider the other chemicals you're exposed to and your age, sex, diet, family traits, lifestyle, and state of health.

### 1.1 WHAT IS FORMALDEHYDE?

Formaldehyde is a colorless, flammable gas at room temperature. It has a pungent, distinct odor and may cause a burning sensation to the eyes, nose, and lungs at high concentrations. Formaldehyde is also known as methanal, methylene oxide, oxymethylene, methylaldehyde, and oxomethane. Formaldehyde can react with many other chemicals, and it will break down into methanol (wood alcohol) and carbon monoxide at very high temperatures.

Formaldehyde is naturally produced in very small amounts in our bodies as a part of our normal, everyday metabolism and causes us no harm. It can also be found in the air that we breathe at home and at work, in the food we eat, and in some products that we put on our skin. A major source of formaldehyde that we breathe every day is found in smog in the lower atmosphere. Automobile exhaust

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from cars without catalytic converters or those using oxygenated gasoline also contain formaldehyde. At home, formaldehyde is produced by cigarettes and other tobacco products, gas cookers, and open fireplaces. It is also used as a preservative in some foods, such as some types of Italian cheeses, dried foods, and fish. Formaldehyde is found in many products used every day around the house, such as antiseptics, medicines, cosmetics, dish-washing liquids, fabric softeners, shoe-care agents, carpet cleaners, glues and adhesives, lacquers, paper, plastics, and some types of wood products. Some people are exposed to higher levels of formaldehyde if they live in a new mobile home, as formaldehyde is given off as a gas from the manufactured wood products used in these homes.

Formaldehyde is used in many industries. It is used in the production of fertilizer, paper, plywood, and urea-formaldehyde resins. It is present in the air in iron foundries. It is also used in the production of cosmetics and sugar, in well-drilling fluids, in agriculture as a preservative for grains and seed dressings, in the rubber industry in the production of latex, in leather tanning, in wood preservation, and in photographic film production. Formaldehyde is combined with methanol and buffers to make embalming fluid. Formaldehyde is also used in many hospitals and laboratories to preserve tissue specimens.

### **1.2 WHAT HAPPENS TO FORMALDEHYDE WHEN IT ENTERS THE ENVIRONMENT?**

Most of the formaldehyde you are exposed to in the environment is in the air. Formaldehyde dissolves easily in water, but it does not last a long time in water and is not commonly found in drinking water supplies. Most formaldehyde in the air also breaks down during the day. The breakdown products of formaldehyde in air include formic acid and carbon monoxide. Formaldehyde does not seem to build up in plants and animals, and although formaldehyde is found in some food, it is not found in large amounts. You will find more information about where formaldehyde comes from, how it behaves, and how long it remains in the environment in Chapter 5.

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**1.3 HOW MIGHT I BE EXPOSED TO FORMALDEHYDE?**

You are exposed to small amounts of formaldehyde in the air. It occurs from both natural and man made sources although combustion is the largest source. If you live in an unpopulated area, you may be exposed to about 0.2 parts per billion (ppb) of formaldehyde in the air outdoors. In suburban areas, you may be exposed to about 2–6 ppb of formaldehyde. If you live in a heavily populated area or near some industries, you may be exposed to 10–20 ppb. You may also be exposed to higher levels of formaldehyde during rush hour commutes in highly populated areas because it is formed in automobile and truck exhaust.

There is usually more formaldehyde present indoors than outdoors. Formaldehyde is released to the air from many home products and you may breath in formaldehyde while using these products. Latex paint, fingernail hardener, and fingernail polish release a large amount of formaldehyde to the air. Plywood and particle board, as well as furniture and cabinets made from them, fiberglass products, new carpets, decorative laminates, and some permanent press fabrics give off a moderate amount of formaldehyde. Some paper products, such as grocery bags and paper towels, give off small amounts of formaldehyde. Because these products contain formaldehyde, you may also be exposed on the skin by touching or coming in direct contact with them. You may also be exposed to small amounts of formaldehyde in the food you eat. You are not likely to be exposed to formaldehyde in the water you drink because it does not last a long time in water.

Many other home products contain and give off formaldehyde although the amount has not been carefully measured. These products include household cleaners, carpet cleaners, disinfectants, cosmetics, medicines, fabric softeners, glues, lacquers, and antiseptics. You may also breath formaldehyde if you use unvented gas or kerosene heaters indoors or if you or someone else smokes a cigar, cigarette, or pipe indoors. The amount of formaldehyde in mobile homes is usually higher than it is in conventional homes because of their lower air turnover.

