Circular Economy for EPS Packaging

Making the Right Decision for the Environment

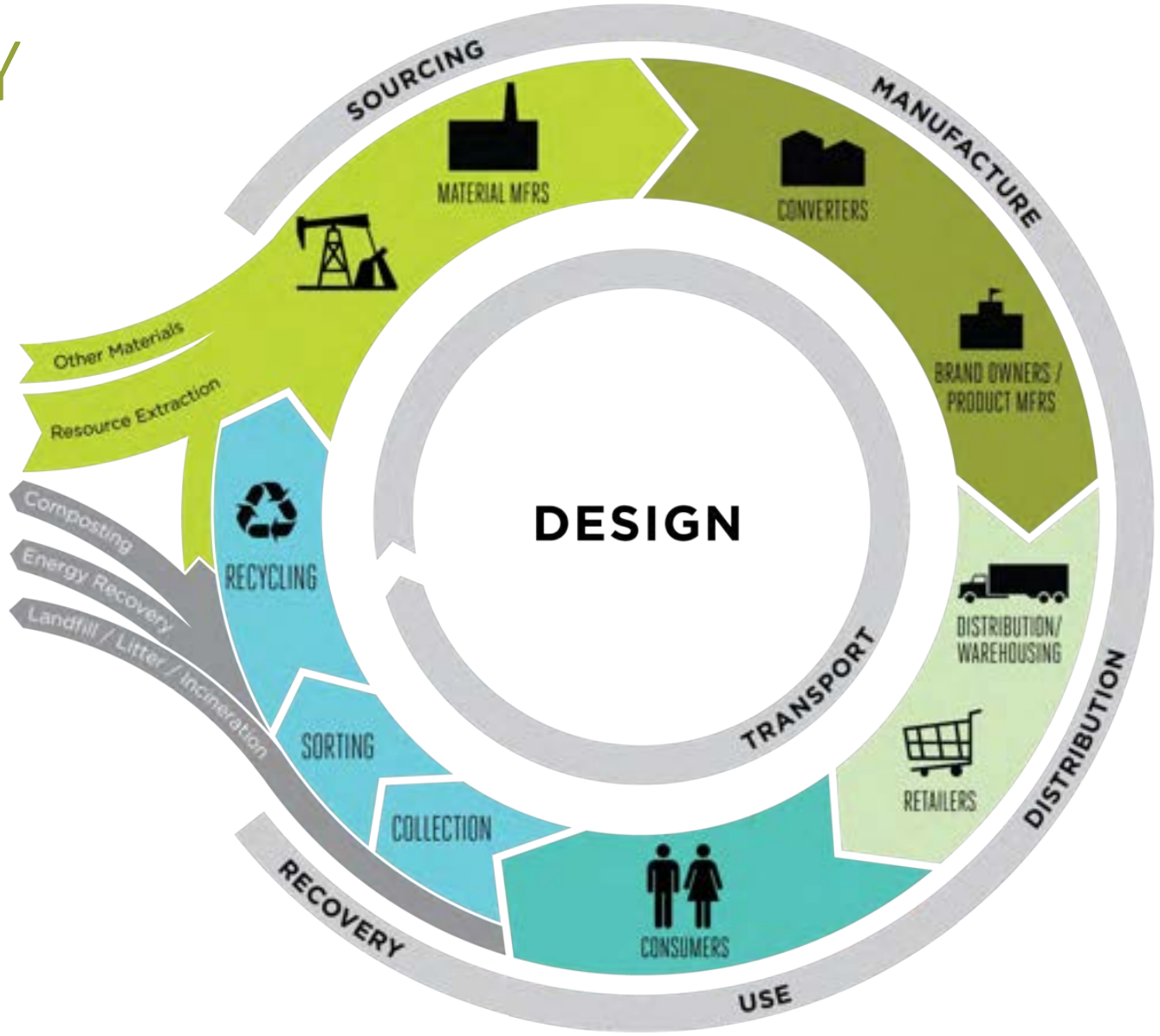
EPS Industry Alliance

April 2022

CIRCULAR ECONOMNY REQUIRES CAREFUL CONSIDERATION

Non-Plastic Packaging Isn't The Only Sustainable Solution

- Creating sustainable packaging requires questions on sourcing, efficiency, recovery, health, and safety.
- Data and science should drive decision making.
- Risk mitigation and damage avoidance metrics are key to minimize environmental impacts.
- Packaging life cycle performance should be properly weighted in addition to end-of-life disposal.



EMAF CIRCULAR ECONOMY LITMUS TEST

- Ellen MacArthur Foundation (EMAF) Endorses & Promotes A One-Size-Fits-All Approach to Environmental Improvement
- EMAF All or Nothing Elimination Criteria Discards Critical Thinking
- EMAF Drives Increased Recycling At the Exclusion of Life Cycle Impacts

"The U.S. Plastics Pact lacked a transparent third-party, data-driven and scientific approach, and its process seems to be rooted in ideology and a predetermined, misguided outcome. In fact, the list of plastic materials they suggest be eliminated by 2025 will only hinder the acceleration of a circular economy, slow progress toward a lower carbon future, and reduce our ability to use greater amounts of recycled material in plastic packaging."

