
Information and recommendations for paramedics and doctors at the site

- Patients exposed only to styrene vapor do not pose a significant risk of secondary contamination. Patients whose clothing or skin is contaminated with liquid styrene (boiling point 145°C, 293°F respectively) can secondarily contaminate rescue and medical personnel by direct contact or evaporation of styrene.
 - Styrene is irritating when it comes in contact with the eyes, skin, nose and throat and causes headache, nausea, vertigo, dizziness, weakness, disorientation, and unconsciousness. Central and peripheral neuropathy has been noted.
 - There is no antidote to be administered to counteract the effects of styrene. Treatment consists of supportive measures.
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1. Substance information

Styrene (C₆H₅-CH=CH₂), CAS 100-42-5

Synonyms: vinylbenzene, phenylethylene, cinnamene

Styrene is, at room temperature, a colorless to yellow, oily liquid with a boiling point of 145°C, respectively 293°F. Both vapor and liquid are potential fire and explosion hazards. Styrene has a sweet, sharp odor at air concentrations of 0.017 – 1.9 ppm, with rapid olfactory fatigue. It is slightly soluble in water, but soluble in alcohol, ether, and acetone. Styrene undergoes spontaneous polymerization. Carbon monoxide may be released in a styrene fire.

Styrene is an organic solvent with a high evaporation rate used in the manufacture of polystyrene plastics, protective coatings, styrenated polyesters, copolymer resins with acrylonitrile and butadiene, and as a chemical intermediate. Styrene-butadiene rubber is the most widely employed type of synthetic rubber.

2. Routes of exposure

Inhalation

Most exposures occur by inhalation. Styrene is readily absorbed by the respiratory tract.

Skin/eye contact

It is absorbed through the skin causing systemic effects.

Ingestion

Styrene is readily absorbed from the gastrointestinal tract. Ingestion is uncommon in occupational settings. However, aspiration is possible.

3. Acute health effects

Systemic

Styrene causes headache, nausea, vertigo, dizziness, weakness, disorientation, and unconsciousness. Acute exposure to high concentrations may produce signs of upper respiratory irritation, followed by asphyxia, muscular weakness, cardiac arrhythmia, coma and death from respiratory paralysis. Central and peripheral neuropathy and alterations in liver enzymes have been noted after long-term exposure.

Respiratory

Styrene is irritating to the upper respiratory tract.

Dermal

Irritation of the skin may be caused by direct contact to liquid styrene.

Ocular

Eye contact to vapor or liquid styrene causes burning discomfort, spasmodic blinking or involuntary closing of the eyelids, redness, and tearing.

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Dose-effect relationships

Dose-effect relationships are as follows:

<u>Styrene concentration</u>	<u>Effect</u>
0.017-1.9 ppm	- Odor threshold (Note: rapid olfactory fatigue)
50 ppm	- subjective complaints including headache, fatigue, difficulty in concentrating
100 ppm	- Mild irritation of eyes and throat
400 - 500 ppm	- Moderate, but tolerable irritation
800 ppm	- Immediate eye and throat irritation, increased nasal secretion, metallic taste, drowsiness and vertigo
2,500 ppm	- dangerous to life within 8 hours
10,000 ppm	- dangerous to life within 20 to 30 minutes

The time-weighted average concentration for a conventional 8-hour workday and a 40-hour workweek to which it is believed that nearly all workers may be repeatedly exposed, day after day, without adverse effect is 20 ppm. The workplace threshold limit value for short-term exposure (15 minutes with 60 minutes between successive exposures in this range) without suffering from irritation, chronic or irreversible tissue damage or narcosis is 40 ppm.

4. Actions

Rescuer self-protection

In response situations that involve exposure to potentially unsafe levels of styrene (see below), pressure-demand, self-contained breathing apparatus and chemical-protective clothing shall be worn.

Patients whose clothing or skin is contaminated with styrene can secondarily contaminate other people by direct contact or evaporation of styrene.

Patient recovery

Patients should be removed from the contaminated zone immediately. Patients who are unable to walk may be removed on backboards or stretchers; if these are not available, carefully remove/transport patients with appropriate action to a safe zone, taking into account your self-protection.

Immediate priorities must follow the "A, B, C's" (Airway, Breathing, Circulation) of resuscitation.

Decontamination

Patients exposed to styrene require decontamination.

Patients who are able and cooperative may assist with their own decontamination. If clothing is contaminated, remove and double-bag the clothing.

Assure that exposed or irritated eyes have been irrigated with plain water or saline for at least 20 minutes. If not, continue eye irrigation during other basic care and transport.

