National Marine Manufacturers Association

# NMMA White Paper: Styrene 101

## Introduction

The first fiberglass boat was built in 1942 in Toledo, Ohio, using materials developed by American Cyanamid Company and Owens Corning. It was not until the 1970's that the modern boat building industry started to take off, leading the way with larger, lighter boats with higher powered engines. As the boating industry grew, many core materials changed and resins were reformulated with new application methods. What has not changed is the chemical styrene: an essential chemical required for manufacturing fiberglass boats.

## 1. What is styrene and what are the chemical uses and benefits?

Styrene is a clear, colorless liquid that is synthesized for commercial use from petroleum and natural gas by-products. Styrene also occurs naturally in the environment and is an inherent component in small concentrations of many commonly consumed foods and beverages, such as coffee, strawberries, and cinnamon.

Styrene is an essential component of materials used to make thousands of remarkably strong, flexible, and light-weight products for home, school, work, and play, including, but not limited to: convenient food containers; protective packaging materials; computer housings; consumer electronics; medical applications; components for automobiles, trucks, trains, boats, aircraft, and other means of transport; wind-energy parts; construction and water treatment products; building insulation; military personnel and vehicle armor; ballistic protection; fuel cells; gasoline and other storage tanks; protective sports gear, such as bicycle helmets; and many other important items. Styrene production and the manufacture of products derived from styrene represent an important part of the U.S. economy and these products enhance quality of life by providing improved energy efficiency, added performance, and cost efficiencies.

## 2. How is Styrene currently regulated by the U.S. Environmental Protection Agency and U.S. Occupational Safety and Health Administration?

### a. Environmental Protection Agency Regulations

Toxic Substances Control Act

The Frank R. Lautenberg Chemical Safety for the 21st Century Act significantly revised the Toxic Substances Control Act (TSCA) in 2016, including a requirement for the Environmental Protection Agency (EPA) to conduct a risk evaluation of existing chemicals regulated under TSCA on a priority basis. TSCA directs EPA to focus first on chemicals listed in its 2014 Chemical Substances Work Plan, which includes styrene. EPA selected priority candidates for evaluation in 2016 and 2019 but did not select styrene, one of 53 substances listed in the work plan not currently under review. EPA is expected to nominate the next round of candidates for TSCA risk evaluation in 2022.

Integrated Risk Information System

The EPA's Integrated Risk Information System (IRIS) characterizes the health hazards of chemicals and develops chronic toxicity values for use in the full range of EPA risk management programs. IRIS assessments represent EPA's official position regarding a chemical substance's carcinogenicity or toxicity. Styrene was last reviewed by the IRIS program in 1992 for non-cancer effects and assigned chronic oral and inhalation toxicity values of 0.2 mg/kg bw/day (milligrams per kilogram of body weight per day) and 1 mg/m3 (milligrams per cubic meter of air) (0.23 ppm), respectively. The IRIS program has not assessed styrene for carcinogenicity.

Toxics Release Inventory

The EPA annually collects and compiles information on the release and management of select chemicals (e.g., recycling, energy recovery, and treatment) by U.S. manufacturing facilities and makes the Toxics Release Inventory (TRI) information public. Styrene is one of many substances selected for TRI reporting as a hazardous air pollutant. Styrene dissipates rapidly when released into the air or water. Fiberglass boat manufacturing and reinforced plastic industries can be a significant source of TRI hazardous air pollutant (HAP) emissions. Overall, TRI reports indicate that styrene air releases are declining over time, in part due to new control technology.

### b. Occupational Safety & Health Agency Regulations

The Occupational Safety and Health Administration (OSHA) regulates styrene as a hazardous substance because of short-term reversible central nervous system effects, such as drowsiness and delayed reaction time that may be experienced from exposure to styrene in the workplace. The OSHA permissible exposure limit (PEL) for styrene, adopted in 1971, is 100 ppm, meaning that a worker should not be exposed to more than an average of 100 ppm styrene during a regular eight-hour workday without respiratory protection.

In 1996, OSHA endorsed the styrene industry's voluntary 50 ppm exposure level program. In 2011 based on new industry-sponsored research, the Styrene Information & Research Center (SIRC) has recommended a 20 ppm guideline.

## 3. What do we know about the health effects of styrene?

NMMA refers to the Styrene Information & Research Center (SIRC) who are the experts on this subject for our information and guidance on the health effects of styrene. In 2019, SIRC completed and published an updated comprehensive human health risk assessment as part of a its 30-year research program and to update the 2002 Harvard styrene risk assessment. The SIRC human health risk assessment reviewed the scientific literature on styrene, develop hazard and exposure assessments, and assessed potential toxicological risk—with a focus on workers in environments where styrene is made or used in manufacturing as well as the general population from environmental and consumer exposures. Distinct areas of study included: cancer and toxicity to the nervous system, immune system, and reproduction and development. Independent scientists with relevant expertise prepared the various sections of the assessment.

The completed assessment was published by the *Journal of Toxicology and Environmental Health, Part B: Critical Reviews* in July 2019. This assessment updates a 2002 styrene risk assessment conducted by Harvard University.

For this assessment, SIRC assembled a group of independent experts to:

- Systematically review the scientific literature on styrene.
- Develop hazard and exposure assessments.
- Assess the current science on styrene and human health—with a focus on workers in environments where styrene is made or used in manufacturing as well as general population exposures from environmental and consumer product sources.

Major conclusions of the project include:

- Consumer products made with styrene remain safe. There is negligible concern or risk from exposures to styrene through everyday use of consumer products.
- Occupational risks are within acceptable ranges for most workers.
- The general population is unlikely to experience adverse health outcomes associated with styrene environmental or consumer exposures.

## 4. Frequently asked questions

### a. Does styrene cause cancer?

There are no strong or consistent indications that styrene causes any form of cancer in humans. Although some studies suggest that styrene-exposed workers may be at increased cancer risk, the human evidence for styrene carcinogenicity is inconclusive.

### b. What about other health effects?

Hearing impairment—ototoxicity—is an area of concern for certain workplace exposures. Simultaneous exposure to noise and styrene appears to increase potential adverse effects. Noise protection is important for styrene workers exposed to high levels of noise.

For more information on styrene health effects go to the SIRC Website at www.styrene.org.