People who work at or near chemical plants that make or use formaldehyde can be exposed to higher than normal amounts of formaldehyde. Doctors, nurses, dentists, veterinarians, pathologists, embalmers, workers in the clothing industry or in furniture factories, and teachers and students who handle preserved specimens in laboratories also might be exposed to higher amounts of formaldehyde. The National

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Institute for Occupational Safety and Health (NIOSH) estimates that 1,329,332 individuals in the United States have had the potential for occupational exposure to formaldehyde.

### **1.4 HOW CAN FORMALDEHYDE ENTER AND LEAVE MY BODY?**

Formaldehyde can enter your body after you breath it in, drink or eat it, or when it comes in contact with your skin. Formaldehyde is quickly absorbed from the nose and the upper part of your lungs. When formaldehyde is eaten and drunk, it is also very quickly absorbed. Very small amounts are probably absorbed from formaldehyde that comes in contact with your skin. Once absorbed, formaldehyde is very quickly broken down. Almost every tissue in the body has the ability to break down formaldehyde. It is usually converted to a non-toxic chemical called formate, which is excreted in the urine. Formaldehyde can also be converted to carbon dioxide and breathed out of the body. It can also be broken down so the body can use it to make larger molecules needed in your tissues, or it can attach to deoxyribonucleic acid (DNA) or to protein in your body. Formaldehyde is not stored in fat.

### **1.5 HOW CAN FORMALDEHYDE AFFECT MY HEALTH?**

Formaldehyde is irritating to tissues when it comes into direct contact with them. Some people are more sensitive to the effects of formaldehyde than others. The most common symptoms include irritation of the eyes, nose, and throat, along with increased tearing, which occurs at air concentrations of about 0.4–3 parts per million (ppm). NIOSH states that formaldehyde is immediately dangerous to life and health at 20 ppm. One large study of people with asthma found that they may be more sensitive to the effects of inhaled formaldehyde than other people; however, many studies show that they are not more sensitive. Severe pain, vomiting, coma, and possible death can occur after drinking large amounts of formaldehyde. Skin can become irritated if it comes into contact with a strong solution of formaldehyde.

To protect the public from the harmful effects of toxic chemicals and to find ways to treat people who have been harmed, scientists use many tests.

One way to see if a chemical will hurt people is to learn how the chemical is absorbed, used, and released by the body; for some chemicals, animal testing may be necessary. Animal testing may also be used to identify health effects such as cancer or birth defects. Without laboratory animals, scientists would lose a basic method to get information needed to make wise decisions to protect public health. Scientists have

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the responsibility to treat research animals with care and compassion. Laws today protect the welfare of research animals, and scientists must comply with strict animal care guidelines.

Several studies of laboratory rats exposed for life to high amounts of formaldehyde in air found that the rats developed nose cancer. Some studies of humans exposed to lower amounts of formaldehyde in workplace air found more cases of cancer of the nose and throat (nasopharyngeal cancer) than expected, but other studies have not found nasopharyngeal cancer in other groups of workers exposed to formaldehyde in air. The Department of Health and Human Services (DHHS) has determined that formaldehyde may reasonably be anticipated to be a human carcinogen (NTP). The International Agency for Research on Cancer (IARC) has determined that formaldehyde is probably carcinogenic to humans. This determination was based on specific judgements that there is limited evidence in humans and sufficient evidence in laboratory animals that formaldehyde can cause cancer. The Environmental Protection Agency (EPA) has determined that formaldehyde is a probable human carcinogen based on limited evidence in humans and sufficient evidence in laboratory animals. More information on the health effects of formaldehyde can be found in Chapter 2.

### **1.6 HOW CAN FORMALDEHYDE AFFECT CHILDREN?**

This section discusses potential health effects from exposures during the period from conception to maturity at 18 years of age in humans. Potential effects on children resulting from exposures of the parents are also considered.

Children and adults are likely to be exposed to formaldehyde in the same way. The most common way for children to be exposed to formaldehyde is by breathing it. Children may also be exposed by wearing some types of new clothes or cosmetics. A small number of studies have looked at the health effects of formaldehyde in children. It is very likely that breathing formaldehyde will result in nose and eye irritation (burning feeling, itchy, tearing, and sore throat). We do not know if the irritation would occur at lower concentrations in children than in adults. Studies in animals suggest that formaldehyde will not cause birth defects in humans. Inhaled formaldehyde or formaldehyde applied to the skin is not likely to be transferred from mother to child in breast milk or to reach the developing fetus.

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**1.7 HOW CAN FAMILIES REDUCE THE RISK OF EXPOSURE TO FORMALDEHYDE?**

If your doctor finds that you have been exposed to significant amounts of formaldehyde, ask if children may also be exposed. When necessary your doctor may need to ask your state department of public health to investigate.

Formaldehyde is usually found in the air. Formaldehyde levels are also higher indoors than outdoors. Opening windows or using a fan to bring in fresh air is the easiest way to lower formaldehyde levels in the home and reduce the risk of exposure to your family.

