

September 2002  
Number 99

*Persistent, Bioaccumulative and Toxic Chemicals*

## Phenol

### What are PBT chemicals?

Persistent, bioaccumulative and toxic (PBT) chemicals do not readily break down in the environment, are not easily metabolized, may accumulate in human or ecological food chains through consumption or uptake and may be hazardous to human health or the environment. A PBT chemical, once released to the environment, may present increasing long-term toxic effects to human health and the environment, even if the release was of a small amount. The U.S. Environmental Protection Agency (U.S. EPA) has created a priority in its hazardous waste minimization program to reduce the presence of PBT chemicals, promote pollution prevention and avoid the transfer of PBT chemicals across environmental media.

Phenol is a high-priority PBT chemical.

### What is the adverse effect of phenol?

A number of effects from breathing phenol in air have been reported in humans. Short-term effects include respiratory irritation, headaches and burning eyes. Chronic effects of high exposures include weakness, muscle pain, anorexia, weight loss and fatigue. Effects of chronic low-level exposures include increases in respiratory cancer, heart disease and effects on the immune system. Virtually all of the workplace exposures associated with these effects involve exposures to other chemicals as well. It is difficult to determine whether these effects are solely due to phenol, or are the result of mixed, multiple, or other chemical exposures.

Pure **phenol** is a colorless-to-white solid. The commercial product containing some water is a liquid. It has a distinct sickeningly sweet and tarry odor. Phenol is used in the production of phenolic resins, nylon, polycarbonate, epoxy and medicinal preparations. Breathing phenol can cause respiratory irritation, headaches and burning eyes. Chronic effects include weakness, muscle pain, anorexia, diarrhea, liver damage, weight loss and increases in respiratory cancer, heart disease and immunological impairment. Ingestion of or skin contact with very high concentrations of phenol has resulted in death. Phenol usage and pollution should be reduced wherever possible.

In 1999, Ohio's hazardous waste program-regulated facilities reported generating 13 million pounds of phenol in waste.

Repeated exposure to low levels of phenol in drinking water has been associated with diarrhea and mouth sores in humans. Ingestion of very high concentrations of phenol has resulted in death.

People who have had skin exposure to phenol experienced liver damage, diarrhea, dark urine and red blood cell destruction. Skin exposure to a relatively small amount of concentrated phenol has resulted in the death of humans.

It is not known if phenol alone causes cancer in humans. Cancer has been shown to occur in mice when phenol was applied to the skin several times each week during the lifetime of the animal. When it is applied in combination with certain cancer-causing chemicals, a higher rate of cancer occurs than when the carcinogens are applied alone. Phenol did not cause cancer in mice or rats when they drank water containing phenol for two years.

Phenol can have beneficial effects when used for medical reasons. It is an antiseptic (kills germs) when

applied to the skin in small amounts and may have antiseptic properties when gargled as a mouthwash. It is an anesthetic (relieves pain) and is a component of certain sore throat lozenges and throat sprays or gargles. Small amounts of phenol in water have been injected into nerve tissue to lessen pain associated with certain nerve disorders. Phenol destroys the outer layers of skin if allowed to remain in contact with skin. Small, concentrated solutions of phenol are sometimes applied to the skin to remove warts and to treat other skin blemishes and disorders.

Children are at greater risk than adults of accidentally ingesting some phenol-containing home products. In the case of one product, a disinfectant containing 26 percent phenol, children under the age of five represented 75 percent of the poisoning cases associated with this product reported to a major poison control center between 1987–1991.

The effects of exposure to phenol on the human reproduction and fetus development are not known. Pregnant animals that drank water containing

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high concentrations of phenol gave birth to babies that had low birth weights and minor birth defects.

Phenol can easily penetrate the skin and enter the body. Phenol also enters the body through the lungs when a person breathes in air or inhales smoke from tobacco which contains phenol. If a person swallows phenol, the intestines will change much of it to a less harmful substance. If phenol enters through the skin, it may reach organs and cause adverse effects before it is metabolized.

### Where is phenol found?

Pure phenol is a colorless-to-white solid. The commercial product containing some water is a liquid. It has a distinct sickeningly sweet and tarry odor.

Most people can taste and smell phenol at levels lower than those associated with adverse health effects. Phenol is moderately soluble in water. It evaporates more slowly than water. Phenol is flammable.

Phenol exists naturally and is manufactured in large quantity. It is found in nature in some foods, in human and animal wastes and in decomposing organic material. Phenol is produced by the body and excreted independent of external exposure or intake. The normal range of phenol in the urine of unexposed individuals is 0.5 to 80 milligrams of phenol per liter of urine.

Phenol is used primarily as an intermediate in the production of phenolic resins. It is used in the manufacture of nylon, polycarbonate and epoxy resins. Phenol also is used in slimicides (chemicals that kill bacteria and fungi in slimes), as a disinfectant, as an antiseptic, and in medicinal preparations, such as mouthwash and sore throat lozenges.

### Who is at risk?

People may be exposed to phenol if they work with or manufacture it. Skin contact is considered the major route of exposure in the workplace. Breathing contaminated air can also occur. It has been estimated that about 584,000 people in the U. S. are exposed to phenol at work.

People may be exposed to very low levels of phenol in their homes. Phenol is found in a number of consumer products. These include some medicinal ointments, drops or lotions, mouthwashes, gargles and antiseptic lotions. Low levels of phenol are found in some foods, including smoked summer sausage, fried chicken, mountain cheese and some species of fish.

Phenol has been found in drinking water and tobacco smoke. It is also found in human urine.

Phenol is present at some waste sites. It may contaminate the dirt and nearby air and water.

### How can people reduce the risk of phenol exposure?

There is a urine test that can tell if you have been exposed to phenol recently (within one or two days). However, the test cannot tell if one was exposed only to phenol since many substances are converted to phenol in the body.

U.S. EPA has a lifetime health advisory for adults for phenol in drinking water of four milligrams per liter (mg/L). U.S. EPA also recommends that the level of phenol in surface water (lakes, streams) should be limited to 3.5 mg/L to protect people from drinking contaminated water or eating contaminated fish.

Household products and over-the-counter medications containing phenol should be stored out of reach of young children to prevent accidental poisonings and skin burns. Always store household chemicals in their original labeled containers. Never store household chemicals in containers that children would find attractive, such as old soda bottles. Keep your Poison Control Center's number next to the phone.

### Sources

Agency for Toxic Substances and Disease Registry  
[www.atsdr.cdc.gov](http://www.atsdr.cdc.gov)

TOXNET, National Library of Medicine, National Institutes of Health  
[www.toxnet.nlm.nih.gov](http://www.toxnet.nlm.nih.gov)

The Office of Pollution Prevention was created to encourage multimedia pollution prevention activities in Ohio to reduce risk to public health, safety, welfare and the environment. Pollution prevention stresses source reduction and, as a second choice, environmentally-sound recycling while avoiding cross media transfers. The office develops information related to pollution prevention, increases awareness of pollution prevention opportunities, and can offer technical assistance to business, government and the public.

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