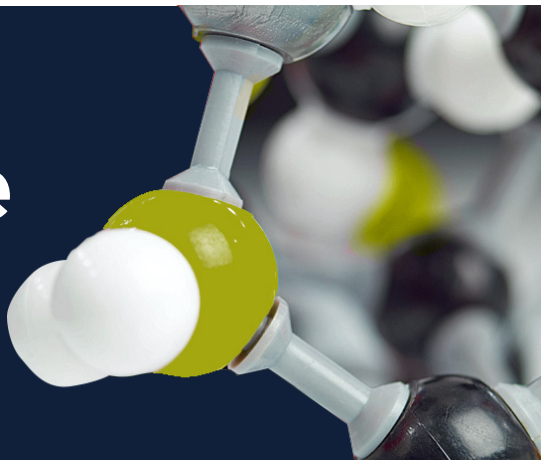
Global EPS SUSTAINABILITY Alliance

Expanded Polystyrene
Chemical Composition



Expanded polystyrene (EPS) is a lightweight, rigid, cellular plastic composed of organic elements – carbon and hydrogen. EPS foam products are made from expandable polystyrene (PS) resin beads impregnated with a blowing agent. The resin beads are expanded and then fused with steam in a mold cavity. This efficient manufacturing process creates a cellular structure filled with air. Most EPS foam is 98% air and only 2% plastic.

Chemical Composition

Everything around us, including the human body and everything we eat and drink, is entirely made up of chemicals. All chemicals have inherent properties that can be a hazard – even water and oxygen (it's possible to drink too much water and oxygen can cause explosions). When evaluating EPS, it is important to recognize the chemical elements and their function in the manufacturing process to produce finished foam products.

Pentane
Polystyrene resin beads contain a small percentage (3-6%) of the blowing agent pentane, a saturated hydrocarbon which has very low global warming potential. When exposed to steam, the pentane expands causing the resin bead to be expanded up to 50 times its original volume. The residual pentane found in finished foam products dissipates within a short time, being replaced with air.

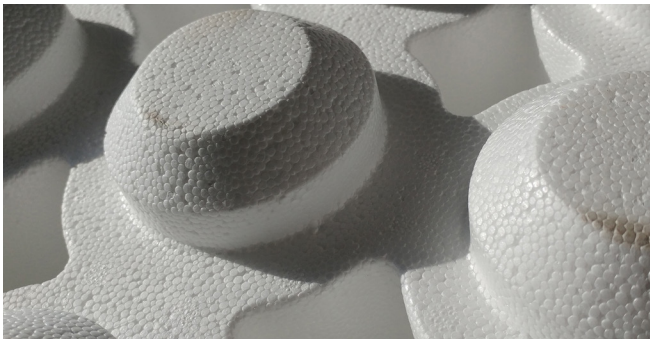
Styrene & Polystyrene
Styrene is a liquid building block chemical used to polymerize a variety of polystyrene plastics. It is also a naturally occurring chemical found in many common plants and foods, such as strawberries, coffee, cinnamon and beef. The residual styrene that can be found in finished EPS foam products is very low.

Flame Retardants
Flame retardants (FR) are used in EPS building insulation to reduce the risk of fire. Experts recognize that the use of flame retardants helps prevent fires from starting and can slow flame spread which is critical when every second counts. To improve the effectiveness of the FR, a synergist is often added to the EPS resin. Typical synergists include dicumyl peroxide and dicumene. Packaging does not require the use of flame retardants.

Human Exposure & Risk vs Hazard

Regulatory agencies set exposure limits through scientific risk assessments to determine a safe threshold for various chemicals found in everyday products. When exposed to a chemical below those thresholds, there is no hazard.

Although trace amounts of styrene are found in EPS foam products, reports published by the FDA and the U.S. Department of Health and Human Services (HHS), indicate the minute amount of styrene found in polystyrene – including EPS – does not pose a threat to human health.



EPS Packaging & Insulation Foam Emissions – 24-hrs Post-Manufacture		
Chemical	Emissions µg/m²•hr	Notes
Pentane	13-130	Fully dissipates after molding.
Styrene	32-80	Residual amount from EPS resin manufacturing.
Acetophenone	47-150	By-product of EPS resin manufacturing with flame retardant. Used in insulation building applications.
Ethylbenzene	3-53	Unreactive styrene impurity.

Indoor Air Quality

Numerous third-party test reports confirm EPS insulation meets some of the most stringent standards for indoor air quality. Intertek Testing has verified EPS packaging and insulation VOC emissions through California Specification 01350, Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers.

The UL Environment Styrene Exposure Assessment for Expanded Polystyrene Foam Insulation Materials report determined indoor air concentrations associated with product emissions of styrene using ASTM D5116, Standard Guide for Small-Scale Environmental Chamber.

Determinations of Organic Emissions from Indoor Materials/Products. This toxicological assessment used "worst-case" conditions for both emitting surface area, airflows and human exposure to conservatively estimate indoor air styrene concentrations and the potential risk to building occupants associated with EPS insulation materials.

According to the report, exposure to EPS insulation within a private office, school classroom or home residence would result in estimated consumer lifetime average daily doses (LADDs) for styrene that are well below 'No Significant Risk Level' (NSRL) published by government agencies.

Worker Safety

EPS manufacturing facilities require proper permitting and must adhere to all applicable workforce safety laws and regulations. Concerning worker exposure to chemical byproducts from expanded polystyrene processes, periodic governmental investigations show EPS manufacturing does not pose a health hazard. Testing concludes that employees were not exposed over applicable occupational exposure limits to carbon monoxide, pentane, styrene, acetophenone, ethylbenzene, xylene, respirable dust, or total dust in molding and cutting production areas. EPS manufacturers must also adhere to respective Material Safety Data Sheets that cover hazards identification, physical and chemical properties, handling and storage, exposure controls, toxicological information, ecological information, and disposal considerations.

Environmental Exposure

EPS products are inert and non-toxic in land and water systems. While EPS will not biodegrade readily in the environment, prolonged exposure to sunlight will cause the material to break down slowly over time. EPS is safe for landfills, it does not break down into hazardous gases or other toxic compounds.

Studies Affirm Potential Exposures for EPS Foam Fall Below Applicable Limits

Organization	Report	Results
Dept. of Health & Human Services, Center for Disease Control, National Institute for Occupational Safety & Health (NIOSH)	NIOSH Health Hazard Evaluation Report 2005-0243-3016, 2006	"EPS manufacturing plant employees were not exposed to greater than applicable occupational exposure limits for carbon monoxide, pentane, styrene, acetophenone, ethylbenzene, xylene or respirable dust."
Aarhus University	Limited Evidence That Styrene Causes Cancer in Humans, 2017	A study of more than 72,000 employees exposed to styrene has not found an increase incidence of a wide range of cancer types.
U.S. Food and Drug Administration (FDA) Food Additive Master File (FAMF)	The Safety of Styrene-Based Polymers for Food Contact Use, 2013	"Estimated daily intake (6.6 µg/person/day) is more than four orders of magnitude less than the acceptable daily intake." (90,000 µg/person/day)

Note: No Significant Risk Level (NSRL) is the risk level of less than 1 case of cancer in 100,000 people over a 70-yr lifetime of exposure.