

## Global Product Strategy (GPS) Safety Summary

### Styrene Monomer

This GPS Safety Summary is a high-level summary intended to provide the general public with an overview of product safety information on this chemical substance. It is not intended to provide emergency response, medical or treatment information, nor to provide an overview of all safety and health information. This summary is not intended to replace the Safety Data Sheet. For detailed guidance on the use or regulatory status of this substance, please consult the Safety Data Sheet, the Styrene Monomer Product Safety Bulletin and the Product Stewardship Bulletin (PSB).

#### Chemical Identity

**Name:** Styrene  
**Brand names:** Styrene Monomer  
**Chemical name (IUPAC):** Phenylethene  
**CAS number:** 100-42-5  
**EC number:** 202-851-5  
**Molecular formula:** C<sub>8</sub>H<sub>8</sub>

#### Uses and Applications

Styrene monomer is a basic building block of the plastics and synthetic rubber industries. It is used to make a host of downstream derivative products that go into many consumer goods. The primary derivatives of styrene monomer, in order of importance, include: polystyrene, expandable polystyrene (EPS) and acrylonitrile butadiene-styrene (ABS) resins, styrene-acrylonitrile (SAN) resins, styrene butadiene (SB) latex, SB Rubber (SBR), unsaturated polyester resins (UPR), and styrene thermoplastic elastomers (TPE)

Polystyrene is widely used to produce commodity and consumer goods. It is used in insulation, packaging, appliances, furniture, toys and cassettes. About 50% of the world production of styrene is consumed in the production of polystyrene.

Expandable polystyrene (EPS) is produced from styrene monomer and non-CFC (chlorinated fluorocarbons) blowing agents. It is primarily used in food packaging, insulation and cushion packaging. ABS/SAN resins are used in construction materials, appliances, business machines and transportation. About 30% of the world production of styrene is consumed in the production of EPS, ABS and SAN.

Other applications of styrene derivatives include paper and textile coatings and carpet backing (SB latex), production of tires (SBR), construction and marine applications (UPR), adhesives and specialty polymers.

## **Physical / Chemical Properties**

Styrene is a colorless to yellowish liquid with an aromatic, sweet odor. If styrene is not stabilized with an appropriate inhibitor, light or heat may promote an uncontrolled polymerization reaction, forming polystyrene. Reaction with oxygen may form a peroxide, which may explode at slightly elevated temperatures. Based on the boiling point of 145 °C (293 °F) and the flash point of 31 °C (87.8 °C), styrene is classified as a flammable liquid and vapor under the Globally Harmonized System (GHS) on classification and labeling.

## **Health Effects**

The human health toxicological hazards of styrene indicate moderate acute toxicity by the inhalation route of exposure, and low acute toxicity by the oral and dermal routes of exposure. Moderate eye and skin irritation were observed as well as temporary irritation of the respiratory tract. Styrene has been listed by the National Toxicology Program (NTP) as reasonably expected to be a human carcinogen. The International Agency for Research on Cancer (IARC) has listed styrene as a group 2B carcinogen (possibly carcinogenic to humans).

Styrene is classified as hazardous under GHS for its health effects.

The table below gives an overview of the health effects assessment results for styrene.

<b>Effect Assessment</b>	<b>Result</b>
Acute Toxicity Oral / inhalation / dermal	Moderate acute toxicity via inhalation route of exposure, and low acute toxicity via oral and dermal routes of exposure. May be fatal if swallowed and enters the airways.
Irritation / corrosion Skin / eye/ respiratory tract	Moderately irritating to eyes and skin. Causes irritation of the respiratory tract.
Sensitization	Not sensitizing.
Toxicity after repeated exposure Oral / inhalation / dermal	May damage hearing organs and impair color vision following prolonged or repeated inhalation.
Genotoxicity / Mutagenicity	Not considered to have mutagenic effects
Carcinogenicity	Listed by NTP as reasonably anticipated to be a human carcinogen and by IARC as a group 2B carcinogen (possibly carcinogenic to humans). Styrene produced tumors in animals that are of no, or questionable, relevance to humans.
Toxicity for reproduction	Not selectively toxic to reproduction.

## **Environmental Effects**

Styrene is considered to be toxic to aquatic life. It is readily biodegradable and does not bioaccumulate.

The table below gives an overview of the environmental assessment results for styrene.

<b>Effect Assessment</b>	<b>Result</b>
Aquatic Toxicity	Toxic to aquatic life

<b>Fate and behavior</b>	<b>Result</b>
Biodegradation	Readily biodegradable
Bioaccumulation potential	Not bioaccumulative
PBT / vPvB conclusion	Not considered to be either PBT or vPvB

PBT = Persistent, Bioaccumulative and Toxic in the environment.

vPvB = very Persistent and very Bioaccumulative in the environment.

## **Exposure**

### Human health

Because styrene is used predominantly in industrial systems as a monomer or intermediate, direct consumer contact is expected to be low. Styrene may be intentionally present in some products such as resins for construction and marine repair e.g. boats or other vessels. Carefully read and follow the instructions given on product labels for proper use.

