Styrene oxide

96-09-3

Hazard Summary

Styrene oxide is used as a reactive plasticizer or diluent for epoxy resins and in the production of phenethyl alcohol and styrene glycol and its derivatives. Acute (short-term) exposure to styrene oxide causes skin and eye irritation in humans. Corneal injury, liver, and neurological effects have been reported in acutely exposed animals. No information is available on the chronic (long-term), reproductive, developmental, or carcinogenic effects of styrene oxide in humans. Maternal toxicity and increased fetal mortality have been observed in rats and rabbits exposed to styrene oxide by inhalation. Several studies have reported an increased incidence of forestomach tumors in rats and mice exposed via gavage (experimentally placing the chemical in the stomach). The International Agency for Research on Cancer (IARC) has classified styrene oxide as a Group 2A, a probable human carcinogen.

Please Note: The main source of information for this fact sheet is the International Agency for Research on Cancer (IARC) monographs on chemicals carcinogenic to man. (6) Other secondary sources include the Hazardous Substances Data Bank (HSDB) (1), 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literature, and the Registry of Toxic Effects of Chemical Substances (RTECS) (5), a database of toxic effects that are not peer reviewed.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

- Styrene oxide is used as a reactive plasticizer or diluent for epoxy resins; in the production of styrene glycol and its derivatives; as a raw material for the production of phenethyl alcohol used in perfumes; as a chemical intermediate for cosmetics, surface coatings, and agricultural and biological chemicals; and in the treatment of fibers and textiles. (1,2,4)

Sources and Potential Exposure

- Styrene oxide may be released to the environment in wastewater or emissions during its production and use. (1,2)
- Humans may be occupationally exposed to styrene oxide in the workplace. (2)

Assessing Personal Exposure

- No information was located regarding the measurement of personal exposure to styrene oxide.

Health Hazard Information

Acute Effects:

- Acute exposure to styrene oxide causes skin and eye irritation in humans. (1-4)
- Corneal injury has been observed in acutely exposed rabbits. (1,2)
- Changes in liver enzymes have been reported in rats following acute intraperitoneal exposure. (1,2)
- Styrene oxide is reported to be a CNS depressant and is associated with the generation of liver lesions in animals following acute oral exposure. (1,3)
- Tests involving acute exposure of rats, mice, guinea pigs, and rabbits have demonstrated styrene oxide to have moderate acute toxicity from oral exposure and high acute toxicity from dermal exposure. (5)

Chronic Effects (Noncancer):

- No information is available on the chronic effects of styrene oxide in humans.
- EPA has not established a Reference Concentration (RfC) or a Reference Dose (RfD) for styrene oxide.
- The California Environmental Protection Agency (CalEPA) has calculated a chronic inhalation reference exposure level of 0.006 milligrams per cubic meter (mg/m^3) for styrene oxide based on respiratory effects and fetal resorptions in rabbits. The CalEPA reference exposure level is a concentration at or below which adverse health effects are not likely to occur. It is not a direct estimator of risk but rather a reference point to gauge the potential effects. At lifetime exposures increasingly greater than the reference exposure level, the potential for adverse health effects increases. (7)

Reproductive/Developmental Effects:

- No information is available on the reproductive or developmental effects of styrene oxide in humans.
- Maternal toxicity and increased fetal mortality have been observed in rats and rabbits exposed to styrene oxide by inhalation. Maternal toxicity, increased preimplantation loss of fetuses, reduced fetal weight, and increased incidence of ossification defects were reported in rats. Maternal toxicity and increased frequency of resorptions were reported in rabbits. (1,2)

Cancer Risk:

- No information is available on the carcinogenic effects of styrene oxide in humans.
- Several studies have reported an increased incidence of squamous-cell carcinomas and papillomas of the forestomach in rats and mice exposed to styrene oxide via gavage. An increased incidence of hepatocellular neoplasms was also reported in mice. (1,2)
- EPA has not classified styrene oxide with respect to potential carcinogenicity.
- The International Agency for Research on Cancer (IARC) has classified styrene oxide as a Group 2A, a probable human carcinogen. (6)

