Sources of Exposure

General Populations

- Pentachlorophenol was a widely used pesticide and wood preservative. Due to this, pentachlorophenol was once widely detected in environmental media. However, current environmental sources of exposure are limited due to restricted current usages and limited environmental persistence.
- The general population can be exposed to low levels of pentachlorophenol through inhalation of contaminated air, ingestion of contaminated water or food, or dermal contact with contaminated soil or products treated with the compound. Exposure may be more likely near wood treatment facilities and hazardous waste sites.
- The general population could also be exposed from dermal contact with pentachlorophenol-treated wood products (e.g., utility poles, railroad ties, wharf pilings).

Occupational Populations

Occupational exposure to pentachlorophenol can occur through inhalation of contaminated workplace air or dermal contact directly with the chemical or with treated wood products. Occupations such as carpenters, lumberyard workers, and loading-dock laborers who handle treated materials may be more likely to be exposed.

Toxicokinetics and Biomonitoring

Toxicokinetics

- Pentachlorophenol is efficiently absorbed following inhalation, oral, and dermal exposure.
- Pentachlorophenol is distributed throughout the body, with the highest levels in the liver and kidneys.
- Metabolism of pentachlorophenol occurs in the liver, and the major pathways are conjugation to form the glucuronide and oxidative dechlorination to form tetrachlorohydroquinone.
- The primary route of pentachlorophenol elimination is urine, with lesser amounts (around 10%) excreted in the feces.

NHANES Biomonitoring

- The geometric mean of urinary pentachlorophenol could not be calculated because the proportion of results below the limit of detection was too high to provide a valid result (National Health and Nutrition Examination Survey [NHANES] 1999–2004).
- Creatine-corrected urinary pentachlorophenol levels for individuals in the 95th percentile of exposure were 1.67, 2.26, and 3.44 µg/g creatinine in NHANES survey years 1990–2000, 2001–2002, and 2003–2004, respectively.

Biomarkers/Environmental Levels

Biomarkers

- Levels of pentachlorophenol can be measured in the urine, serum, hair, adipose tissue, and infant meconium. However, other chemicals (e.g., hexachlorobenzene and lindane) may metabolize to pentachlorophenol in the body; therefore, this is not a specific biomarker for pentachlorophenol.

Environmental Levels

Air

- There are no recent monitoring data for national air levels of pentachlorophenol.

Water

- Analysis of surface water and groundwater samples collected in 2020–2021 revealed no detectable levels of pentachlorophenol in the groundwater samples. The only positive detections in surface water were below the level of quantification (ranging from 0.1 to 0.5 µg/L).

Sediment and Soil

- There are no recent monitoring data for national levels of pentachlorophenol in sediment or soil.

Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 2022. Toxicological Profile for Pentachlorophenol. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

ToxGuide™ for Pentachloro-phenol

C_6HCl_5O

(CAS # 87-86-5)

April 2022

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

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

Chemical and Physical Information

Pentachlorophenol is a Solid

- Pure pentachlorophenol is a colorless or white crystalline solid. Impure pentachlorophenol (usually found at hazardous sites) is dark gray to brown and exists as dust, beads, or flakes.
- At room temperature, pentachlorophenol has no odor, but when heated, it has a strong medicinal odor described as a sweet or burnt smell.
- Pentachlorophenol was widely used as a pesticide and wood preservative.
- Since 1984, the purchase and use of pentachlorophenol has been restricted to certified applicators.
- The only current registered use for pentachlorophenol is as a "heavy-duty" wood preservative. It is primarily used to treat industrial products such as utility poles, wharf pilings, and railroad ties.

Routes of Exposure

- Inhalation – Likely route of exposure for the general and occupational populations.
- Oral – Likely route of exposure for the general population through ingestion of contaminated foodstuffs and water.
- Dermal – Relevant route of exposure for the general and occupational populations.

Pentachlorophenol in the Environment

- The environmental fate of pentachlorophenol is dependent upon the pH of the soil or water.
- In water and soil, pentachlorophenol is not volatile except under acidic conditions. Pentachlorophenol has greater mobility in soils under neutral or alkaline conditions and has a greater tendency to bioconcentrate under acidic conditions.
- Pentachlorophenol volatilizes from treated wood surfaces and can be transported back to surface waters and soils via wet and dry deposition.
- Pentachlorophenol is hydrolytically stable and is generally considered moderately persistent under aerobic and anaerobic conditions. It can undergo direct photolysis in sunlit surface waters.

Relevance to Public Health (Health Effects)

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 pentachlorophenol.

Oral

- An acute-duration (≤14 days) oral MRL of 0.005 mg/kg/day was derived for pentachlorophenol.
- No intermediate-duration oral MRL was derived for pentachlorophenol.
- A chronic-duration (≥365 days) oral MRL of 0.005 mg/kg/day was derived for pentachlorophenol.

Health Effects

- Inhalation and/or dermal exposure to pentachlorophenol led to enlarged liver, increased serum liver enzymes, centrilobular degeneration, and alterations in porphyrin excretion in exposed workers.
- Oral studies in animals strongly support the liver as a target organ. Hepatocellular hyperplasia, fibrosis, necrosis, and degeneration have been observed in rats, mice, and dogs.
- Exposure of rats to pentachlorophenol during pregnancy resulted in increased fetal/neonatal mortality, skeletal malformations, and decreased pup growth.
- The Department of Health and Human Services (HHS) has categorized pentachlorophenol as "reasonably anticipated to be a human carcinogen" and the U.S. Environmental Protection Agency (EPA) has categorized it as "likely to be carcinogenic to humans." The International Agency for Research on Cancer concluded that pentachlorophenol is "carcinogenic to humans" (Group 1). These agencies have concluded that epidemiological studies have found an association between pentachlorophenol exposure and non-Hodgkin's lymphoma.

Children's Health

- It is not known if children are more sensitive to pentachlorophenol exposure than adults.