

Ethylbenzene

100-41-4

Hazard Summary

Ethylbenzene is mainly used in the manufacture of styrene. Acute (short-term) exposure to ethylbenzene in humans results in respiratory effects, such as throat irritation and chest constriction, irritation of the eyes, and neurological effects such as dizziness. Chronic (long-term) exposure to ethylbenzene by inhalation in humans has shown conflicting results regarding its effects on the blood. Animal studies have reported effects on the blood, liver, and kidneys from chronic inhalation exposure to ethylbenzene. Limited information is available on the carcinogenic effects of ethylbenzene in humans. In a study by the National Toxicology Program (NTP), exposure to ethylbenzene by inhalation resulted in an increased incidence of kidney and testicular tumors in rats, and lung and liver tumors in mice. EPA has classified ethylbenzene as a Group D, not classifiable as to human carcinogenicity.

Please Note: The main sources of information for this fact sheet are EPA's Integrated Risk Information System (IRIS) (5), which contains information on inhalation and oral chronic toxicity of ethylbenzene and the RfC, and oral chronic toxicity and the RfD, and the Agency for Toxic Substances and Disease Registry's (ATSDR's) Toxicological Profile for Ethylbenzene. (1)

Uses

- Ethylbenzene is used primarily in the production of styrene. It is also used as a solvent, as a constituent of asphalt and naphtha, and in fuels. (1)

Sources and Potential Exposure

- In one study, ethylbenzene was detected in urban air at a median concentration of 0.62 parts per billion (ppb). The median level in suburban air was about 0.62 ppb, while the mean level measured in air in rural locations was about 0.13 ppb. (1)
- Ethylbenzene has been detected in indoor air at mean concentrations of approximately 1 ppb. The indoor levels tend to be higher than the ambient levels, due to the use of household products such as cleaning products or paints. (1)
- Occupational exposure to ethylbenzene occurs in factories that use ethylbenzene to produce other chemicals; for gas and oil workers; and for varnish workers, spray painters, and persons involved in gluing operations. (1)
- Exposure to ethylbenzene occurs from the use of consumer products, gasoline, pesticides, solvents, carpet glues, varnishes, paints, and tobacco smoke. (1)

Assessing Personal Exposure

- Laboratory tests can determine ethylbenzene exposure by measuring the breakdown products in the urine. (1)

Health Hazard Information

Acute Effects:

- Respiratory effects, such as throat irritation and chest constriction, irritation of the eyes, and neurological effects such as dizziness, have been noted from acute inhalation exposure to ethylbenzene in humans. (1–3)
- Animal studies have reported central nervous system (CNS) toxicity; pulmonary effects; and effects on the liver, kidney, and eyes (irritation) from acute inhalation exposure to ethylbenzene. (1)
- Tests involving acute exposure of rats have shown ethylbenzene to have moderate toxicity from inhalation and oral exposure. (1,4)

Chronic Effects (Noncancer):

- Chronic exposure to ethylbenzene by inhalation in humans has shown conflicting results regarding its effects on the blood. In one study of workers occupationally exposed to ethylbenzene, effects on the blood were noted, while in another study, no adverse effects on the blood were seen. (1)
- In a 20-year study of humans occupationally exposed to ethylbenzene, no liver toxicity was noted. (1)
- Animal studies have reported effects on the blood, liver, and kidneys from chronic inhalation exposure to ethylbenzene. (1,3)
- The Reference Concentration (RfC) for ethylbenzene is 1 milligram per cubic meter (mg/m^3) based on developmental toxicity in rats and rabbits. The RfC is an estimate (with uncertainty spanning perhaps an order of magnitude) of a continuous inhalation 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 RfC, the potential for adverse health effects increases. Lifetime exposure above the RfC does not imply that an adverse health effect would necessarily occur. (5)
- EPA has low confidence in the study on which the RfC was based because higher exposure levels may have provided more information on the potential for maternal toxicity and developmental effects; low confidence in the database because, although other studies have examined a variety of other endpoints (e.g., liver and lung), by histopathology in rats and mice, there are no chronic studies and no multigeneration developmental studies; and, consequently, low confidence in the RfC. (5)
- The Reference Dose (RfD) for ethylbenzene is 0.1 milligrams per kilogram body weight per day ($\text{mg}/\text{kg}/\text{d}$) based on liver and kidney toxicity in rats. (5)
- EPA has low confidence in the study on which the RfD was based because rats of only one sex were tested and the experiment was not of chronic duration; low confidence in the supporting database because other oral toxicity data were not found; and, consequently, low confidence in the RfD. (5)