Remove contact lenses if present and easily removable without additional trauma to the eye.

Assure that exposed skin and hair have been flushed with plain water for at least 15 minutes. If not, continue flushing during other basic care and transport. Protect eyes during flushing of skin and hair.

Assure that following ingestion mouth was rinsed with plenty of water and afterwards charcoal as a slurry (240 ml water/30 g charcoal) has been administered. Emesis not recommended.

Initial treatment

Therapy will be empiric; there is no specific antidote to counteract the effects of styrene.

Patients with an exposure concentration of 100 ppm or greater (for 15 minutes or more) and patients without available exposure measurements but suspected of being exposed to concentrations of 100 ppm or greater (for 15 minutes or more) should be transferred to a hospital/emergency

department.

The following measures are recommended if exposure by inhalation is 100 ppm (for 15 minutes or more), if symptoms, e. g. eye irritation or pulmonary symptoms have developed, or if no exposure concentration can be estimated but exposure has possibly occurred:

- **Administration of oxygen**
- **Administration of 8 puffs of beclomethasone (800 µg beclomethasone dipropionate) from a metered dose inhaler.**

Patients with severe clinical respiratory symptoms (e.g. bronchospasms, stridor) should be treated as follows:

a) Nebulization of adrenaline (epinephrine): 2 mg adrenaline (2 ml) with 3 ml NaCl 0.9% and inhale through a nebulizer mask.

b) Administration of a β 2-selective adrenoceptor agonist, e.g., four strokes of terbutaline or salbutamol or fenoterol (one stroke usually contains 0.25 mg of terbutaline sulfate; or 0.1 mg of salbutamol; or 0.2 mg of fenoterol); this may be repeated once after 10 minutes. Alternatively, 2.5 mg salbutamol and 0.5 mg atrovent may be administered by nebulizer mask.

If inhalation is not possible, administration of terbutaline sulfate (0.25 mg to 0.5 mg) subcutaneously or salbutamol (0.2 mg to 0.4 mg over 15 minutes) intravenously.

c) Intravenous administration of 250 mg methylprednisolone (or equivalent steroid dose).

Patients with clinical signs of a toxic lung edema (e.g. foamy sputum, wet crackles) should be treated as follows:

a) Start CPAP-therapy (Continuous Positive Airway Pressure Ventilation).

b) Intravenous administration of 1000 mg methylprednisolone (or an equivalent steroid dose) is recommended.

Intubation of the trachea or an alternative airway management should be considered in cases of respiratory compromise. When the patient's condition precludes this, consider cricothyrotomy if equipped and trained to do so.

Note: Efficacy of corticosteroid administration has not yet been proven in controlled clinical studies.

If liquid styrene has been in contact with the skin, irritations may result, treat as thermal burns.

After eye exposure, irritation may result; treat as thermal burns. Consult an ophthalmologist.

*Patient release/
follow-up instructions*

Asymptomatic patients with an exposure concentration of **less than 100 ppm** (and less than 15 minutes) or minor direct contact to liquid styrene **as well as patients who have a normal clinical examination and no signs or symptoms of toxicity may be discharged after an appropriate observation period in the following circumstances:**

- a) The evaluating physician is experienced in the evaluation of individuals with styrene exposure.
- b) Information and recommendations for patients with follow-up instructions are provided verbally and in writing. Patients are advised to seek medical care promptly if symptoms develop or recur.

- c) The physician is comfortable that the patient understands the health effects of styrene and the provided follow-up instructions.
- d) Site medical is notified, so that the patient may be contacted at regular intervals in the 24-hour period following release.
- e) Drinking of alcohol beverages should be forbidden for at least 72 hours.
- f) Heavy physical work should be precluded for 24 hours.
- g) Exposure to cigarette smoke should be avoided for 72 hours; the smoke may worsen the condition of the lungs.

In this document BASF has made a diligent effort to ensure the accuracy and currency of the information presented but makes no claim that the document comprehensively addresses all possible situations related to this topic. This document is intended as an additional resource for paramedics and doctors at the site in assessing the condition and managing the treatment of patients exposed to styrene. It is not, however, a substitute for the professional judgement of a paramedic or a doctor and must be interpreted in the light of specific information regarding the patient available to such a paramedic or doctor and in conjunction with other sources of authority.

BASF SE **BASF Corporation**
Corporate Health Management
Carl-Bosch-Straße 38
67056 Ludwigshafen
Germany

Medical Department
100 Campus Drive, M/S F 221
Florham Park, NJ 07932
USA