

POLYSTYRENE: THE SAFETY RECORD

What decades of independent science, regulatory review, and commercial use confirm

INTRODUCTION



Ask most people what they know about polystyrene and the answer is often the same: it is bad for the environment, and probably not safe. Neither characterization holds up to scrutiny. Decades of independent research and review by the world's leading health and food safety authorities tell a different story — one that rarely makes headlines but is well established in the scientific record. The U.S. Food and Drug Administration, the European Food Safety Authority, and independent peer-reviewed researchers have consistently reached the same conclusion: **polystyrene, as used in food-contact packaging and transport applications, is safe.**

This report assembles that evidence in one place. It is a forward-looking document, not a defensive one. The goal is to ensure that policymakers, brand partners, and recycling system stakeholders are working from what the evidence actually says — not from a confusion between styrene, the raw liquid ingredient used to make polystyrene, and polystyrene itself, the solid, stable material that results from it. These are two different things with two very different safety profiles, and the distinction between them is where the conversation needs to start.

GETTING THAT DISTINCTION RIGHT IS IMPORTANT TO OVERCOME THIS MISCONCEPTION.

Polystyrene is not a hazardous material. It is a well-characterized, extensively reviewed polymer with a 50-year regulatory approval record and no credible evidence of consumer health risk.

SECTION 1

STYRENE AND POLYSTYRENE ARE NOT THE SAME MATERIAL

Most of the concern about polystyrene safety traces back to a single misunderstanding: treating styrene and polystyrene as the same thing. They are not. Styrene is a small low molecular weight chemical. Polystyrene is the solid, extremely high molecular weight polymer produced from it. Once styrene is polymerized into polystyrene, the properties of polystyrene are fundamentally different than styrene.

STYRENE: THE MONOMER

Styrene is the liquid ingredient used to make polystyrene. It is also, perhaps surprisingly, a naturally occurring compound found in many everyday foods – strawberries, cinnamon, coffee, peanuts, and beef among them. The European Food Safety Authority has confirmed that the styrene people consume through their diet from natural food sources is comparable to what they might encounter from polystyrene packaging. Decades of research across the general population have found no consistent evidence linking styrene to cancer.

POLYSTYRENE: THE POLYMER

Polystyrene is the stable solid material produced when styrene molecules polymerize, forming high molecular weight polystyrene. In that finished form, it does not react with food, liquids, or the environment under normal conditions of use. Tiny traces of residual styrene can remain in the finished product, and these are tightly regulated – the FDA sets strict limits for food-contact applications, and commercial polystyrene products come in below those limits. The FDA’s acceptable daily intake for styrene is 90 milligrams per person per day. Actual exposure from polystyrene packaging, conservatively estimated at just 0.007 milligrams, is at a level that can be safely ingested daily over a lifetime without appreciable health risk.

KEY DISTINCTION



Styrene is the raw liquid ingredient. Polystyrene is the finished solid material made from it. Concerns about styrene at high exposure levels do not apply to polystyrene in its finished form.

This is not a minor distinction. It is the difference between a low molecular weight chemical and the high molecular weight material used to safely transport food, medicine, and large appliances – and it is the distinction that regulators have built their approvals around for more than 50 years.

SECTION 2

A 50-YEAR REGULATORY RECORD

Polystyrene has not gone unscrutinized. It has been reviewed repeatedly, by multiple independent bodies, over more than five decades. The findings have been remarkably consistent. Here is what the major authorities say.

U.S. FDA 	EUROPEAN FOOD SAFETY AUTHORITY 	INTERNATIONAL AGENCY FOR RESEARCH ON CANCER 	STYRENE INFORMATION RESEARCH CENTER 
Determined suitable for food contact for 50+ years. Covers direct and incidental food-contact applications including containers, trays, and appliance components. Continues to monitor health and toxicology data; determination has remained unchanged.	In 2025, EFSA reviewed the full body of evidence and found polystyrene packaging safe at real-world exposure levels. Recycled PS resin comes in 87% below their safety limit.	The International Agency for Research on Cancer classifies styrene as Group 2A: not a finding of harm. It applies to styrene the raw ingredient, not to polystyrene the finished material. The same category includes consumption of red meat and drinking very hot beverages.	After reviewing 30+ years of evidence, the Styrene Information and Research Center found no meaningful health risk to consumers from everyday styrene exposure.



U.S. FOOD AND DRUG ADMINISTRATION (FDA)

For more than 50 years, the FDA has determined that polystyrene is suitable for use in food-contact applications – containers, trays, clamshells, and the interior components of household appliances like refrigerators. That determination reflects a rigorous review process. The FDA continues to monitor relevant health and toxicology data and has maintained its position on polystyrene’s suitability for food-contact use across decades of commercial application. The breadth of that determination reflects the FDA’s confidence in polystyrene’s stable properties and its performance across the temperature and contact conditions encountered in normal commercial use.



EUROPEAN FOOD SAFETY AUTHORITY (EFSA): JUNE 2025 REASSESSMENT

In June 2025, EFSA completed its most comprehensive review of polystyrene food-contact materials in decades. Reviewing the full body of available research – animal studies, human exposure data, and real-world measurement data – EFSA reached a clear conclusion: polystyrene packaging is safe at real-world exposure levels.

