

Sources of Exposure

Toxicokinetics and Normal Human Levels

Biomarkers/Environmental Levels

ToxGuide™

for

Phenol

C₆H₆O

CAS# 108-95-2

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U.S. Department of Health and
Human Services
Public Health Service
Agency for Toxic Substances
and Disease Registry
www.atsdr.cdc.gov

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General Populations

- Exposure may occur by inhalation of low levels in air or ingestion of low levels in water. These levels may be higher for people living near hazardous waste sites.
- Exposure will occur by using consumer products that contain phenol such as throat lozenges, mouthwashes, antiseptic lotions, and toilet and floor disinfectants and cleaners.
- Exposure can occur by ingestion of minute amounts present in certain foods.
- Phenol is utilized in some medical procedures to remove skin lesions or in injections to alleviate chronic pain.
- Smoke from cigarettes is a source of phenol for smokers and for those who inhale second hand smoke.

Occupational Populations

- Exposure can occur during the manufacture of phenol or of consumer products that contain phenol.

Toxicokinetics

- Phenol is well absorbed by the inhalation, oral, and dermal routes of exposure. Phenol in air also is well-absorbed through the skin.
- Once absorbed, phenol is widely distributed throughout the body and the liver and kidneys generally have the greatest amount of phenol-derived products.
- In mammals, phenol undergoes direct sulfation and glucuronidation, and phenol that is not directly conjugated can be the substrate of oxidative metabolism, principally by cytochrome P4502E1. The metabolism of phenol is saturable.
- Data in humans and laboratory animals indicate that phenol is rapidly eliminated, primarily in the urine as sulfate and glucuronide; phenol does not accumulate in the body.

Normal Human Levels

- Usually <10 mg/L in urine of persons not exposed to phenol or benzene.

Biomarkers

- No studies were located regarding levels of phenol or its metabolites in human tissues and fluids associated with effects.
- Phenol and phenol metabolites are not specific biomarkers of exposure to phenol.

Environmental Levels

Air

- Median concentration of 0.03 ppb in 7 samples from urban/suburban U.S. air; data from 1982. More recent data are not available.

Sediment and Soil

- Range from 0.07 to 0.7 mg/kg in a small percentage of U.S. sediment samples; data from 2006.

Water

- Up to 1 ppb in unpolluted groundwater and 0.01–1 ppb in unpolluted rivers; data from 1985.
- Range of 2–56 ppb in waterways in Chicago, IL; data from 2006.

Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 2008. Toxicological Profile for Phenol. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Services.

Chemical and Physical Information

Routes of Exposure

Relevance to Public Health (Health Effects)

Phenol is a Solid

- Phenol is a colorless-to-white solid when pure; the commercial product is liquid.
- Phenol has a sickeningly sweet and tarry odor.
- Phenol is flammable.
- Phenol is moderately soluble in water; it evaporates slower than water.
- Phenol is primarily used in the production of phenolic resins and in the manufacture of nylon and other synthetic fibers.
- Phenol is also used as a general disinfectant and antiseptic in various products, including toilet and floor disinfectants and medicinal preparations such as mouthwashes, sore throat lozenges and sprays, and antiseptic lotions.

- Inhalation – Important route of exposure for those living near coal and petroleum fueled facilities and municipal waste incinerators. Significant exposure route for workers that manufacture phenol.
- Oral – Use of medicinal products such as throat lozenges and mouthwashes. Also, predominant route of exposure at or near waste sites via ingestion of contaminated water.
- Dermal – Use of ointments and cleaners containing phenol. Also, bathing or showering with water contaminated with phenol. Significant exposure route for workers in contact with phenol vapors or liquid phenol.

Phenol in the Environment

- Phenol enters the air, water, and soil as a result of its manufacture and use.
- Phenol has a short half-life in air, less than 1 day. In air, it reacts with photochemically-produced hydroxyl radicals.
- Phenol generally remains in soil only about 2–5 days. In soil, phenol biodegrades under both aerobic and anaerobic conditions.
- Phenol is rapidly degraded in water, but it can remain in water for a week or more if present in high concentrations.
- Phenol does not accumulate in fish, other animals, or in plants.

Health effects are determined by the dose (how much), the duration (how long), and the route of exposure.

Minimal Risk Levels (MRLs)

Inhalation

- No acute-, intermediate- or chronic-duration inhalation MRLs were derived for phenol.

Oral

- An MRL of 1 mg/kg/day has been derived for acute-duration oral exposure (≤ 14 days).
- No intermediate- or chronic-duration oral MRLs were derived for phenol.

Health Effects

- Phenol is an irritating and corrosive substance by all routes of exposure.
- High concentrations of phenol in the air cause respiratory irritation.
- Ingestion of high concentrations of phenol can produce internal burns.
- Application of phenol to the skin can cause dermal inflammation and necrosis.
- Ingestion of high amounts of phenol or application of high amounts on the skin can cause cardiac arrhythmias and may produce tremors and seizures.
- Based on inadequate evidence from studies in humans and animals, the EPA considers phenol not classifiable as to human carcinogenicity.

Children's Health

- Vomiting and lethargy are common signs of toxicity observed in children that ingest products containing phenol and are treated at poison control centers.
- It is not known whether children are more susceptible to phenol poisoning than adults.