Reproductive/Developmental Effects:

- No information is available on the developmental or reproductive effects of ethylbenzene in humans. (1)
- Animal studies have reported developmental effects, such as fetal resorptions, retardation of skeletal development, and an increased incidence of extra ribs in animals exposed to ethylbenzene via inhalation. (1,3,5)

Cancer Risk:

- The only available human cancer study monitored the conditions of workers exposed to ethylbenzene for 10 years, with no tumors reported. However, no firm conclusions can be made from this study because exposure information was not provided, and 10 years is insufficient for detecting long latency tumors in humans. (1)
- In a study by the NTP, exposure to ethylbenzene by inhalation resulted in a clearly increased incidence of kidney and testicular tumors in male rats, and a suggestive increase in kidney tumors in female rats, lung tumors in male mice, and liver tumors in female mice. (6)
- EPA has classified ethylbenzene as a Group D, not classifiable as to human carcinogenicity. (5)

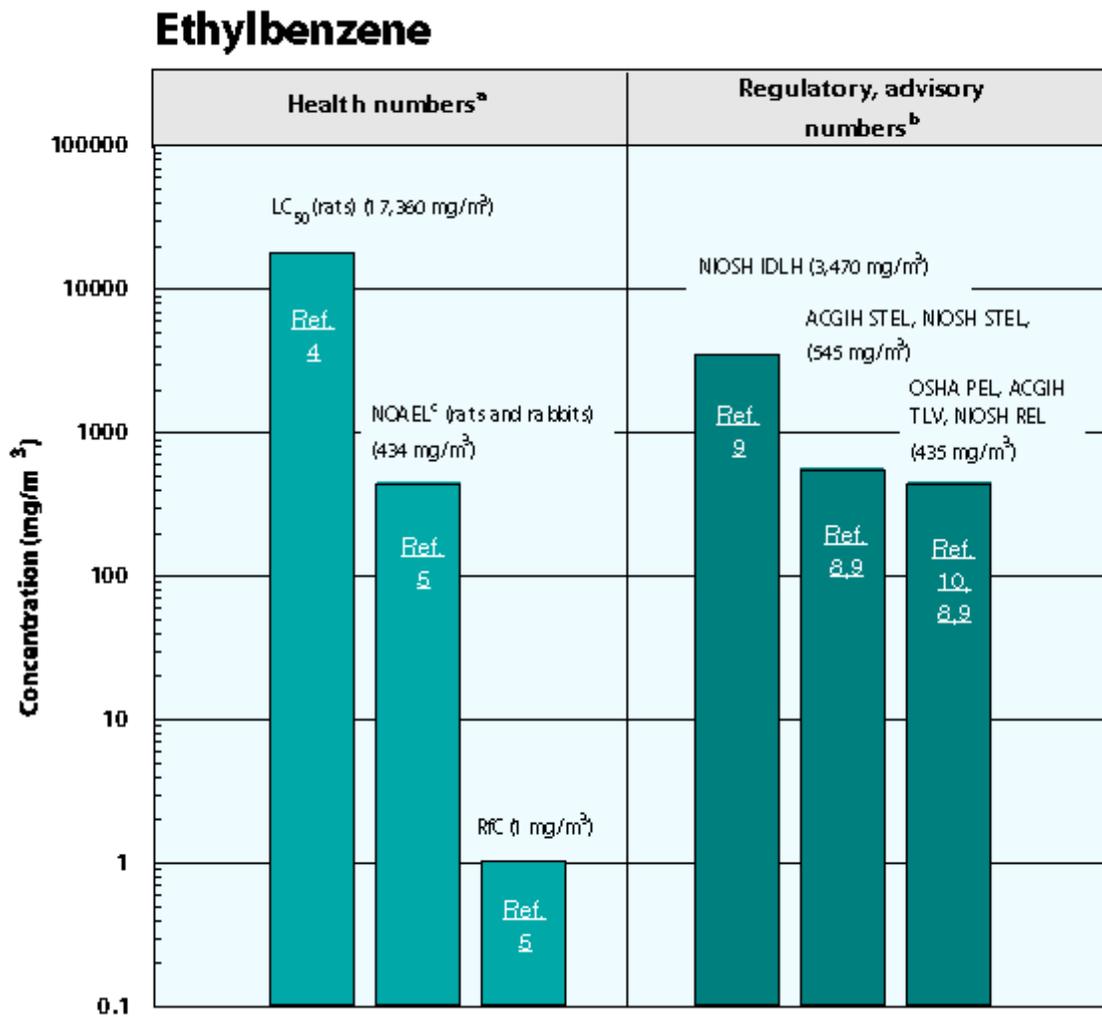
Physical Properties

- Ethylbenzene is a colorless liquid that smells like gasoline. (1)
- The odor threshold for ethylbenzene is 2.3 parts per million (ppm). (7)
- The chemical formula for ethylbenzene is C_8H_{10} , and the molecular weight is 106.16 g/mol. (1)
- The vapor pressure for ethylbenzene is 9.53 mm Hg at 25 °C, and its octanol/water partition coefficient ($\log K_{ow}$) is 3.13. (1)

Conversion Factors:

To convert concentrations in air (at 25 °C) from ppm to mg/m^3 : $mg/m^3 = (ppm) \times (\text{molecular weight of the compound}) / (24.45)$. For ethylbenzene: 1 ppm = 4.34 mg/m^3 .

Health Data from Inhalation Exposure



ACGIH STEL --American Conference of Governmental and Industrial Hygienist's threshold limit value short-term exposure limit; a 15-minute TWA exposure which should not be exceeded at any time during a workday.

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

LC₅₀ (Lethal Concentration ₅₀)--A calculated concentration of a chemical in air to which exposure for a specific length of time is expected to cause death in 50% of a defined experimental animal population.

NIOSH IDLH --National Institute of Occupational Safety and Health immediately dangerous to life and health; NIOSH concentration representing the maximum level of a pollutant from which an individual could escape within 30 minutes without escape-impairing symptoms or irreversible health effects.