Joshua Baca

Vice President, Plastics Division
American Chemistry Council

EPS CONTRIBUTES TO CIRCULAR ECONOMY SOLUTIONS

Proven Recyclability

EPS Recycling Demonstrates Consistent Growth, From 33.6MLBS In 2008 To 46.4MLBS In 2018

Recycled-Content & Biodegradability

EPS End-of-Life Options Range From Recycled-Content Resin to New Biodegradable Feedstocks

Clean Manufacturing

Air Emissions Abatement & Water Recycling & Other Lean Manufacturing Processes Are Widely Adopted

EPS Provides A Unique Combination of Performance Characteristics for Packaging Logistics

THERMAL INSULATION

Keeps your home warm, your food fresh, and your medicine properly stored

SHOCK ABSORPTION

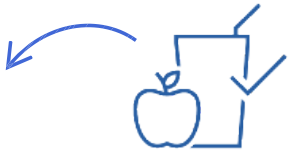
Protects everything from fragile high-value electronics, to large home appliances, and delicate fruits & vegetables

ULTRA LIGHTWEIGHT

With 95% of its volume composed of air, a little material makes a big difference in protecting goods cheaply during transport

SAFE TO USE

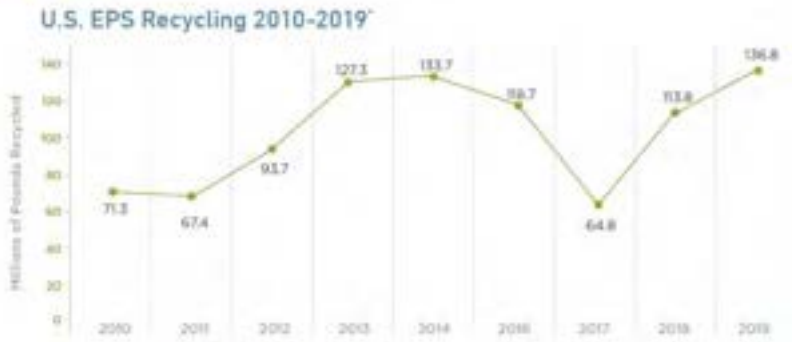
BPA and Phthalate free, mildew resistant, FDA-approved for medical & food-grade applications, and safer for handling



EPS TRANSPORT PACKAGING CIRCULAR ECONOMY

EPS Industry Alliance

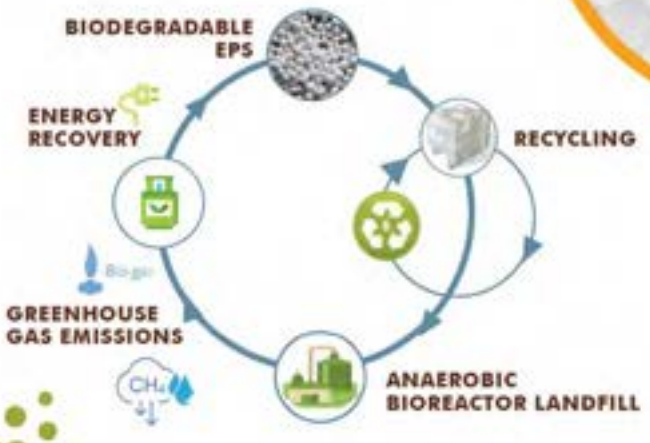
RECYCLABLE



136.8 MILLION POUNDS RECYCLED IN 2019

RECYCLED CONTENT

BIODEGRADABLE



REUSE

www.epsindustry.org

EPS Is More Sustainable Than Most People Imagine

EPS foam is of **98% air**, which results in lower energy consumption.

EPS

Life cycle analyses show that EPS has far less impact on the environment than other competitive materials for the same use; in particular paper.

Material Substitutions Are Risky

Recent studies show that heavier alternatives to lightweight plastics can significantly increase raw material requirements, energy consumption & landfill volume.

On a global scale, environmental costing indicates that plastics alternatives may cost $400 to $500 billion more **(4 to 5 times more).**

Meat, fish & produce shipped in EPS have a longer shelf life, leading to less food waste.

EPS is Recyclable

Historically, EPS recycling averages **~18%** over a **25-year** trendline.

EPS recycling is most successful in commercial waste streams with large volume sources of EPS waste.

Consumer access to EPS recycling sometimes requires extra effort, but with proper equipment & handling, it is successful in many communities.

Walmart · Nutrisystem · Omaha Steaks · Whirlpool · Best Buy · Williams-Sonoma

Creative problem solving for challenging recycling scenarios means Walmart, NutriSystems, Williams Sonoma, Whirlpool, Best Buy, Omaha Steaks are committed to long term EPS recycling.