EFSA also set a conservative safety limit for how much residual styrene can migrate into food from packaging. Commercial polystyrene products come in well below that limit. Recycled polystyrene resin produced through dissolution recycling – now commercially available – has been measured at 87% below EFSA’s limit, demonstrating that even recycled material meets the bar.

EFSA 2025

Found polystyrene packaging safe at real-world exposure levels. Recycled PS resin tests at <5 ppb residual styrene, 87% below EFSA’s safety limit. The <5 ppb figure is drawn from published commercial production data from dissolution recycling operators and is referenced in EFSA’s June 2025 reassessment. It reflects the output of the dissolution process specifically, not mechanical recycling.



INTERNATIONAL AGENCY FOR RESEARCH ON CANCER (IARC)

IARC’s Group 2A classification for styrene – the same category that includes consumption of red meat and drinking very hot beverages – means the evidence is not conclusive. It is not a finding of harm, it sets no exposure threshold, and it applies to styrene the raw ingredient, not polystyrene the finished material. Both the FDA and EFSA have reviewed it and have not changed their opinions on compliance for polystyrene food-contact use.

SECTION 3

WHAT INDEPENDENT SCIENCE SAYS

Regulatory approvals are one part of the picture. Independent researchers — working separately from industry and government — have also examined the question, and their findings align. **Here is what the science shows.**

2019 PEER-REVIEWED RISK ASSESSMENT UPDATE

In 2019, the Styrene Information and Research Center published a comprehensive human health risk assessment, peer-reviewed and published in the Journal of Toxicology and Environmental Health, Part B, synthesizing more than 30 years of research on styrene toxicology. The assessment reviewed evidence from occupational settings, environmental exposure, and everyday consumer contact. Findings on consumer safety were clear:

- Everyday exposure to styrene — from packaging, food contact, or general environment — is unlikely to cause health harm in the general population.
- No consistent evidence was found linking everyday styrene exposure in the general population to cancer or other health problems.
- Research findings from industrial, high-exposure workplaces do not apply to consumers, whose exposure levels are dramatically lower.
- **No meaningful health risk:** after reviewing 30+ years of evidence, SIRC found no meaningful health risk to consumers from everyday styrene exposure.
- **General population safety:** the general population is very unlikely to experience adverse health effects from environmental or consumer exposures to styrene.
- **No strong evidence linking styrene to cancer:** the weight of evidence does not support a conclusion that styrene causes cancer in humans under typical exposure scenarios.



NATURALLY OCCURRING STYRENE IN FOOD

One of the most useful ways to understand polystyrene packaging exposure is to put it alongside something familiar. Styrene occurs naturally in many everyday foods – strawberries, cinnamon, beef, and coffee. EFSA confirmed that what people consume from natural food sources is comparable to what they might encounter from polystyrene packaging. The graphic below shows where polystyrene packaging sits in that context.

FDA SAFETY LIMIT

Maximum daily styrene exposure regulators consider acceptable, set conservatively



90 mg/day

ACTUAL ESTIMATED EXPOSURE
FROM ALL PS PACKAGING

Compared with current FDA safety limit
Acceptable Daily Intake (ADI)



0.007 mg/person/day

NATURALLY OCCURRING
STYRENE IN CINNAMON

Styrene occurs naturally in many common foods including strawberries, cinnamon, and coffee

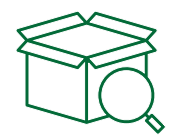
~30 mg/kg concentration
~0.075 mg per tsp consumed



SECTION 4

FOOD-CONTACT SAFETY IN PRACTICE

Understanding how polystyrene's safety approvals work in practice — not just in principle — is important for anyone evaluating it as a packaging material or a circularity investment.



MIGRATION TESTING AND REGULATORY COMPLIANCE

Food-contact regulations require that packaging materials do not transfer substances to food in quantities that could pose a health risk. For polystyrene, commercial producers conduct migration testing as part of compliance assurance, and aggregated data consistently show migration levels well below both FDA and EFSA limits.

Polystyrene's physical properties work in its favor here. Like PET, one of the most trusted food-contact materials in the world, polystyrene resists transfer at normal storage and refrigerated temperatures. Products are formulated and tested against the specific conditions of use regulators have defined, and reported data consistently show they perform well within limits.



COLD CHAIN AND MEDICAL APPLICATIONS

EPS transport packaging is widely used in pharmaceutical cold-chain logistics — including vaccine distribution and temperature-sensitive medical supply shipments — because of its thermal performance, structural integrity, and well-established safety profile. These are among the most demanding regulatory environments for packaging materials, and EPS transport packaging's continued role in them reflects the confidence of regulatory bodies in its stable properties.



RECYCLED POLYSTYRENE IN FOOD CONTACT

A key question for the circularity agenda is whether recycled polystyrene can meet food-contact safety standards. The evidence says yes, across mechanical, dissolution, and chemical recycling pathways.

