Pentachlorophenol: Characteristics and Hazards

Characteristics

Chemical formula: C_6Cl_5OH
CAS#: 87-86-5
Molecular wt.: 266.35
Synonyms: PCP, Penta, Penchlorol
Selected Trade Names: Dowicide, Pentacon, Priltox, Santobrite, Weedone, Woodtreat

Pentachlorophenol (PCP) is a manufactured chemical in the chlorinated hydrocarbon class of chemicals. It became available for commercial use ca. 1948 and was commonly used as an insecticide, herbicide, and fungicide. It was typically used on wood and wood products. PCP has also been recommended and used in the past as an insecticide for wood artifacts and antiquities, which is a concern for conservators.[1]

Since 1984 PCP has been restricted from general use and is limited for use only by certified operators. It continues to be used today as a preservative for utility poles, railroad ties, and wharf pilings.[2] Technical grade PCP, which has been used in most formulations past and present, is only 86% pure. The remaining 14% consist of contaminants including polychlorinated dibenzo-p-dioxins and dibenzofurans.[3] Pure-grade PCP is a white crystalline solid with a phenolic odor. Technical grade PCP can vary in color from white to dark gray brown. PCP formulations were available in blocks, flakes, granules, liquid concentrates, wettable powders, and petroleum-based solutions.

Persistence

PCP is moderately persistent in the environment. It has a half-life of 45 days in soil. Sunlight, other chemicals, and microorganisms break down PCP into other chemicals within days to months.[4]

Hazards

PCP is listed by the EPA as toxicity class II, which means that it is considered moderately toxic. The EPA also considers PCP to be a probable human carcinogen. The International Agency for Cancer Research considers PCP a possible human carcinogen.[2] Exposures to high levels of PCP or lower levels over a period of time cause cells in the body to produce excess heat, which if unabated, can cause damage to organs and body systems.[2] A list of symptoms of varying degrees of severity is listed below, as well as the targeted organs and systems:

- **Exposure routes:** inhalation, dermal absorption, ingestion
- **Target organs and systems:** eyes, skin, thyroid, liver, kidneys, respiratory system, reproductive system, cardiovascular system, immune system, central nervous system.[3]
- **Symptoms:** irritation of eyes, nose and throat, dermatitis, sneezing, cough, weakness, exhaustion, elevated body temperature, fever, anorexia, weight loss, sweating, headache, dizziness, nausea, vomiting, breathing difficulties, chest pain
- **Exposure Limits:**

LC_{50}(rats): 0.2–2.1 mg/L (inhalation)[4]
NIOSH REL: TWA 0.5 mg/m³ (inhalation)[5]
LD_{50}(rats): 27–211 mg/kg (ingestion)[4]
OSHA PEL: TWA 0.5 mg/m³ (inhalation)[5]
IDLH (immediately dangerous to life and health) concentration:[5] 2.5 mg/m³

Note: Both NIOSH and OSHA indicate that skin absorption is also a significant source of exposure.[5]

Personal Protection

When working with materials suspected of having been treated with PCP, and particularly if one is generating dust and particles by sanding or dusting or other activities, one should wear personal protective clothing and equipment. This would include protection for the hands, eyes, and skin. A respirator should also be worn to protect from inhalation exposure.

For potential exposures up to IDLH levels of 2.5 mg/m³, NIOSH and OSHA recommend wearing:

- A chemical cartridge respirator with organic vapor cartridges in combination with a dust, mist, and fume filter
- A powered, air-purifying respirator with organic vapor cartridges in combination with a dust, mist, and fume filter
- A supplied air respirator
- A self-contained breathing apparatus with a full face piece.[5]

Notes

1. Deschiens, Robert and Christine Coste. 1957. The protection of works of art in carved wood from the attack of wood-eating insects. *Museum* 10(1):55–59.
2. Agency for Toxic Substances and Disease Registry (ATSDR). 2001. Pentachlorophenol. *ToxFAQS.* Atlanta, Georgia: U.S. Department of Health and Human Services, Public Health Service. Available at www.atsdr.cdc.gov/toxfaq.html.
3. Agency for Toxic Substances and Disease Registry (ATSDR). 2001. *Toxicological Profile for Pentachlorophenol.* Atlanta: U.S. Department of Health and Human Services, Public Health Service. Available at www.atsdr.cdc.gov/toxprofiles/tp51.html.
4. Extension Toxicology Network. 1996. Pentachloropheno(PCP). *Extoxnet Pesticide Information Profiles.* Available at: http://ace.orst.edu/ifo/extoxnet/pips/pentachlo.htm.
5. NIOSH. 2002. *NIOSH Pocket Guide to Chemical Hazards.* U.S. Department of Health and Human Services. NIOSH Publication No. 2002-140. Available at www.cdc.gov/niosh.

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