

# Product Stewardship Summary

## Styrene

### General Statement

Styrene is a colorless liquid with a sweet odor used to make thousands of everyday products for home, school, work and play. Styrene is produced primarily from ethyl benzene, a chemical found in petroleum. It is also a naturally occurring substance found in foods such as cinnamon, coffee, and strawberries.

Exposure to levels of styrene typically found in the environment is not expected to be harmful to human health or the environment. Exposure controls in the workplace serve to prevent adverse health effects to workers.

### Chemical Identity

Name: Styrene

Brand Names: Multiple products in the Aroset™, Pliogrip™, Northwest Coatings™, Derakane™, Pureseal™, and other lines

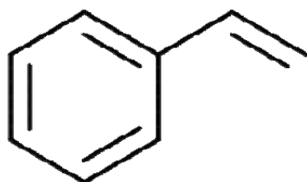
Chemical name (IUPAC): Styrene

CAS number: 100-42-5

ES number: 202-851-5

Molecular formula: C<sub>8</sub>H<sub>8</sub>

Structure:



### Uses and Applications

Styrene is used to manufacture polymers. The polymers are used in the production of plastics such as: polystyrene (PS), acrylonitrile butadiene styrene (ABS); rubber, such as: styrene-butadiene rubber (SBR), styrene-butadiene latex, styrene-isoprene-styrene (SIS), styrene-ethylene/butylene-styrene (S-EB-S), styrene-divinylbenzene(S-DVB), and unsaturated polyesters.

Styrene-containing polymers are used to manufacture a wide variety of everyday goods ranging from cups and utensils to furniture, bathroom and kitchen appliances, hospital and school supplies, sports and recreational equipment, consumer electronics, automotive parts and durable, light weight packages.

Ashland does not produce styrene but instead purchases styrene from both US and international manufacturers. Ashland's Performance Materials business uses styrene to manufacture unsaturated polyester resins. Ashland Performance Materials' unsaturated polyester resins are used to make, among other things, boats, counter tops, shower stalls, automobile parts, construction materials, storage tanks and piping.



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**Physical/Chemical Properties**  
**Phys/Chem Safety Assessment**

Styrene exists as a colorless to yellowish flammable liquid under normal conditions. It is relatively insoluble in water. Styrene has a sweet odor, which is detectable at very low levels of less than one part per million in air.

Property	Value
Form	Colorless to yellowish liquid
Physical state	Liquid
Color	Colorless to yellowish
Odor	Sweet. Odor threshold 0.04-0.32 ppm
Density	0.9060 g/cm <sup>3</sup> at 20°C
Boiling point	146.65°C
Flammability	H226: Flammable liquid and vapour
Explosive properties	Not explosive
Self-ignition temperature	490°C
Vapor pressure	6.67 hPa@20°C, 12.66 hPa@30°C
Mol weight	104.15 g/mol
Water solubility	320 mg/L@25°C
Flash point	31°C
Octanol-water partition coefficient (LogKow)	3.05

**Health Effects**  
**Human Health Safety Assessment**

**Consumer:** Consumers are unlikely to come into contact with harmful levels of styrene, as styrene monomer is found only in trace quantities in consumer products.

**Worker:** Exposure of humans to styrene by contact with the liquid or by breathing styrene in the air may result in temporary irritation of the eye and skin. Breathing styrene may also result in temporary irritation of nose and throat. Irritation is typically seen when styrene levels in the air exceed 100 ppm. Central Nervous System (CNS) effects, such as dizziness, drowsiness, headaches and nausea, may also occur from exposures exceeding 100 ppm. Repeated exposure to 20 – 50 ppm styrene in the air has also been suggested to cause effects on hearing, color vision and reaction time.

Effect Assessment	Result
Acute Toxicity Oral / inhalation / dermal	H332: Harmful if inhaled H304: May be fatal if swallowed and enters airways H303: May be harmful if swallowed (China GHS, Taiwan GHS)
Irritation / corrosion Skin / eye / respiratory test	H315: Causes skin irritation H319: Causes serious eye irritation H335: May cause respiratory irritation
Sensitization	Not classified
Toxicity after repeated exposure Oral / inhalation / dermal	H372: Causes damage to through prolonged or repeated exposure if inhaled
Genotoxicity / Mutagenicity	Not classified
Carcinogenicity	Not classified under CLP/GHS. Classified by IARC as Group 2B – possibly carcinogenic to humans. Classified by US NTP as reasonably anticipated to be a human carcinogen
Toxicity for reproduction	H361d Suspected of damaging the unborn child (CLP)

## Environmental Effects

### Environmental Safety Assessment

Based on available data, styrene is not expected to be toxic in relevant environmental concentrations.

Effect Assessment	Result
Aquatic Toxicity	H401 Toxic to aquatic life (China GHS, Taiwan GHS, Japan GHS)
<b>Fate and behavior</b>	
Biodegradation	Readily biodegradable
Bioaccumulation potential	Not highly bioaccumulative
PBT / vPvB conclusion	Not PBT or vPvB

## Exposure

### Human Health

The principal route of styrene exposure for the general population and workers is via air. Air contamination levels of styrene for the general public can be attributed to emissions from industrial activities, building materials, consumer products, vehicle exhaust, and tobacco smoke. Rural or suburban air generally contains lower concentrations of styrene than urban air. Indoor air often contains higher levels of styrene than outdoor air. Typical levels of styrene in outdoor air ranges from 0.06–4.6 parts per billion (ppb) and indoor air ranges from 0.023–11.5 ppb.