EPS Transport Packaging Plays An Integral Role in Global Product Distribution

ELIMINATING POLYSTYRENE IS NOT THE ANSWER

U.S. DOE RELIES ON EPS FOR COVID VACCINE DISTRIBUTION

The Importance of Cold-Chain Packaging Material Criteria

- Interdisciplinary, Complex Decision Making Across Six Major Supply Chain Networks Involving 15+ Environmental Impact Stages
- Industry Best Practices for Health & Safety to Maintain Product Integrity
- Packaging Use & Labeling Must Comply w/ FAA, FTC, FDA, DOT, ASTM & ISO Environmental Standards
- Inter-State Commerce Laws Pose Certain Challenges for Transport Packaging

EPS Is The Gold Standard for Cold-Chain Packaging

Fish Spoilage 101

- Begins at Catch, Continues Throughout Shelf Life
- Tipping Point is at Core Temperature (~40^{o}F)
- Occurs More Rapidly at Higher Temperatures
- Results in Post-Harvest Losses, Decreased Shelf Life & Food Safety Risks
- Maintaining Core Temperature From Catch is Essential

Infallibility Factors

- Multiple Transfer Points
- Reliability of Refrigeration Equipment
- Point of Sale Display

“EPS IS SIMPLY A BETTER PRODUCT”

Here in Puerto Montt, fishing is a way of life, and salmon is king. During the summer, we can sometimes spend weeks out at sea, and once we make a catch, the clock starts running. Fish must arrive as fresh as possible in places as far as the USA, and every penny we spend getting it there matters to us and our families.

Fortunately, cheap & lightweight EPS boxes are a great way to keep fish fresh without affecting taste or smell during the journey. Pretty much everyone I know uses EPS boxes many times over before having to recycle them.

Lucas Meyer

Fisherman for over 30 years
Puerto Montt, Chile

Ellen MacArthur Elimination Criteria

ASSESMENT OF PLASTIC PACKAGING IN THE GLOBAL ENVIRONMENT
Problematic & Unnecessary Plastic Packaging

1. It is not reusable, recyclable or compostable (per EMF definitions).
2. It contains, or its manufacturing requires hazardous chemicals that pose a significant risk to human health or the environment (using precautionary principal).
3. It can be avoided (or replaced by a reuse model) while maintaining utility.
4. It hinders or disrupts the recyclability or compostability of other items.
5. It has a high likelihood of being littered or ending up in the natural environment.

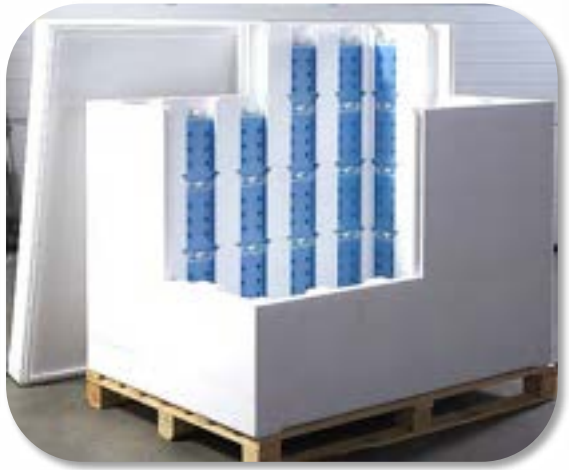
EPS Transport Packaging Does Not Meet the Elimination Criteria

Not All Polystyrene Is the Same

Ellen MacArthur Elimination Criteria #1

It Is Not Reusable, Recyclable Or Compostable

EPS Transport Packaging Is Widely Recycled, Frequently Used In Innovative Reuse Applications & Has Biodegradable Feedstock Options



