

Benzene and Cancer Risk

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What is benzene?

Benzene is a colorless, flammable liquid with a sweet odor. It evaporates quickly when exposed to air. Benzene is formed from natural processes, such as volcanoes and forest fires, but most people are exposed to benzene through human activities.

Benzene is one of the 20 most widely used chemicals in the United States. It is used mainly to make other chemicals, including plastics, resins, lubricants, rubbers, dyes, detergents, drugs, and pesticides. In the past it was also commonly used as an industrial solvent (a substance that can dissolve or extract other substances) and as a gasoline additive, but these uses have been greatly reduced in recent decades.

Benzene is also a natural part of crude oil and gasoline (and therefore motor vehicle exhaust), as well as [cigarette smoke](#)¹.

How are people exposed to benzene?

People are exposed mainly by breathing in air containing benzene. Benzene can also be absorbed through the skin during contact with a source such as gasoline, but

because liquid benzene evaporates quickly, this is less common.

People can be exposed to benzene:

- At work
- In the environment
- When using some consumer products

The highest levels of exposure typically have been in the workplace, although high-level exposures have decreased greatly over the last several decades due to federal and state regulations.

Workplace exposures

Workers in industries that make or use benzene can be exposed to this chemical. These include the rubber industry, oil refineries, chemical plants, shoe manufacturers, and gasoline-related industries. Other people who may be exposed to benzene at work include steel workers, printers, lab technicians, gas station employees, and firefighters.

Federal regulations limit exposure to benzene in the workplace (see below).

Community exposures

People can be exposed to benzene from gasoline fumes, automobile exhaust, emissions from some factories, and wastewater from certain industries. Benzene is commonly found in air, but the levels in most places are usually very low. Levels of benzene can be higher in enclosed spaces with unventilated fumes from gasoline, glues, solvents, paints, and art supplies. Areas with heavy traffic, gas stations, and areas near industrial sources may also have higher air levels.

Cigarette smoke (either from smoking yourself or from [secondhand smoke](#)²) accounts for about half of the exposure to benzene in the United States. Benzene levels in rooms containing tobacco smoke can be many times higher than normal.

People can also be exposed to benzene in contaminated drinking water and some foods (although the levels are usually very low).

Does benzene cause cancer?

Exposure to benzene has been linked with a higher risk of cancer,

particularly [leukemia](#)³ and other cancers of blood cells.

What do studies show?

Researchers try to determine if a substance causes cancer using 2 main types of studies:

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

Often neither type of study provides conclusive evidence on its own, so researchers usually look at both human and lab-based studies when trying to figure out if something causes cancer.

Studies in people

Rates of [leukemia](#)⁴, particularly acute myeloid leukemia (AML), have been found to be higher in studies of workers exposed to high levels of benzene, such as those in the chemical, shoemaking, and oil refining industries.

Some studies have also suggested links to childhood leukemia (particularly AML) as well as acute lymphocytic leukemia (ALL), chronic lymphocytic leukemia (CLL), and other blood-related cancers (such as [multiple myeloma](#)⁵ and [non-Hodgkin lymphoma](#)⁶) in adults. However, the evidence is not as strong for these cancers.

There is much less evidence linking benzene to any other type of cancer.

Lab studies

When inhaled or swallowed, benzene has been found to cause different types of tumors in lab animals such as rats and mice. These results support the finding of an excess risk of leukemia in humans. However, most studies in people have not found an increased risk of cancers other than leukemia among those with higher exposures.

Benzene has been shown to cause chromosome changes in bone marrow cells in the lab. (The bone marrow is where new blood cells are made.) Such changes are commonly found in human leukemia cells.

What expert agencies say

Several national and international agencies study 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 the available evidence.**

Based on animal and human evidence, several expert agencies have evaluated the cancer-causing potential of benzene.

The **International Agency for Research on Cancer (IARC)** is part of the World Health Organization (WHO). One of its goals is to identify causes of cancer. IARC classifies benzene as “carcinogenic to humans,” based on sufficient evidence that it causes acute myeloid leukemia (AML). IARC also notes that benzene exposure has been linked with acute lymphocytic leukemia (ALL), chronic lymphocytic leukemia (CLL), multiple myeloma, and non-Hodgkin lymphoma.

The **US National Toxicology Program (NTP)** is an interagency program that includes the National Institutes of Health (NIH), the Centers for Disease Control and Prevention (CDC), and the Food and Drug Administration (FDA). The NTP has classified benzene as “known to be a human carcinogen.”

The **US Environmental Protection Agency (EPA)** maintains the Integrated Risk Information System (IRIS), an electronic database of human health effects from exposure to various substances in the environment. The EPA classifies benzene as a known human carcinogen.

