

Styrene is a clear, colorless liquid that is a component of materials used to make thousands of everyday products for home, school, work, and play. Products made from polymers derived from styrene add convenience, value, and quality to daily life. They range from packaging such as jewel cases that protect CDs and containers that keep yogurt fresh to toys, recreational equipment, and myriad consumer electronics as well as construction, transportation, medical, health and safety applications. Probably the most recognizable material is polystyrene, often encountered as expanded polystyrene foam.



Scientific Experts Report That Styrene Does Not Threaten Human Health

¹ Tang Weici, Ingrid Hemm, and Gerhard Eisenbrand, "Estimation of Human Exposure to Styrene and Ethylbenzene," *Toxicology* 144, 1-3 (April 2000), pp. 39-50.

² U.S. Department of Health and Human Service, National Toxicology Program, Center for the Evaluation of Risks to Human Reproduction, *NTP-CERHR Monograph on the Potential Human Reproductive and Developmental Effects of Styrene* (Washington, D.C.: U. S. Government Printing Office, NIH Publication No. 06-4475, February 2006), Table 5, p. II-7.

³ See, for example, David H. Steele; Michael J. Thornburg; John S. Stanley; Roland R. Miller; Richard Brooke; Janette R. Cushman; and George Cruzan, "Determination of Styrene in Selected Foods," *Journal of Agricultural and Food Chemistry* 42, 8 (August 1994), pp. 1661-1665.

⁴ Most of these data are compiled from Table 5 in U.S. Department of Health and Human Service, National Toxicology Program, Center for the Evaluation of Risks to Human Reproduction, *NTP-CERHR Monograph on the Potential Human Reproductive and Developmental Effects of Styrene* (Washington, D.C.: U. S. Government Printing Office, NIH Publication No. 06-4475, February 2006), p. II-7. The data on styrene exposure owing to residual migration from a polystyrene foam cup is extracted from two sources: S. L. Varner and Charles V. Breder, "Headspace Sampling and Gas Chromatographic Determination of Styrene Migration from Food-Contact Polystyrene Cups Into Beverages and Food Simulants," *Journal of the Association of Official Analytical Chemists* 64, 5 (September 1981), pp. 1122-1130, and Gregory L. Durst and Edward A. Laperle, "Styrene Monomer Migration as Monitored by Purge and Trap Gas Chromatography and Sensory Analysis for Polystyrene Containers," *Journal of Food Science* 55, 2 (March 1990), pp. 522-524. Based on these studies, 5 to 10 part per billion is a reasonable estimate for the amount of styrene migrating into a contained liquid from polystyrene foam cups.

A version of the table found in *NTP-CERHR Monograph on the Potential Human Reproductive and Developmental Effects of Styrene* (with a polystyrene foam cup added from the Varner and Breder & Durst and Laperle sources) can be found below. The data indicate that compared with these six common foods, the high end of styrene exposure from a polystyrene foam cup is slightly higher than beef and coffee beans and considerably lower than styrene exposure from cinnamon. At the low end, styrene exposure from a polystyrene foam cup is comparable to styrene exposure from beef.

Food (except 2) (with no packaging contact)	Range of Styrene Exposure Levels (parts per billion)
1. Cinnamon	170-39,000
2. Beer	10-200
3. Beef	5.3-6.4
4. Coffee Beans	1.6-6.4
5. Strawberries	0.37-3.1
6. Peanuts	1-2.2
7. Wheat	0.4-2

⁵ "SIRC: Frequently Asked Questions," Styrene Information & Research Center web site. <<http://www.styrene.org/faqs.html#health>>

⁶ The Harvard Center for Risk Analysis (J. T. Cohen; G. Carlson; G. Charnley; D. Coggin; E. Delzell; J. D. Graham; H. Greina; D. Krewski; M. Medinsky; R. Manson; D. Paustenbach; B. Petersen; S. Rapport; L. Rhomberg; P. B. Ryan; and K. Thompson), "A Comprehensive Evaluation of the Potential Health Risks Associated with Occupational and Environmental Exposure to Styrene," *Journal of Toxicology and Environmental Health* 5, 1-2 (January 2002), pp. 1-263.

The Safety of Styrene



in Selected Foods

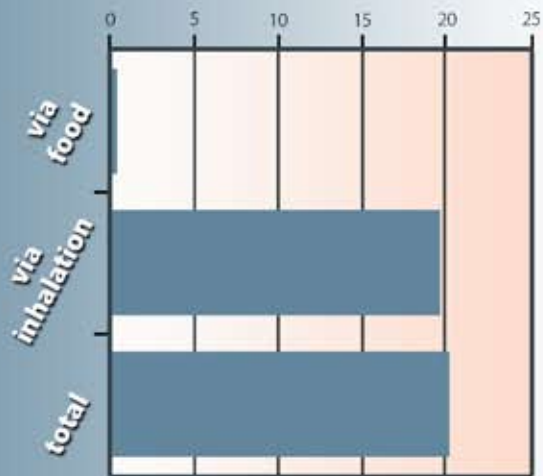


Figure 1 Average Annual Styrene Intake - High End Range

Most people are exposed to styrene every day in tiny amounts that may be present in the air, primarily from automobile exhaust and cigarette smoke, or that occur naturally in food such as cinnamon, beef, coffee beans, peanuts, wheat, and strawberries. These generally are trace amounts, which were difficult to detect until recent technological advances improved scientists' ability to measure minute amounts of chemicals. Figure 1 shows the average annual styrene intake (at the high end of the range) based on sources of exposure.¹

Figure 2 shows levels of naturally occurring styrene in selected foods.² In the final analysis, all credible research indicates that it is safe for consumers to consume cinnamon, beef, coffee beans, peanuts, wheat, and strawberries.³ Styrene is a constituent of polystyrene, which is used to produce food grade packaging, among other products.⁴ Studies indicate that a person ingests more styrene from cinnamon and beer than from a polystyrene cup.