THERMOCON PROTECT System Packaging

reuse

Subaru Re-Use Solutions

reuse

EVRgreen™ Biodegradable EPS Resin

BIODEGRADABLE

REfoam

EPS Using an Additive to Catalyze Degradation

BIODEGRADABLE

EPS LIFE CYCLE

EPS IS RECYCLABLE

19,850 TONS
OF EXPANDED POLYSTYRENE (EPS) WAS RECYCLED IN 2018

THAT'S EQUAL TO

THE WASTE GENERATED BY
13,233
U.S. HOUSEHOLDS

WHICH WAS USED TO CREATE
SOMETHING NEW

EPS Industry Alliance

www.epsindustry.org

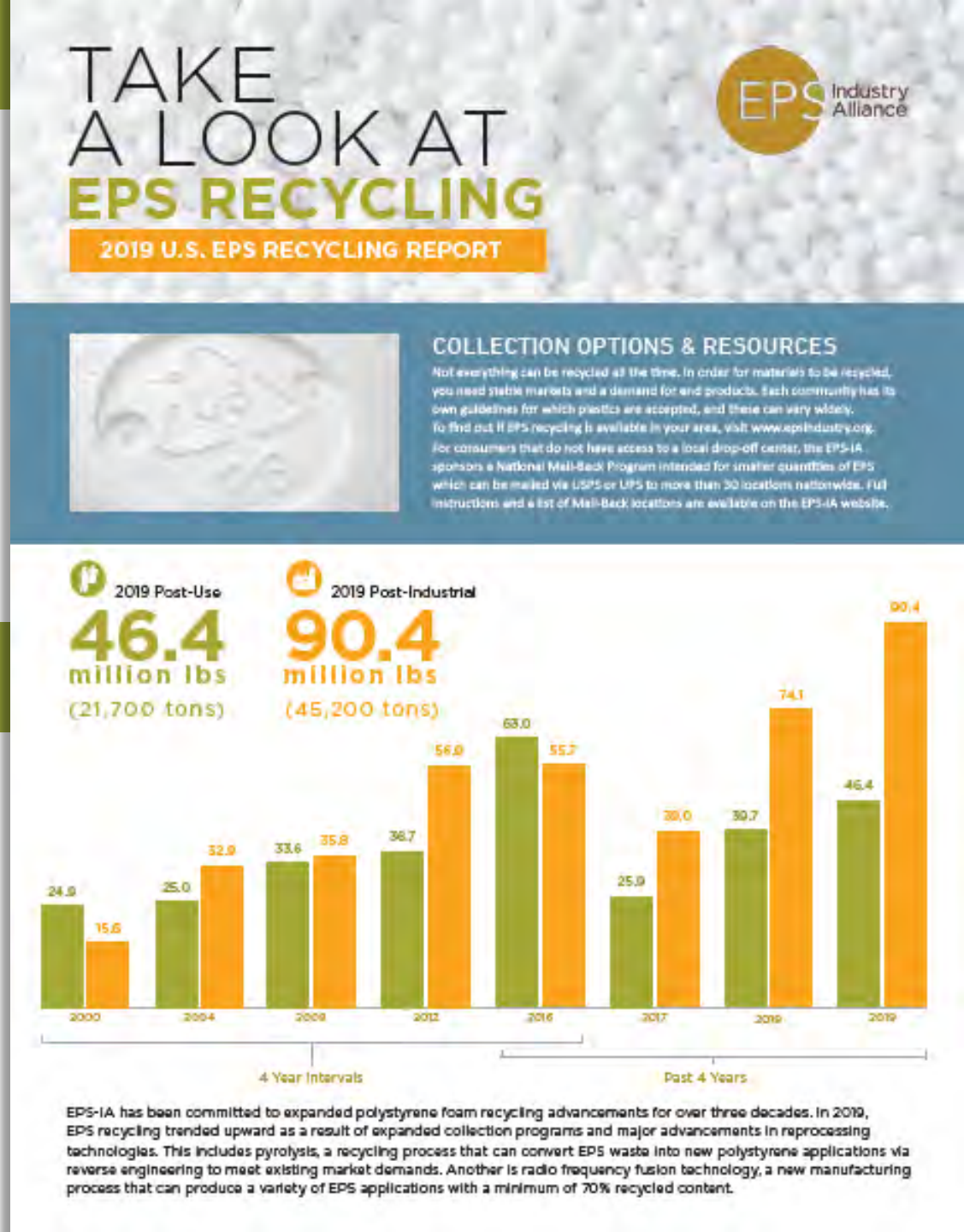
POLYSTYRENE BANS AREN'T THE ANSWER.

EPS Recycling Solutions

Mechanical Recycling	Clean EPS Waste Holds Its Value In Recycling Markets
Advanced Recycling	Employs Reverse Engineering To Incorporate Recycled Polystyrene Into Existing Applications
Recycled-Content Resin	Eco-Six™ Resin Uses 80%+ Recycled EPS Since 2012

Consumer Access

Curbside	50 U.S. Cities Serving 24 Million
Drop-Off	Over 230 Drop-Off Locations
Collection Events	100's of Community Recycling Drives
Mail-Back Program	Accepted by 30 EPS Manufacturers



Expanded Polystyrene is easily used as ‘regrind’ to produce new EPS products with recycled content.

Unexpectedly Circular

EPS Recycling Innovations

Polystyrene Waste – Including EPS Packaging – Is a Major Driver in Advanced Recycling

“RECYCLING IS NOT A PREDICTOR OF ENVIRONMENTAL IMPACT”

“Simply knowing that an item is recyclable or compostable tells us surprisingly little about the actual impact on human health and the environment or the trade-off between different materials.

A lot of consumers are making their choices based on whether or not something is easy to recycle and that is not a meaningful predictor. It's pretty random, it's about as useful as tossing a coin or consulting a Ouija board.

Popular is not always wise.”

