

## Sources of Exposure

## Toxicokinetics and Normal Human Levels

## Biomarkers/Environmental Levels

ToxGuide™

for

Phenol

$C_6H_6O$

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](http://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 ( $\leq 14$  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.