

p-Phenylenediamine

106-50-3

Hazard Summary

p-Phenylenediamine is primarily used as a dye intermediate and as a dye. Acute (short-term) exposure to high levels of p-phenylenediamine may cause severe dermatitis, eye irritation and tearing, asthma, gastritis, renal failure, vertigo, tremors, convulsions, and coma in humans. Eczematoid contact dermatitis may result from chronic (long-term) exposure in humans. In rats and mice chronically exposed to p-phenylenediamine in their diet, depressed body weights, but no other clinical signs of toxicity, were observed in several studies. No information is available on the reproductive, developmental, or carcinogenic effects of p-phenylenediamine in humans. EPA has not classified p-phenylenediamine with respect to carcinogenicity.

Please Note: The main source of information for this fact sheet is EPA's Health and Environmental Effects Profile for Phenylenediamines. (2) Other secondary sources include the Hazardous Substances Data Bank (HSDB) (3), a database of summaries of peer-reviewed literature, and the Registry of Toxic Effects of Chemical Substances (RTECS) (5), a database of toxic effects that are not peer reviewed.

Uses

- p-Phenylenediamine is primarily used as a dye intermediate and as a dye (e.g., hair dyes and dyes used for dyeing furs), as well as a photographic developing agent and a chemical intermediate. p-Phenylenediamine is also used as a vulcanization accelerator and as an antioxidant in rubber compounds. (2,4,8)

Sources and Potential Exposure

- Individuals may be occupationally exposed to p-phenylenediamine during its manufacture or use. (1)
- Exposure may occur through contact with hair dye. (2)

Assessing Personal Exposure

- No information was located regarding the measurement of personal exposure to p-phenylenediamine.

Health Hazard Information

Acute Effects:

- Acute exposure to high levels of p-phenylenediamine may cause severe dermatitis, eye irritation and tearing, asthma, gastritis, renal failure, vertigo, tremors, convulsions, and coma in humans. (2-4)
- Tests involving acute exposure of rats and guinea pigs have demonstrated p-phenylenediamine to have **high** acute toxicity from oral exposure. (5)

Chronic Effects (Noncancer):

- Eczematoid contact dermatitis may result from chronic exposure in humans. (4)
- In rats and mice chronically exposed to p-phenylenediamine in their diet, depressed body weights, but no other clinical signs of toxicity, were observed in several studies. (2,8)
- In one study, elevated liver and kidney weights were observed in orally high-dosed rats. (2)
- EPA has not established a Reference Concentration (RfC) for p-phenylenediamine.

- EPA has calculated a provisional Reference Dose (RfD) of 0.19 milligrams per kilogram body weight per day (mg/kg/d) based on whole body effects in rats. The RfD is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily oral exposure to the human population (including sensitive subgroups) that is likely to be without appreciable risk of deleterious noncancer effects during a lifetime. It is not a direct estimator of risk but rather a reference point to gauge the potential effects. At exposures increasingly greater than the RfD, the potential for adverse health effects increases. Lifetime exposure above the RfD does not imply that an adverse health effect would necessarily occur. The provisional RfD is a value that has had some form of Agency review, but it does not appear on IRIS. (6)

Reproductive/Developmental Effects:

- No information is available on the reproductive or developmental effects of p-phenylenediamine in humans. (2)
- In one study of rats exposed via gavage, fetal evaluations showed no biological or statistically significant increase in malformations or developmental variations at any dose tested. (3)

Cancer Risk:

- No information is available on the carcinogenic effects of p-phenylenediamine in humans.
- p-Phenylenediamine dihydrochloride (a hydrochloride salt of p-phenylenediamine) was not carcinogenic in a study of rats and mice exposed to the compound in the diet. Lung tumors in female rats and thyroid tumors in male rats occurred only in treated groups but at low incidences that were not statistically significant. In mice, tumors of the lungs, hematopoietic system, and liver occurred at a slightly higher, but not statistically significant, incidence in treated compared with control mice. (2,8)
- Other studies have also demonstrated that p-phenylenediamine is not carcinogenic by oral or dermal exposure. (2,8)
- EPA has not classified p-phenylenediamine with respect to carcinogenicity.