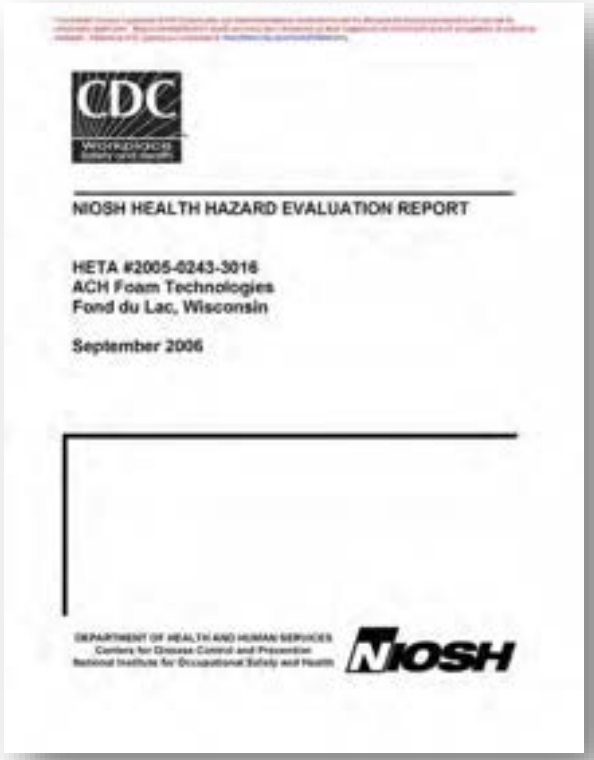
David Allaway

Senior Analyst
Oregon Department of Environmental Quality

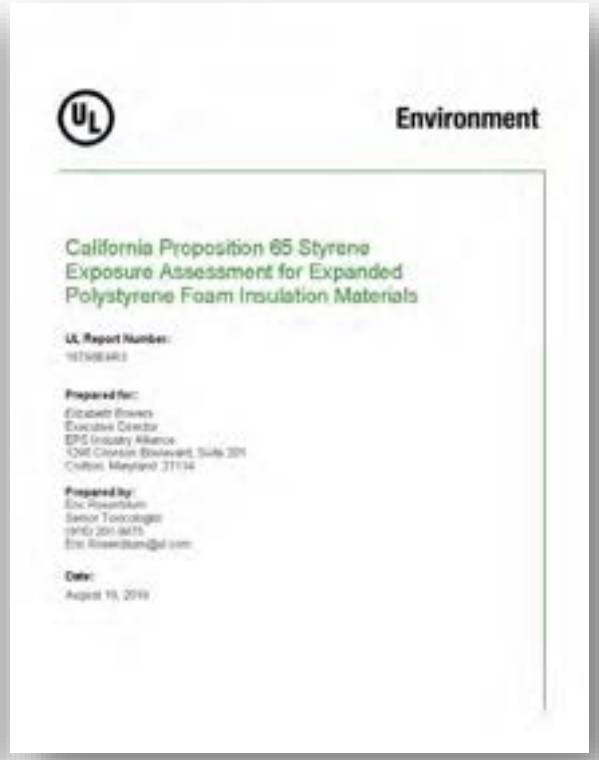
Ellen MacArthur Elimination Criteria #2

It contains, or its manufacturing requires hazardous chemicals
that pose a significant risk to human health or the environment.