(For more information on the classification systems used by these agencies, see [Determining if Something Is a Carcinogen⁷](#) and [Known and Probable Human Carcinogens⁸](#).)

Does benzene cause any other health problems?

Benzene is a potentially dangerous chemical. High levels of exposure can cause both short-term and long-term health effects.

Short-term effects

Breathing in high doses of benzene can affect the nervous system, which can lead to drowsiness, dizziness, headaches, tremors, confusion, and/or unconsciousness. Eating foods or drinking fluids contaminated with high levels of benzene can cause vomiting, stomach irritation, dizziness, sleepiness, convulsions, and rapid heart rate. In extreme cases, inhaling or swallowing very high levels of benzene can be deadly.

Exposure to benzene liquid or vapor can irritate the skin, eyes, and throat. If benzene touches the skin, it can result in redness and blisters.

Long-term effects

Long-term exposure to benzene mainly harms the bone marrow, the soft, inner parts of bones where new blood cells are made. This can result in:

- Anemia (a low red blood cell count), which can cause a person to feel weak and tired.
- A low white blood cell count, which can lower the body's ability to fight infections and might even be life-threatening.
- A low blood platelet count, which can lead to excess bruising and bleeding.

There is also some evidence that long-term exposure to benzene might harm reproductive organs. Some women who have breathed in high levels of benzene for many months have had irregular menstrual periods and ovary shrinkage, but it is not known for sure if benzene caused these effects. It is not known if benzene exposure affects fertility in men.

Are benzene levels regulated?

Several US government agencies regulate benzene levels and exposures.

The Occupational Safety & Health Administration (OSHA) is the federal agency responsible for health and safety regulations in most workplaces. OSHA limits exposure to benzene in the air in most workplaces to 1 ppm (part per million) during an average workday and a maximum of 5 ppm over any 15-minute period. When working at potentially higher exposure levels, OSHA requires employers to provide personal protective equipment such as respirators.

The EPA limits the percentage of benzene allowed in gasoline to a yearly average of 0.62% by volume (with a maximum of 1.3%).

The EPA limits concentrations of benzene in drinking water to 5 ppb (parts per billion). Some states may have lower limits. Likewise, the US Food and Drug Administration (FDA) sets a limit of 5 ppb in bottled water.

The Consumer Product Safety Commission (CPSC) considers any product containing 5% or more by weight of benzene to be hazardous, requiring special labeling.

Can I avoid or limit my exposure to benzene?

It might not be possible to avoid benzene completely. But if you are concerned about benzene, you can limit your exposure in several ways .

Stay away from cigarette smoke. If you smoke, it's important to [try to quit](#)⁹. It's also important to avoid secondhand smoke. Cigarette smoke is a major source of exposure to benzene, as well as some other harmful chemicals.

Pump gas carefully and use gas stations with vapor recovery systems that capture the fumes. Avoid skin contact with gasoline.

When possible, **limit the time you spend near idling car engines**. This can help lower your exposure to exhaust fumes, which contain benzene (as well as other potentially harmful chemicals).

Use common sense around any chemicals that might contain benzene. Limit or avoid exposure to fumes from solvents, paints, and art supplies, especially in unventilated spaces.

If you are exposed to benzene at your workplace, **talk to your employer about limiting your exposure** through process changes (such as replacing the benzene with another solvent or enclosing the benzene source) or by using personal protective equipment. If needed, you can also contact the Occupational Safety & Health Administration (OSHA), which can provide more information or assistance.

What should I do if I've been exposed to benzene?

For short-term exposure to high levels of benzene, the Centers for Disease Control and Prevention (CDC) recommends getting away from the source of benzene, removing any clothing that may have benzene on it, washing exposed areas with soap and water, and getting medical care as soon as possible.

If you think you may have been exposed to benzene over a long period of time, talk to a doctor. Benzene can be measured in the blood or breath, and breakdown products of benzene can be measured in urine. These tests can only detect recent exposures to benzene. They can't reliably show how much benzene you've been exposed to, nor can they predict possible health effects.

Hyperlinks

1. www.cancer.org/cancer/risk-prevention/tobacco.html
2. www.cancer.org/cancer/risk-prevention/tobacco/health-risks-of-tobacco/secondhand-smoke.html
3. www.cancer.org/cancer/types/leukemia.html
4. www.cancer.org/cancer/types/leukemia.html
5. www.cancer.org/cancer/types/multiple-myeloma.html
6. www.cancer.org/cancer/types/non-hodgkin-lymphoma.html
7. www.cancer.org/cancer/risk-prevention/understanding-cancer-risk/determining-if-something-is-a-carcinogen.html
8. www.cancer.org/cancer/risk-prevention/understanding-cancer-risk/known-and-probable-human-carcinogens.html
9. www.cancer.org/cancer/risk-prevention/tobacco/guide-quitting-smoking.html

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