NIOSH REL --NIOSH's recommended exposure limit; NIOSH-recommended exposure limit for an 8- or 10-h time-

weighted-average exposure and/or ceiling.

NIOSH STEL --NIOSH's recommended short-term exposure limit; a 15-minute TWA exposure which should not be exceeded at any time during a workday.

NOAEL --No-observed-adverse-effect level.

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.

^c NOAEL is from the critical study used as the basis for the EPA RfC.

Summary created in April 1992, updated January 2000

References

1. Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological Profile for Ethylbenzene (Update). Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA. 1999.
2. E.J. Calabrese and E.M. Kenyon. Air Toxics and Risk Assessment. Lewis Publishers, Chelsea, MI. 1991.
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.
4. U.S. Department of Health and Human Services. Registry of Toxic Effects of Chemical Substances (RTECS, [online database](#)). National Toxicology Information Program, National Library of Medicine, Bethesda, MD. 1993.
5. U.S. Environmental Protection Agency. [Integrated Risk Information System \(IRIS\) on Ethylbenzene](#). National Center for Environmental Assessment, Office of Research and Development, Washington, DC. 1999.
6. National Toxicology Program. [Toxicology and Carcinogenesis Studies of Ethylbenzene \(CAS No. 100-41-4\) in F344/N Rats and B6C3F1 Mice \(Inhalation Studies\)](#). TR No. 466. U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health, Bethesda, MD. 1999.
7. J.E. Amore and E. Hautala. Odor as an aid to chemical safety: Odor thresholds compared with threshold limit values and volatilities for 214 industrial chemicals in air and water dilution. *Journal of Applied Toxicology*, 3(6):272-290. 1983.
8. American Conference of Governmental Industrial Hygienists (ACGIH). 1999 TLVs and BEIs. Threshold Limit Values for Chemical Substances and Physical Agents. Biological Exposure Indices. Cincinnati, OH. 1999.
9. National Institute for Occupational Safety and Health (NIOSH). [Pocket Guide to Chemical Hazards](#). U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention. Cincinnati, OH. 1997.
10. Occupational Safety and Health Administration (OSHA). Occupational Safety and Health Standards, Toxic and Hazardous Substances. Code of Federal Regulations. 29 CFR 1910.1000. 1998.