Science Shows EPS Chemical Composition Is Below Established Risk Levels



Independent Govt Investigation

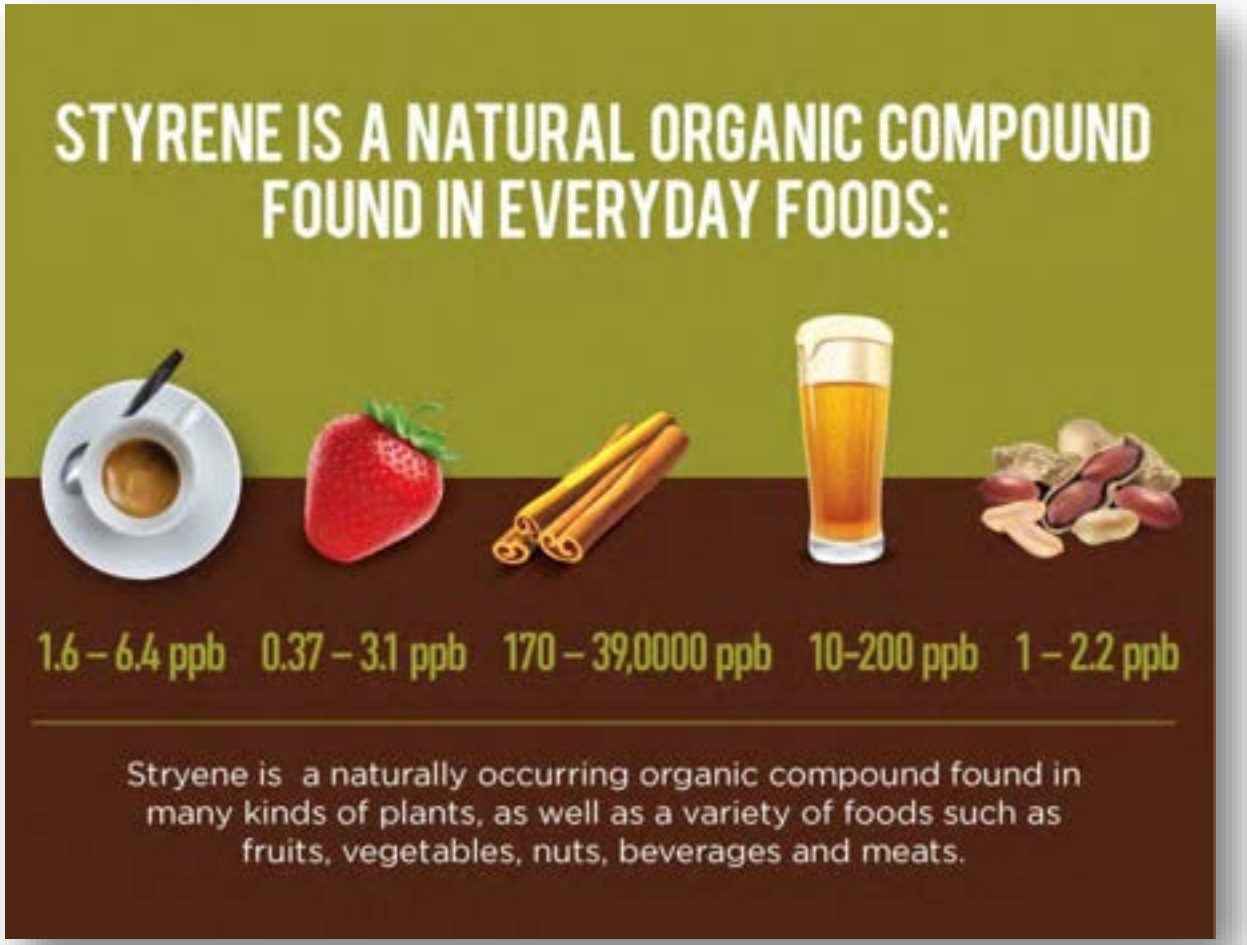


Styrene Risk Assessment

VOC Emissions
CA Specification 01350

Life Cycle Assessment
Eco-Toxicity

Styrene Used In EPS Is Approved By U.S. Food & Drug Administration For Use In Food-Contact

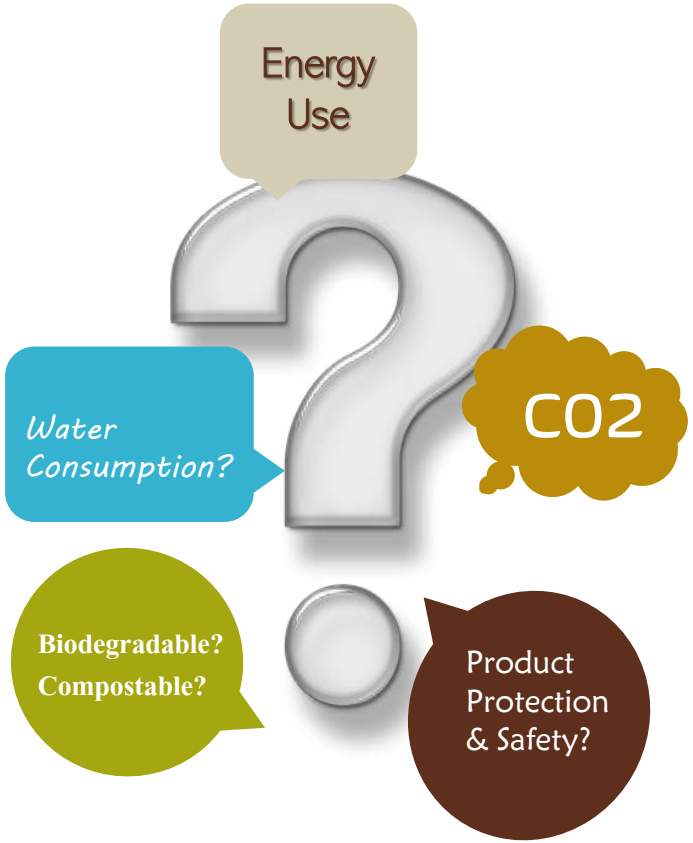


Ellen MacArthur Elimination Criteria #3

It Can Be Avoided (Or Replaced By A Reuse Model) While Maintaining Utility

EPS Outperforms Alternative Materials To Minimize Damage-In-Transit

Many nuances must be considered in plastic substitutes, from their recyclability and global warming potential (GWP) to their versatility and suitability for applications. The shifts to alternative materials have emerged as a knee-jerk reaction to consumer anti-plastic sentiment, but these abrupt alterations are not as environmentally-sound as they might first appear.



PACKAGING LIFE CYCLE – YOU NEED THIS!

LIFE CYCLE ANALYSIS SUPPORTS EPS PACKAGING

Comparisons of life-cycle impact of the uses of three different packaging materials shows that EPS compares favorably with polypropylene (PP) & cardboard packaging because of its energy-efficient production & light weight.