Personnel exposure can occur either in a styrene manufacturing facility or in industrial or manufacturing facilities that use styrene to produce polystyrene or styrenic copolymers. It is usually produced, distributed, stored and consumed in closed systems. However, worker exposure can potentially occur during operations such as product transfer, product sampling or maintenance/repair activities on product-containing systems. The risk of accidental exposure should be controlled by selecting and applying the appropriate Risk Management Measures.

### Environment

Styrene is predominantly used as monomer in polymer production taking place in closed industrial processes. Therefore emissions and environmental exposure to styrene are very low.

## **Risk Management Measures**

For detailed guidance on the use of styrene, please consult the Safety Data Sheet and the Styrene Monomer Product Safety Bulletin.

Styrene Monomer should only be handled by knowledgeable and trained personnel.

### Human Health

When using chemicals make sure that there is adequate ventilation. Always use appropriate chemical-resistant gloves to protect the hands and skin, wear eye protection such as chemical goggles, and flame-retardant clothing. Do not eat, drink or smoke where chemicals are handled, processed or stored. Wash hands and skin following contact. If the substance gets into the eyes, rinse eyes thoroughly for at least 15 minutes with tap water and seek medical attention.

In the case of transfer or maintenance operations, always clear transfer lines prior to decoupling, and flush/drain to a closed system for recycle prior to opening equipment.

In cases where engineering controls cannot maintain airborne substance concentrations below exposure limits, or in cases with a risk of accidental exposure, additional risk management measures may be necessary such as the use of a complete suit protecting against chemicals and supplied air, a self-contained breathing apparatus or respirator.

#### Environmental

Prevent entry into waterways, sewers, basements or confined areas. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. All recovered material should be packaged, labelled, transported and disposed of or reclaimed in conformance with applicable laws and regulations and in conformance with good engineering practices.

#### Flammability / reactivity

Equipment used for handling and storage of Styrene should be grounded to prevent build-up of static electricity.

Regularly monitor inhibitor concentration level in the styrene in storage tanks and containers and ensure that the proper / minimum concentration is met, and consider addition of inhibitor if the concentration of inhibitor level becomes too low.

#### **Regulatory Information / Classification and Labeling**

This substance has been registered under REACH by relevant companies of LyondellBasell in the European Union.

For a detailed overview of the regulatory status of this substance, please refer to the Product Stewardship Bulletin (PSB) available from [LyondellBasell.com](http://LyondellBasell.com).

Under the Globally Harmonized System on classification and labeling (GHS) substances are classified according to their physical, health and environmental hazards. The hazards are communicated via specific labels on the product packaging and the Safety Data Sheet. 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.

For a detailed overview of the classification and labeling of this substance, please refer to the regional Safety Data Sheet, which can be found on [LyondellBasell.com](http://LyondellBasell.com).

## **Conclusion Statements**

- Styrene is used in the production of styrene polymers, copolymers, and synthetic rubbers which are extremely versatile and can be used in many industrial and consumer products.
- Styrene is classified as hazardous under GHS for its flammability and health effects. It has moderate acute toxicity to human health via the inhalation route of exposure, it is a moderate skin and eye irritant, and may damage hearing organs and impair color vision on prolonged or repeated exposure. Styrene has been listed as a possible carcinogen by IARC and NTP, and is toxic to aquatic organisms.
- By observing the appropriate Risk Management Measures, the styrene exposure to be expected at workplaces and to the general public/consumer are below recommended exposure limits.

## **Contact Information within Company**

For further information on this product in general, please consult the LyondellBasell corporate website ([www.lyb.com](http://www.lyb.com)).

## **Date of issue**

Date of issue: 4 June 2015.

## **Disclaimer**

Before using a product sold by a company of the LyondellBasell family of companies, users should make their own independent determination that the product is suitable for the intended use and can be used safely and legally.

SELLER MAKES NO WARRANTY; EXPRESS OR IMPLIED (INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY WARRANTY) OTHER THAN AS SEPARATELY AGREED TO BY THE PARTIES IN A CONTRACT.

This product(s) may not be used in:

- (i) any U.S. FDA Class I, Health Canada Class I, and/or European Union Class I medical devices, without prior notification to Seller for each specific product and application; or
  - (ii) the manufacture of any of the following, without prior written approval by Seller for each specific product and application: U.S. FDA Class II Medical Devices; Health Canada Class II or Class III Medical Devices; European Union Class II Medical Devices; film, overwrap and/or product packaging that is considered a part or component of one of the aforementioned medical devices; packaging in direct contact with a pharmaceutical active ingredient and/or dosage form that is intended for inhalation, injection, intravenous, nasal, ophthalmic (eye), digestive, or topical (skin) administration; tobacco related products and applications, electronic cigarettes and similar devices, and pressure pipe or fittings that are considered a part or component of a nuclear reactor.
- Additionally, the product(s) may not be used in: (i) U.S. FDA Class III Medical Devices; Health Canada Class IV Medical Devices; European Class III Medical Devices; (ii) applications involving permanent implantation into the body; (iii) life-sustaining medical applications; and (iv) lead,

asbestos or MTBE related applications. All references to U.S. FDA, Health Canada, and European Union regulations include another country's equivalent regulatory classification.

Users should review the applicable Safety Data Sheet before handling the product.

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