Air contamination levels in the workplace are due to handling, storing and processing of styrene and styrene containing polymers. The highest potential for exposure to styrene occurs in the reinforced-plastics industry. Workers involved in styrene polymerization, rubber manufacturing, and styrene-polyester resin facilities may also be exposed to styrene.

Exposure can also occur by eating foods containing styrene and by absorbing styrene through the skin. Low levels of styrene occur naturally in a variety of foods, such as fruits, vegetables, nuts, beverages, and meats. In addition, negligible amounts of styrene can be transferred to food from styrene-based packaging material.

Styrene is occasionally detected in groundwater, drinking water, or soil samples. Drinking water containing styrene or bathing in water containing styrene may result in low levels of exposure. Workers may come in skin contact with styrene during handling, storing and processing of styrene and styrene containing polymers.

### Environment

Environmental exposure to styrene is minimal, as styrene quickly reacts or degrades. Only large releases are anticipated to have the potential for environmental damage

## Risk Management Recommendations

Exposure to styrene is controlled by sufficient ventilation and proper handling and storage techniques. Examples include: ventilation system, proper protective equipment such as eye protection (i.e., splash proof goggles), normal work clothing which covers arms and legs, resistant gloves, and NIOSH approved respirators in situations where exposure exceeds allowable exposure limits and/or ventilation alone is not sufficient. In addition, low pressure spraying and reduced styrene level polymers also have been used to reduce styrene exposure in the workplace.

National and local governments regulate styrene emissions from facilities. The regulatory emission limits for each facility are established to protect the health and environment of the community surrounding the facility and are written into the facility's operating permit.

Exposure to styrene in the workplace is covered by established exposure limits. A partial list of references follows:

US OSHA PEL: 100 ppm (8h TWA)

ACGIH TLV: 20 ppm (8h TWA)

EU and member states: <http://osha.europa.eu/en/topics/ds/oel/index.stm/members.stm>

China: 50 mg/m<sup>3</sup> (8h TWA)

## Regulatory Agency Review

Styrene:

- is on the list of REACH Registered substances ((EC) 1907/2006)
- is on the US TSCA inventory
- is on the Australia Inventory of Chemical Substances
- is on the Canada Domestic Substances List
- is on the China Inventory of Existing Chemical Substances
- is on the Japan Inventory of Existing & New Chemical Substances
- is on the Japan Industrial Safety & Health Law Inventory
- is on the Korea Existing Chemicals Inventory
- is on the New Zealand Inventory of Chemicals
- is on the Philippines Inventory of Chemicals and Chemical substances
- has been classified by IARC as a Group 2B carcinogen
- has been classified by the US National Toxicology Program as a reasonably anticipated human carcinogen

## Regulatory Information / Classification and Labeling

Under GHS substances are classified according to their physical, health, and environmental hazards. The hazards are communicated via specific labels and the SDS. GHS attempts to standardize hazard communication so that the intended audience (workers, consumers, transport workers, and emergency responders) can better understand the hazards of the chemicals in use.

### Hazard Statements:

H226: Flammable liquid and vapour

H304: May be fatal if swallowed and enters airways

H315: Causes skin irritation

H319: Causes serious eye irritation

H332: Harmful if inhaled

H335: May cause respiratory irritation

H372: Causes damage to organs through prolonged or repeated exposure

H401 Toxic to aquatic life

H361d Suspected of damaging the unborn child

### Signal word: Danger

### Precautionary statements:

P210: Keep away from heat/sparks/open flames/hot surfaces – No smoking.

P240: Ground/bond container and receiving equipment

P261: Avoid breathing dust/fume/gas/mist/vapors/spray

P280: Wear protective gloves/protective clothing/eye protection/face protection

P312L Call a POISON CENTER or doctor/physician if you feel unwell

P337+P313: If eye irritation persists: Get medical advice/attention

### Hazard pictograms:



GHS02: flameGH



S07: Exclamation Point



GHS08: Health Hazard

## Conclusion

Styrene is a vital component of modern plastics, rubbers, composites, and many everyday materials. With proper engineering controls and protective equipment, workers can safely use styrene to produce a variety of consumer products. Consumers, in turn, are not expected to be exposed to dangerous levels of styrene.

## Contact Information with Company

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## Additional Information

For more information on GHS, visit <http://www.osha.gov/dsg/hazcom/ghsguideoct05.pdf> or [http://live.unece.org/trans/danger/publi/ghs/ghs\\_welcome\\_e.html](http://live.unece.org/trans/danger/publi/ghs/ghs_welcome_e.html).

Ashland product stewardship summaries are located at <http://www.ashland.com/stewardship>

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*REACH registration is specific to Importers/Manufacturers that place the chemical on the EU market, and specific to registered uses. Inclusion on the list of REACH Registered Substances does not automatically imply registration by Ashland.*

*Inclusion on the New Zealand Inventory of Chemicals applies only to the pure substance listed. The importer of record must determine whether or not their substances are in compliance.*