Dissolution recycling has demonstrated the ability to produce recycled PS resin that meets or exceeds the safety profile of virgin material. Since 2013, one U.S. operator has used dissolution to produce FDA-approved food-contact polystyrene. A second has operated since 2023 at more than 8,000 metric tons per year with greater than 99% polymer recovery, producing pellets with 25% certified recycled content cleared for direct food contact. Residual styrene in this resin has been measured below 5 parts per billion, far below EFSA's limit. This low residual styrene level is specific to dissolution recycling, which uses a solvent process that actively removes contaminants. Mechanically recycled polystyrene retains a residual styrene profile similar to the input material – typically well within FDA and EFSA limits, but not at the sub-5 ppb level achieved by dissolution. Both pathways produce food-contact-safe material; dissolution achieves the lowest residual styrene of any recycling method.

Chemical recycling extends the system further. Processes like pyrolysis and gasification break used polystyrene back to its basic building blocks, providing a pathway for material that is contaminated or otherwise unsuitable for mechanical or dissolution recycling. The output is virgin-equivalent raw material for producing polystyrene suitable for food-contact applications.

The policy implication is straightforward: classifications of polystyrene as problematic on safety grounds are not supported by the evidence. The safety record of recycled polystyrene, produced through validated technology, is as strong as that of virgin material.

FOOD-CONTACT RECYCLED PS

Dissolution-recycled PS resin cleared for direct food contact under FDA criteria since 2013. Residual styrene <5 ppb, well below EFSA's safety limit.



SECTION 5

ADDRESSING COMMON CONCERNS

Several safety concerns about polystyrene appear regularly in policy and media coverage. Each is addressed below.

“POLYSTYRENE LEACHES HARMFUL CHEMICALS INTO FOOD.”

The evidence does not support this. Actual exposure to styrene from polystyrene packaging is estimated at 0.007 milligrams per person per day – a safe level based on current hazard and exposure. EFSA’s 2025 review found polystyrene packaging safe at real-world exposure levels.

“STYRENE IS A CARCINOGEN.”

It is not classified as one. IARC’s Group 2A designation – the same category as consumption of red meat or drinking very hot beverages (> 65°C) – means the evidence is inconclusive, not that harm has been found. It applies to styrene the raw ingredient, not polystyrene the finished material. The FDA and EFSA have both reviewed it and their acceptance for polystyrene food-contact use remain unchanged.

“RECYCLED POLYSTYRENE CANNOT BE USED SAFELY IN FOOD CONTACT.”

Commercial evidence says otherwise. Dissolution-recycled polystyrene has been produced for FDA-approved food-contact use since 2013. Residual styrene in that resin has been measured below 5 parts per billion – well within safety limits. The safety of recycled polystyrene in food-contact applications is not theoretical. It is commercially demonstrated.

SECTION 6

SAFETY AND CIRCULARITY ARE COMPLEMENTARY

There is a connection between the safety story and the circularity story that is easy to miss but worth making explicit. Polystyrene's safety and its recyclability are not separate arguments. They are two expressions of the same underlying property: chemical stability. The characteristics that make polystyrene safe in food-contact applications – its stability, its resistance to transferring substances, its structural integrity – are the same characteristics that make it well-suited for recycling.

Dissolution recycling makes this connection concrete. The process produces resin from post-consumer polystyrene that meets FDA food-contact standards, with residual styrene below 5 parts per billion. A material that can re-enter the food-contact supply chain through recycling is not a material with a safety problem. It is a material with a future.



Polystyrene's chemical stability, the basis of its safety record, is also the basis of its recyclability. These are not separate arguments. They are the same polymer property, viewed from two angles.

For policymakers, the implication is straightforward: the case for polystyrene circularity and the case for polystyrene safety are the same case. Supporting one means supporting the other.



CONCLUSION

The safety record of polystyrene is not ambiguous. It has been reviewed by the FDA for more than 50 years, independently reassessed by EFSA as recently as June 2025, and studied by independent researchers across decades. Every major review has reached the same conclusion: polystyrene, in its finished solid form, is safe for its intended uses. Consumer exposure from compliant packaging is far below any level of regulatory concern.

The confusion that persists in public discourse traces back to a single misunderstanding: styrene, the raw ingredient, and polystyrene, the finished material, are not the same thing. The evidence makes that clear.

For PSRA and its partners, the safety record is not merely a defensive data point. It is the foundation on which the circularity case is built. A material that is safe, well-characterized, recyclable through multiple proven technologies, and supported by robust end markets is a material with a future in the circular economy.

KEY SOURCES & SUPPORTING REFERENCES

U.S. FDA food additive and food-contact substance approvals for polystyrene (50+ year record); EFSA reassessment of styrene in food-contact materials (June 2025); Volume 121 of IARC Monographs on styrene (Group 2A classification); Gibbons et al., Evaluation of potential health effects associated with occupational and environmental exposure to styrene, Journal of Toxicology and Environmental Health, Part B (2019); Styrene Information and Research Center (SIRC) Capstone Human Health Risk Assessment (2019); PSRA, The Case for Polystyrene Circularity (June 2026); RRS Polystyrene U.S. and Canada End Markets Study (February 2026).