Removing formaldehyde sources from the house will also reduce the risk of exposure. Since formaldehyde is found in tobacco smoke, not smoking or smoking outside will reduce exposure to formaldehyde. Unvented heaters, such as portable kerosene heaters, also produce formaldehyde. If you do not use these heaters in your home or shop, you help to prevent the build up of formaldehyde indoors.

Formaldehyde is found in small amounts in many consumer products including antiseptics, medicines, dish-washing liquids, fabric softeners, shoe-care agents, carpet cleaners, glues, adhesives, and lacquers. If you or a member of your family uses these products, providing fresh outdoor air when you use them, this will reduce your exposure to formaldehyde. Some cosmetics, such as nail hardeners, have very high levels of formaldehyde. If you do not use these products in a small room, or if you have plenty of ventilation when you use them, you will reduce your exposure to formaldehyde. If your children are not in the room when you use these products, you will also reduce their exposure to formaldehyde.

Formaldehyde is emitted from some wood products such as plywood and particle board, especially when they are new. The amount of formaldehyde released from them decreases slowly over a few months. If you put these materials in your house, or buy furniture or cabinets made from them, opening a window will lower formaldehyde in the house. The amount of formaldehyde emitted to the house will be less if the wood product is covered with plastic laminate or coated on all sides. If it is not, sealing the unfinished sides will help to lower the amount of formaldehyde that is given off.

Some permanent press fabrics emit formaldehyde. Washing these new clothes before use will usually lower the amount of formaldehyde and reduce your family's risk of exposure.

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**1.8 IS THERE A MEDICAL TEST TO DETERMINE WHETHER I HAVE BEEN EXPOSED TO FORMALDEHYDE?**

We have no reliable test to determine how much formaldehyde you have been exposed to or whether you will experience any harmful health effects.

More information about medical tests for formaldehyde can be found in Chapter 2.

**1.9 WHAT RECOMMENDATIONS HAS THE FEDERAL GOVERNMENT MADE TO PROTECT HUMAN HEALTH?**

The federal government develops regulations and recommendations to protect public health. Regulations can be enforced by law. Federal agencies that develop regulations for toxic substances include the EPA, the Occupational Safety and Health Administration (OSHA), and the Food and Drug Administration (FDA). Recommendations provide valuable guidelines to protect public health but cannot be enforced by law. Federal organizations that develop recommendations for toxic substances include the Agency for Toxic Substances and Disease Registry (ATSDR) and the NIOSH.

Regulations and recommendations can be expressed in not-to-exceed levels in air, water, soil, or food that are usually based on levels that affect animals, then they are adjusted to help protect people. Sometimes these not-to-exceed levels differ among federal organizations because of different exposure times (an 8-hour workday or a 24-hour day), the use of different animal studies, or other factors.

Recommendations and regulations are also periodically updated as more information becomes available. For the most current information, check with the federal agency or organization that provides it. Some regulations and recommendations for formaldehyde include the following:

Several international, national, and state authorities have established regulations or guidelines for the use and production of formaldehyde. OSHA has established the permissible exposure limit (PEL) 8-hour time-weighted average (TWA) at 0.75 ppm and the 15-minute Short-Term Exposure Limit (STEL) at 2 ppm. The EPA sets regulations for reporting quantities used and how much formaldehyde can legally be produced from automobile exhaust; the FDA also has regulations about the use of formaldehyde in the food you eat.

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Non-enforceable guidelines have also been established for formaldehyde. The American Conference of Governmental and Industrial Hygienists (ACGIH) has established a ceiling limit for occupational exposure (Threshold Limit Value [TLV]) of 0.4 ppm. NIOSH has a recommended exposure limit for occupational exposure (8-hour TWA) of 0.016 ppm, and a 15-minute ceiling limit of 0.1 ppm.

More information about the federal and state regulations and guidelines for formaldehyde can be found in Chapter 7.

**1.10 WHERE CAN I GET MORE INFORMATION?**

If you have any more questions or concerns, please contact your community or state health or environmental quality department or

Agency for Toxic Substances and Disease Registry  
Division of Toxicology  
1600 Clifton Road NE, Mailstop E-29  
Atlanta, GA 30333

\* Information line and technical assistance

Phone: (800) 447-1544  
Fax: (404) 639-6359

ATSDR can also tell you the location of occupational and environmental health clinics. These clinics specialize in recognizing, evaluating, and treating illnesses resulting from exposure to hazardous substances.

\* To order toxicological profiles, contact

National Technical Information Service  
5285 Port Royal Road  
Springfield, VA 22161  
Phone: (800) 553-6847 or (703) 487-4650