

US EPA ARCHIVE DOCUMENT

Technical Factsheet on: STYRENE

[List of Contaminants](#)

As part of the Drinking Water and Health pages, this fact sheet is part of a larger publication:
National Primary Drinking Water Regulations

Drinking Water Standards

MCLG: 0.1 mg/L

MCL: 0.1 mg/L

HAL(child): 1 day: 20 mg/L; Longer-term: 2 mg/L

Health Effects Summary

Acute: EPA has found styrene to potentially cause the following health effects from acute exposures at levels above the MCL: nervous system effects such as depression, loss of concentration, weakness, fatigue and nausea.

Drinking water levels which are considered "safe" for short-term exposures: For a 22 lb. child consuming 1 liter of water per day: a one-day exposure to 20 mg/L; upto a 7-year exposure to 2 mg/L.

Chronic: Styrene has the potential to cause the following health effects from long-term exposures at levels above the MCL: liver and nerve tissue damage.

Cancer: There is some evidence that styrene may have the potential to cause cancer from a lifetime exposure at levels above the MCL.

Usage Patterns

Production of styrene has increased: from 8.5 billion lbs. in 1988 to 10.7 billion lbs in 1993. In 1989, it was estimated that industries consumed styrene as follows: Polystyrene, 55%; acrylonitrile-butadiene-styrene (ABS), 10%; styrene-butadiene rubber (SBR), 5%; styrene-butadiene latex, 5%; unsaturated polyester resins, 5%; miscellaneous uses, including other copolymers, 7%; exports, 13%.

Initially, styrene was used primarily in the synthetic rubber industry, but most styrene is currently consumed in plastics, resins, coatings, and paints. To date, all commercial uses are based on chemical reactions that polymerize or copolymerize styrene.

Release Patterns

Styrene is released into the environment by emissions and effluents from its production and its use in polymer manufacture. It has been found in exhausts from spark-ignition engines, oxy-acetylene flames, cigarette smoke and gases emitted by pyrolysis of brake linings. Stack emissions from waste incineration have been found to contain styrene. Styrene is emitted in automobile exhaust. Consumers may be exposed to potentially high levels of styrene monomer through contact with unsaturated polyester resin products used in fiberglass boat construction and repair, and as auto body fillers and casting plastics. These products may contain styrene at concentrations of 30 to 50%. Its presence in various food products is due to monomer leaching from polystyrene containers.

From 1987 to 1993, according to EPA's Toxic Chemical Release Inventory, styrene releases to land and water totalled over 2 million lbs., of which about 85 percent was to land. These releases were primarily

from adhesives and sealants industries. The largest releases occurred in Texas. The largest direct releases to water occurred in Louisiana.

Environmental Fate

If released to the atmosphere, styrene will react rapidly with both hydroxyl radicals and ozone with a combined, calculated half-life of about 2.5 hours. If released to environmental bodies of water, styrene will volatilize relatively rapidly and may be subject to biodegradation. Five day aqueous theoretical BOD (TBOD) of 80% in acclimated sewage seed and 42% TBOD in an unacclimated seed have been observed. Styrene is not expected to hydrolyze.

If released to soil it will biodegrade, with reports of 95% degradation from a landfill soil and 87% degradation from a sandy loam soil in 16 weeks. It is expected to leach with a low-to-moderate soil mobility, based upon a Koc of 520 to 555 estimated using regression-derived equations or structure estimation methods.

Styrene is not expected to bioaccumulate or bioconcentrate in organisms and food chains to any measurable extent. A BCF of 13.5 was experimentally determined in a bioconcentration study using goldfish. Based upon its measured water solubility and log Kow, the BCF of styrene can be estimated to be approximately 24 and 100, respectively, from regression-derived equations.

While styrene has been detected in various drinking waters, it was not detected in a groundwater supply survey of 945 finished water supplies which use groundwater sources. Styrene has been detected in various chemical, textile, latex, oil refinery and industrial wastewater effluents. Styrene has been frequently detected in the ambient air of source dominated locations and urban areas, has been detected in the air of a national forest in Alabama, and has been detected in the vicinity of oil fires. Food packaged in polystyrene containers has been found to contain small amounts of styrene.

Chemical/Physical Properties

CAS Number: 100-42-5

Color/ Form/Odor: Colorless or yellowish oily liquid with aromatic, almost floral odor; available as polymer grade.

M.P.: -30.63 C B.P.: 145.2 C

Vapor Pressure: 4.5 mm Hg at 25 C; highly volatile

Octanol/Water Partition (Kow): Log Kow = 2.95

Density/Spec. Grav.: 0.906 at 20 C

Solubility: 310 mg/L at 25 C; Slightly soluble in water

Soil sorption coefficient: Koc estimated at 520 to 555; low mobility in soil

Odor/Taste Thresholds: Taste threshold in water is 0.73 mg/L

Bioconcentration Factor: BCF = 13.5 in fish; not expected to bioconcentrate in aquatic organisms.

Henry's Law Coefficient: 0.00275 atm-cu m/mole at 25 C; rapid evaporation from water.

Trade Names/Synonyms: Vinyl benzene, Phenethylene, Cinnamene, Diarex HF 77, Styrolene, Styron, Styropol,

Other Regulatory Information

Monitoring:

-- For Ground/Surface Water Sources:

Initial Frequency- 4 quarterly samples every 3 years

Repeat Frequency- Annually after 1 year of no detection

-- Triggers - Return to Initial Freq. if detect at > 0.0005 mg/L

Analysis

<u>Reference Source</u> EPA 600/4-88-039	<u>Method Numbers</u> 502.2; 524.2
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Treatment/Best Available Technologies: Granular Activated Charcoal and Packed Tower Aeration

Toxic Release Inventory - Releases to Water and Land, 1987 to 1993 (in pounds):

TOTALS (in pounds)	Water	Land
Top Ten States*	275,888	1,796,451
TX	160,411	572,294
WV	1,600	555,360
IN	0	124,794
WI	0	102,973
OH	0	90,358
GA	0	79,000
LA	53,430	0
FL	0	38,800
NY	32	33,192
KY	0	18,000
Major Industries*		
Adhesives, sealants	0	537,360
Concrete products	0	398,424
Synthetic rubber	152,215	149,147
Misc. plastic products	515	201,713
Plastics and resins	25,133	71,363
Boatbuilding, repair	220	83,256
Car parts, access.	0	79,250
Misc. Indust. organics	34,275	43,290
Travel trailers, campers	0	45,129
Custom plastic resins	720	44,320

* Water/Land totals only include facilities with releases greater than a certain amount - usually 1000 to 10,000 lbs.

For Additional Information

EPA can provide further regulatory or other general information:
EPA Safe Drinking Water Hotline - 800/426-4791

Other sources of toxicological and environmental fate data include:
Toxic Substance Control Act Information Line - 202/554-1404
Toxics Release Inventory, National Library of Medicine - 301/496-6531
Agency for Toxic Substances and Disease Registry - 404/639-6000