Numerous studies have found that styrene is not harmful in the amounts we sometimes encounter in air or food. In 1994, after an exhaustive assessment of styrene's possible health and environmental effects, the Canadian government ministries Health Canada and Environment Canada concluded that styrene is "non-toxic" for regulatory purposes. Health Canada found that styrene "does not constitute a danger to human life and health" and "does not constitute a danger to the environment on which human life depends."⁵ In 2002, a twelve-member panel of international experts selected by the Harvard Center for Risk Analysis reported that styrene is naturally present in foods, and the styrene levels in these foods does not represent a threat to human health.⁶

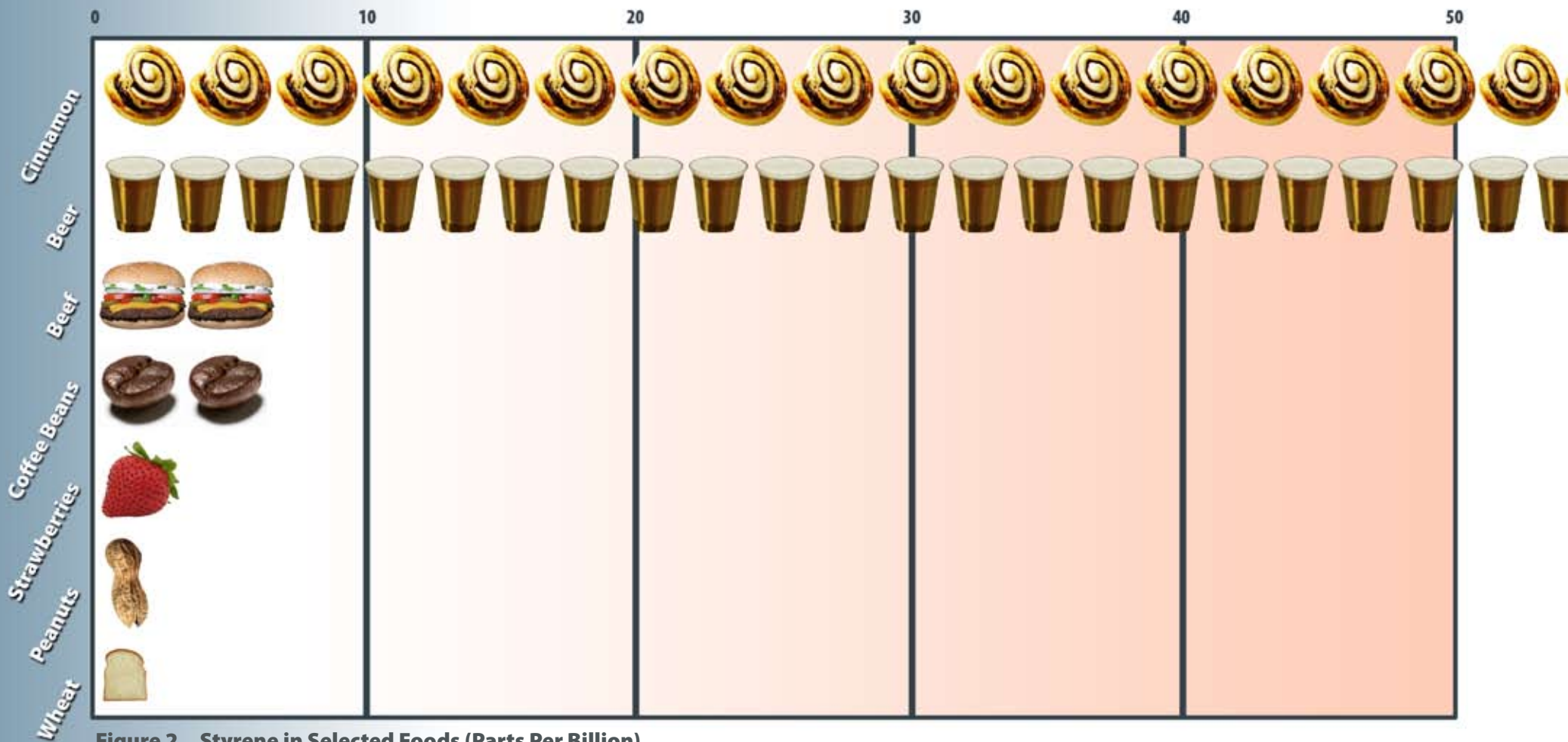


Figure 2 Styrene in Selected Foods (Parts Per Billion)