** Comparative Results of Three Packaging Solutions in an Average 6kg European Situation, Pricewaterhouse Coopers, November 2011.*

Environmental Impact	EPS	PP	Cardboard
	6 kg		
Non- Renewable Primary Energy (MJ)	1	1.3	1
Depletion of Non-Renewable Resources (kg eq Sb)	1	1.3	1
Greenhouse Gas Emissions (kg CO_2 eq 100 years)	1	1	1.3
Air Acidification (g SO_2 eq)	1	1.2	1.9
Photochemical Oxidants Formation (g eq ethylene)	1	0.3	0.2
Water Consumption (m_3)	1	0.8	3.5
Water Eutrophication (in g eq PO_{43})	1	1.2	5.1
Total Waste Production (kg)	1	2.3	5.2

“EDUCATING TOWARD SMARTER CHOICES”

As a professor, there is one skill I strive to ensure all my students develop in class. That skill is critical thinking. Avoiding snap judgements, and thoroughly thinking through the pros and cons of the decisions we face, makes us better as individuals and as a society.

Hot topic discussions always arise in class, such as how to solve the world’s growing waste problem, and I’ve been surprised by how often the narrative on this issue has changed over time.

We’ve come a long way from disregarding the issue, to considering bans on problematic products, and finally embracing a model of circularity with proper waste disposal, as the issue has been better understood.

EPS products have a long way to go to reach this ambitious goal, but their irreplaceability makes the journey ahead worthwhile.

Rachel Robinson

College professor
Houston, USA

Ellen MacArthur Elimination Criteria #4

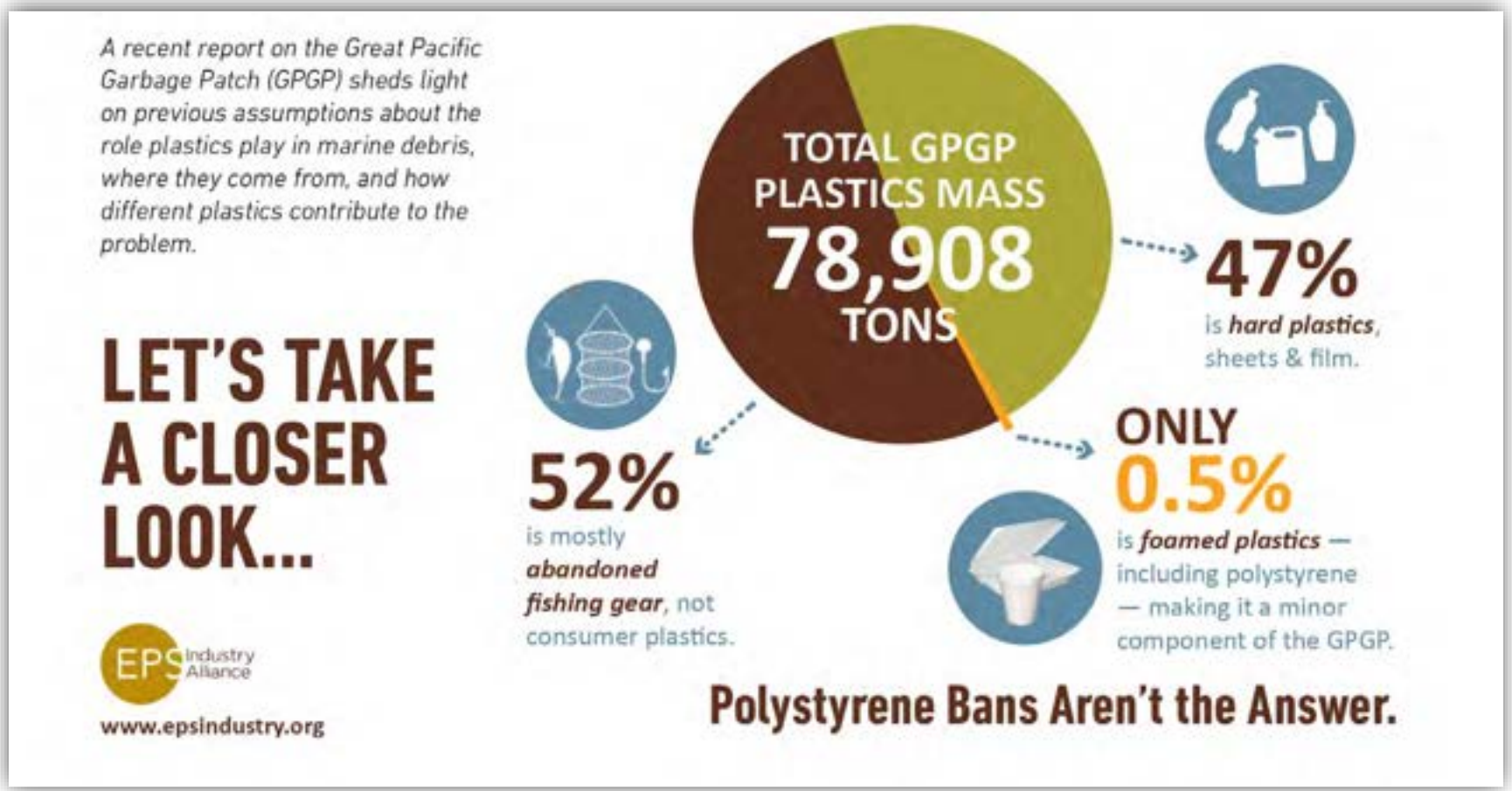
It Hinders Or Disrupts The Recyclability or Compostability of Other Items