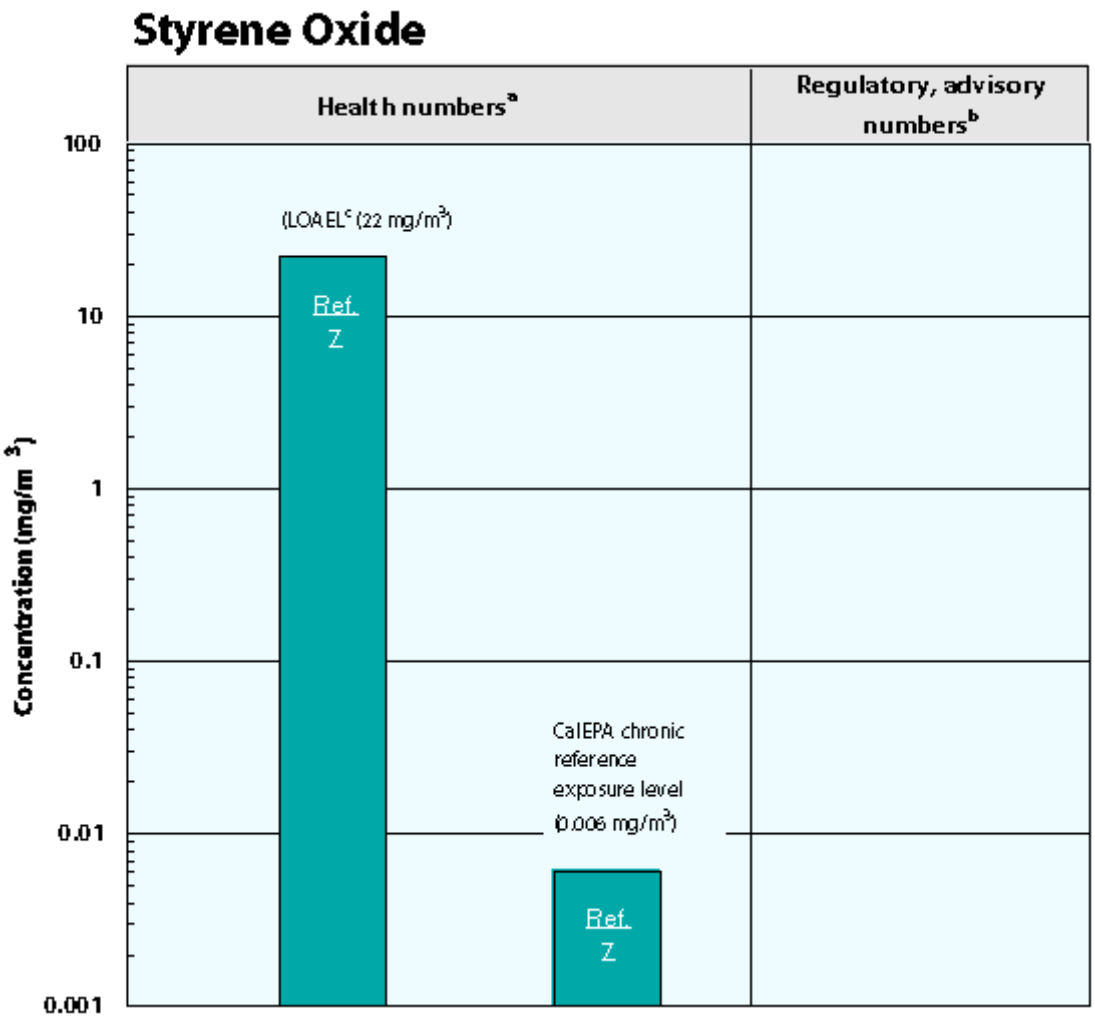
Physical Properties

- The chemical formula for styrene oxide is C_8H_8O, and its molecular weight is 120.15 g/mol. (1,2) Styrene
- oxide occurs as a colorless to pale straw-colored liquid that is slightly soluble in water. (1,2,4) Styrene
- oxide has a sweet, pleasant odor, with an odor threshold of about 0.4 parts per million (ppm). (1) The
- vapor pressure for styrene oxide is 0.3 mm Hg at 20 °C. (1,2)

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 styrene oxide: 1 ppm = 4.91 mg/m^3.

Health Data from Inhalation Exposure



LOAEL--Lowest observed adverse effect level.

The health 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.

[c] The LOAEL is from the critical study used as the basis for the CalEPA chronic inhalation reference exposure level.

References

Summary created in April 1992, updated in January 2000

1. 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.
2. International Agency for Research on Cancer (IARC). IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans: Allyl Compounds, Aldehydes, Epoxides and Peroxides. Volume 36. World Health Organization, Lyon. 1985.
3. G.D. Clayton and F.E. Clayton, Eds. Patty's Industrial Hygiene and Toxicology. Volume IIA. 3rd revised ed. John Wiley & Sons, New York. 1981.
4. M. Sittig. Handbook of Toxic and Hazardous Chemicals and Carcinogens. 2nd ed. Noyes Publications, Park Ridge, NJ. 1985.
5. 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.

6. International Agency for Research on Cancer (IARC). IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans: Overall Evaluations of Carcinogenicity: An Updating of IARC Monographs Volumes 1 to 42. Supplement 7. World Health Organization, Lyon. 1987.
7. California Environmental Protection Agency (CalEPA). Technical Support Document for the Determination of Noncancer Chronic Reference Exposure Levels. Draft for Public Comment. Office of Environmental Health Hazard Assessment, Berkeley, CA. 1997.