Physical Properties

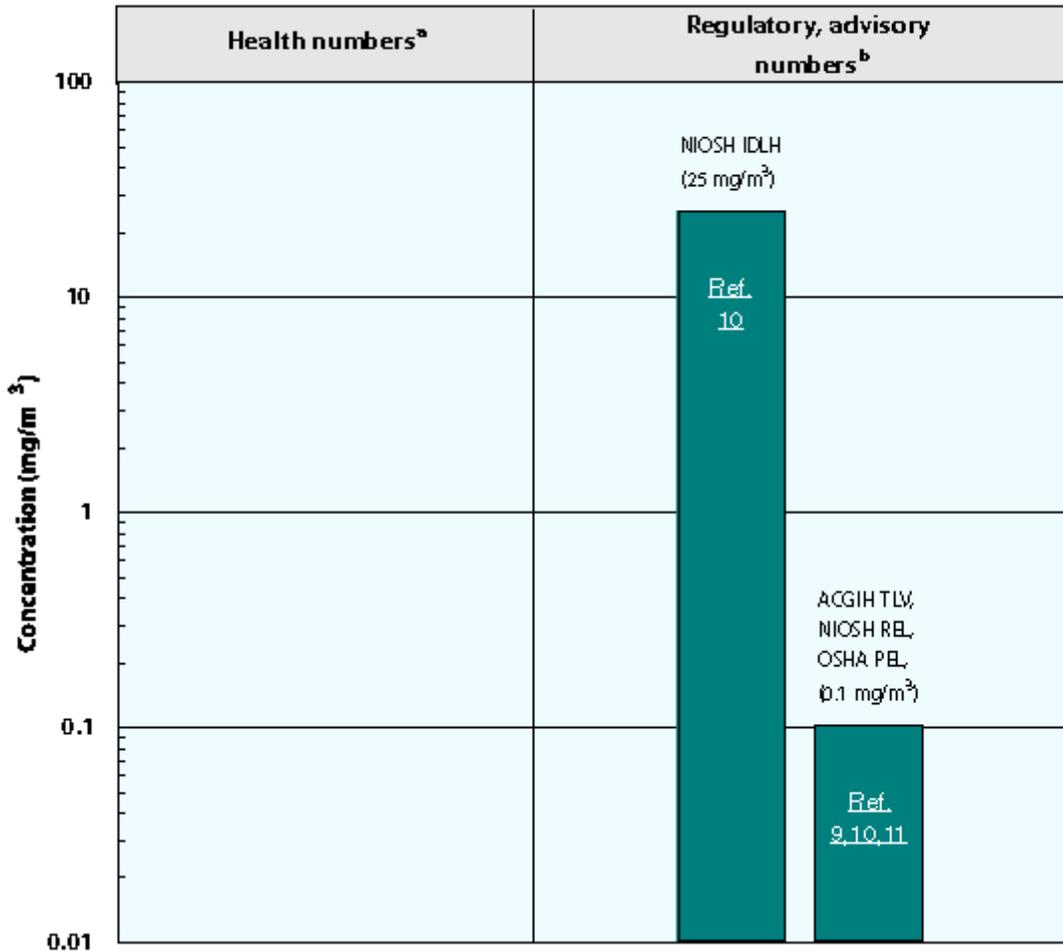
- The chemical formula for p-phenylenediamine is C₆H₈N₂, and its molecular weight is 108.15 g/mol. (2)
- p-Phenylenediamine occurs as a white to slightly red solid or crystals that darken on exposure to air; it is slightly soluble in water. (2,4,7)
- The odor threshold for p-phenylenediamine has not been established.
- The vapor pressure for p-phenylenediamine is less than 1 mm Hg at 21 °C, and its log octanol/water partition coefficient (log K_{ow}) is -0.25. (2,7)

Conversion Factors:

To convert concentrations in air (at 25 °C) from ppm to mg/m³: $\text{mg}/\text{m}^3 = (\text{ppm}) \times (\text{molecular weight of the compound}) / (24.45)$. For p-phenylenediamine: 1 ppm = 4.4 mg/m³.

Health Data from Inhalation Exposure

p-Phenylenediamine



ACGIH TLV --American Conference of Governmental and Industrial Hygienists' threshold limit value expressed as a time-weighted average; the concentration of a substance to which most workers can be exposed without adverse effects.

NIOSH REL --National Institute of Occupational Safety and Health's recommended exposure limit; NIOSH-recommended exposure limit for an 8- or 10-h time-weighted-average exposure.

NIOSH IDLH -- NIOSH's immediately dangerous to life or health concentration; NIOSH recommended exposure limit to ensure that a worker can escape from an exposure condition that is likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from the environment.

OSHA PEL --Occupational Safety and Health Administration's permissible exposure limit expressed as a time-weighted average; the concentration of a substance to which most workers can be exposed without adverse effect averaged over a normal 8-h workday or a 40-h workweek.

The health and regulatory values cited in this factsheet were obtained in December 1999.

^a Health numbers are toxicological numbers from animal testing or risk assessment values developed by EPA.

^b Regulatory numbers are values that have been incorporated in Government regulations, while advisory numbers are nonregulatory values provided by the Government or other groups as advice. OSHA numbers are regulatory, whereas NIOSH and ACGIH numbers are advisory.

References

Summary created in April 1992, updated January 2000

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