Contamination Is The Single Largest Threat To Recyclability Disruption

Ellen MacArthur Elimination Criteria #5

It Has A High Likelihood Of Being Littered Or Ending Up In The Natural Environment

EPS Transport Packaging Is 2.7% of U.S. Litter & Less Than 0.5% of Plastic Marine Debris



“WE SHOULD THINK ABOUT THE BIG PICTURE”

I think society has focused on solving the waste problem, and we definitely need to do that, but we shouldn’t lose sight of the real problem facing our generation: climate change. Said differently, if all we do is recycle more, does that mean we are doing less harm to the environment?

More and more people are doing their part, choosing fully recyclable materials, putting garbage in the right place, and starting action in their communities, but I think that we should also start questioning corporations about everything that happens before and after we as consumers get to make a choice. Fixing the amount of carbon emissions needed to heat my home, or get an Amazon package delivered to me, now that’s big picture stuff.

Olivia Turella

College Student, São Paulo, Brazil

EPS PACKAGING PERFORMANCE & ENVIRONMENTAL CHARACTERISTICS ARE HARD TO BEAT

When Evaluating Alternative Materials:

- ✓ Is It Recyclable At Scale & Profitable?
- ✓ Are Life Cycle Impact Trade-Offs Net Zero?
- ✓ Are Material Costs Equivalent or Less?
- ✓ Are Optimized Shipping Loads Maintained or Improved?
- ✓ Does It Achieve Equal Damage Avoidance?
- ✓ Does It Comply With U.S. FDA, DOT & FAA Guidance?

EPS Recycling Access Map

U.S & Canada

www.epsindustry.org

Additional EPS Sustainability Resources

The EPS Industry Alliance is the North American trade association representing the expanded polystyrene manufacturing supply chain. EPS-IA members produce innovative packaging solutions following best practices for environmental stewardship throughout the EPS product life cycle.

EPS Industry Alliance

1298 Cronson Boulevard, Suite 201

Crofton, MD 21114 USA

(800)607-3772

www.epspindustry.org

SEE POLYSTYRENE RECYCLING IN ACTION

EPS Industry Alliance

Foam Recycling With Manufacturers

(1:00) — 2019

Environmental Impacts of EPS Packaging Systems

1,000 Units of EPS for Vacuum Cleaner Packaging

Environmental Emissions - Total Pollutants*

Category	Parameter	Inventory Value (lb Per 1,000 Units)	Primary Source (Fuel or Process-Related)	% Reduction 10% Open-Loop Recycling	% Reduction 10% Closed-Loop Recycling	% Reduction 20% Closed-Loop Recycling
GLOBAL WARMING						
	CO2 (Carbon Dioxide)	1867	99% Fuel-Related	2%	4%	9%
	N2O (Nitrous Oxide)	N/A	N/A	N/A	N/A	N/A
	CH4 (Methane)	0.029	100% Fuel-Related	0%	3%	6%
ACIDIFICATION						
	SOx (Sulphur Oxides)	7.33	83% Fuel-Related	2%	4%	8%
	NOx (Nitrogen Oxides)	5.85	90% Fuel-Related	2%	6%	9%
	NH3 (Ammonia)	0.02	99% Process-Related	5%	10%	20%
EUTROPHICATION						
	NOx (Nitrogen Oxides)	5.85	90% Fuel-Related	2%	6%	9%
	N2O (Nitrous Oxide)	N/A	N/A	N/A	N/A	N/A
	NH3 (Ammonia)	0.02	99% Process-Related	5%	10%	20%
PHOTOCHEMICAL						
	C5H12 (Pentane)	15.7	100% Process-Related	0%	0%	0%
	CO (Carbon Monoxide)	2.5	98% Fuel-Related	2%	4%	8%
	Other Organics	0.53	100% Fuel-Related	2%	4%	8%
	CH4 (Methane)	0.029	100% Fuel-Related	0%	3%	6%
	HC's (Hydrocarbons)	19.7	65% Fuel-Related	4%	7%	14%

*Does not reflect all impact categories in Resource & Environmental Profile Analysis of EPS Packaging Products report.

'Resource and Environmental Profile Analysis of EPS Packaging Products', Franklin Associates, Ltd., 1997

Questions?

Please Contact Us…

EPS Industry Alliance
1298 Cronson Boulevard, Suite 201
Crofton, MD 21114 USA
Phone: 410-451-8340 Fax: 410-451-8343
betsy.bowers@epsindustry.org • www.epspindustry.orgy.org