

Toluene-2, 4-Diamine

95-80-7

Hazard Summary

Exposure to toluene-2,4-diamine is primarily occupational. Acute (short-term) exposure to high levels of toluene-2,4-diamine in humans has caused severe skin and eye irritation sometimes leading to permanent blindness. Other effects include respiratory problems, stomach gas, rise in blood pressure, dizziness, convulsions, fainting, and coma. No information is available regarding the chronic (long-term) or carcinogenic effects of toluene-2,4-diamine in humans. Chronic animal studies have reported liver injury. In animal studies, toluene-2,4-diamine was carcinogenic following dietary administration, producing a significant increase in the incidence of a large variety of tumor types, including liver, mammary gland, subcutaneous fibromas, lung lymphomas, and leukemia. EPA has classified toluene-2,4-diamine as a Group B2, probable human carcinogen.

Please Note: The main source of information for this fact sheet is EPA's Health and Environmental Effects Profile for 2,4-Toluenediamine (1). 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literature, and the Registry of Toxic Effects of Chemical Substances (RTECS) (4), a database of toxic effects that are not peer reviewed.

Uses

- Toluene-2,4-diamine is used primarily in the production of toluene diisocyanate, which is used in the production of polyurethane. It is used as an intermediate in the synthesis of dyes and heterocyclic compounds. (1)
- Toluene-2,4-diamine is also used to prepare direct oxidation black, a dye for hair and furs, and to prepare dyes for leather. (1)
- Other uses of toluene-2,4-diamine include enhancement of thermal stability in polyamides, fatigue resistance and dyeability in fibers, and the preparation of impact-resistant resins, polyimides with superior wire-coating properties, benzimidazolethiols (antioxidants), hydraulic fluids, urethane foams, fungicide stabilizers, and sensitizers for explosives. (1)

Sources and Potential Exposure

- Toluene-2,4-diamine was identified but not quantified in wastewater samples from an unspecified industry. (1)
- Toluene-2,4-diamine was found to leach from boil-in-bags and pouches into water at low concentrations.(1)
- Exposure to toluene-2,4-diamine is possible through the inhalation of air in polyurethane plants. (2)

Assessing Personal Exposure

- There is no known reliable test to determine whether you have been exposed to toluene-2,4-diamine, but it is suggested that periodic physical examinations including study of liver function and red blood cell count can be helpful in monitoring exposure. (3)

Health Hazard Information

Acute Effects:

- In humans, acute exposures to toluene-2,4-diamine produces severe skin and eye irritation sometimes leading to permanent blindness. Other effects include respiratory problems (e.g., asthma), stomach gas, rise in blood pressure, dizziness, convulsions, fainting, and coma. (3)
- Tests involving acute exposure of rats, mice, and rabbits have shown toluene-2,4-diamine to have moderate to high toxicity. (4)

Chronic Effects (Noncancer):

- No information is available regarding the long-term effects of toluene-2,4-diamine in humans.
- Chronic animal studies have reported liver injury to rats and mice. Focal degenerative liver changes were observed in both sexes of both species. (1)
- EPA has not established a Reference Concentration (RfC) or a Reference Dose (RfD) for toluene-2,4-diamine. (5)

Reproductive/Developmental Effects:

- In humans occupationally exposed to toluene-2,4-diamine, several studies did not report any statistically significant reproductive or developmental effects. (1)
- Developmental and reproductive effects were observed in animals, including a significant decrease in the number of births and increases in maternal deaths, stillbirths, and resorptions. (1)

Cancer Risk:

- No studies were located concerning the carcinogenicity of toluene-2,4-diamine in humans.
- In animal studies, toluene-2,4-diamine was carcinogenic following dietary administration to mice and rats, producing a significant increase in the incidence of a large variety of tumor types, including liver, mammary gland, subcutaneous fibromas, lung lymphomas, and leukemia. The liver tumors were the most prevalent tumor type observed in both rats and mice. (1)
- EPA has classified toluene-2,4-diamine as a Group B2, a probable human carcinogen. (6)
- EPA has calculated an oral cancer slope factor of $3.2 \text{ (mg/kg/d)}^{-1}$ and an oral unit risk factor of $9.1 \times 10^{-5} \text{ (}\mu\text{g/L)}^{-1}$. (6)

Physical Properties

- Toluene-2,4-diamine is a colorless, crystalline solid. (1)
- Toluene-2,4-diamine is very soluble in hot water. (7)
- The chemical formula for toluene-2,4-diamine is $\text{C}_7\text{H}_{10}\text{N}_2$, and it has a molecular weight of 122.17 g/mol. (1)
- The vapor pressure for toluene-2,4-diamine is 0.249 mm Hg at 25 °C, and the log octanol/water partition coefficient ($\log K_{ow}$) is 0.337. (8)

Conversion Factors:

To convert concentrations in air (at 25 °C) from ppm to mg/m^3 : $\text{mg}/\text{m}^3 = (\text{ppm}) \times (\text{molecular weight of the compound}) / (24.45)$. For toluene-2,4-diamine: $1 \text{ ppm} = 5.0 \text{ mg}/\text{m}^3$. To convert concentrations in air from $\mu\text{g}/\text{m}^3$ to mg/m^3 : $\text{mg}/\text{m}^3 = (\mu\text{g}/\text{m}^3) \times (1 \text{ mg}/1,000 \mu\text{g})$.

Note: There are very few health numbers or regulatory/advisory numbers for toluene-2,4-diamine; thus, a graph has not been prepared for this compound. The information cited in this fact sheet was obtained in December 1999.

References

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3. U.S. Department of Health and Human Services. Hazardous Substances Data Bank (HSDB, [online database](#)). National Toxicology Information Program, National Library of Medicine, Bethesda, MD. 1993.
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5. U.S. Environmental Protection Agency. [Integrated Risk Information System \(IRIS\) on 2,4-Diaminotoluene](#). National Center for Environmental Assessment, Office of Research and Development, Washington, DC. 1999.
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7. R.C. Weast and M.J. Astle. Eds. CRC Handbook of Chemistry and Physics. 63rd ed. CRC Press, Inc., Boca Raton, FL. 1982.
8. U.S. Environmental Protection Agency. Assessment Tools for the Evaluation of Risk (ASTER, [online database](#)). Environmental Research Laboratory, Duluth, MN. 1993.