

Circular Economy for EPS Packaging

Making the Right Decision for the Environment

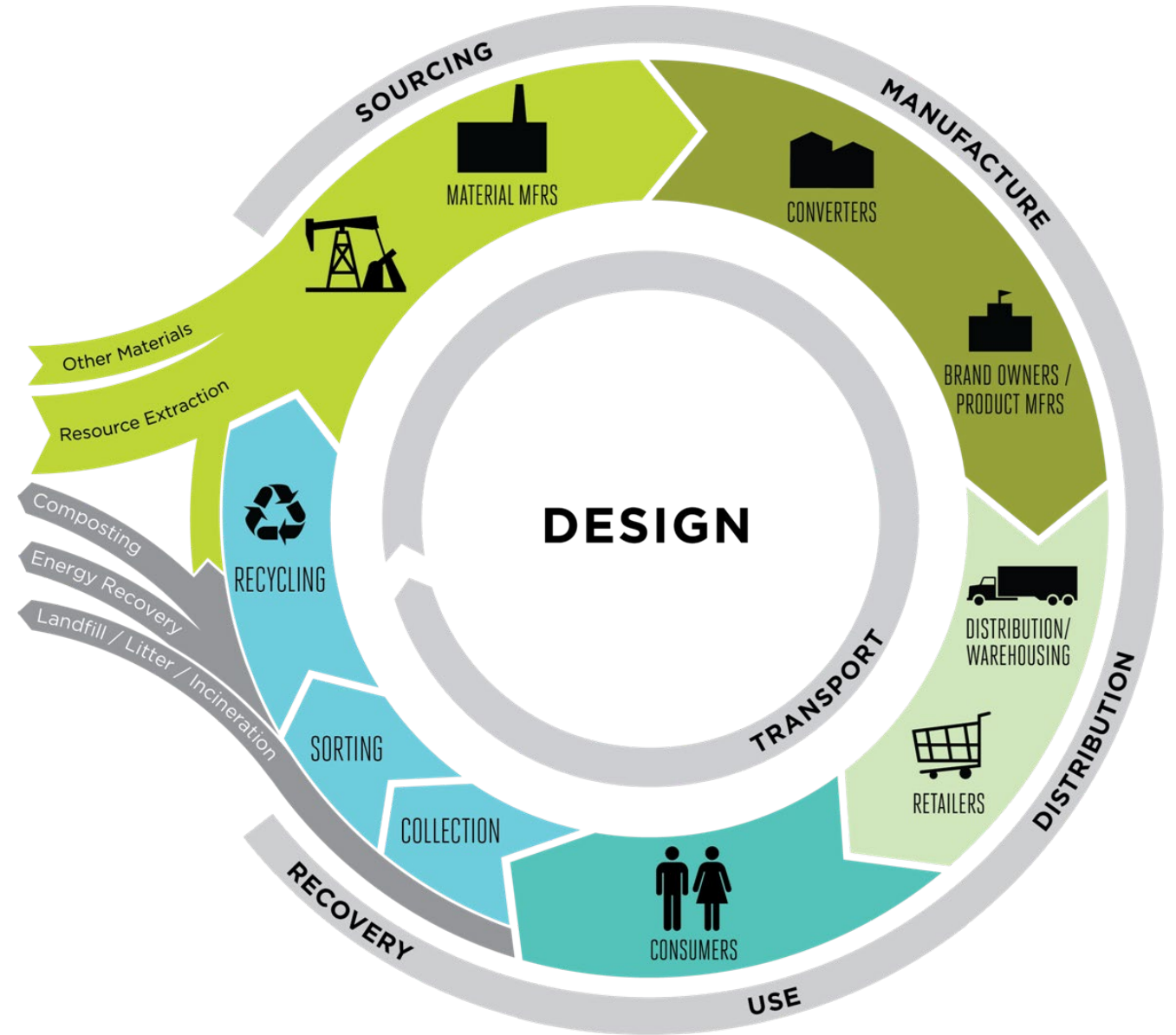


September 2023

CIRCULAR ECONOMY REQUIRES CAREFUL CONSIDERATION

Non-Plastic Packaging Isn't The Only Sustainable Solution

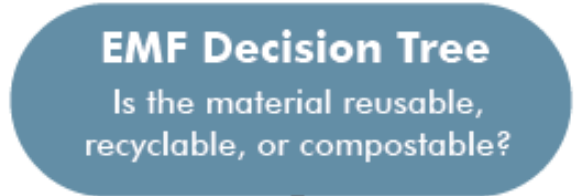
- Creating sustainable packaging requires questions on sourcing, efficiency, recovery, health, and safety.
- Data and science should drive decision making.
- Risk mitigation and damage avoidance metrics are key to minimize environmental impacts.
- Packaging life cycle performance should be properly weighted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



EPS Recycling Surpasses Global Environmental Targets

According To The EMF Decision Tree, Reusable and/or Recyclable Plastics Are Not Categorized As A Problematic Or Unnecessary Material.

The Ellen MacArthur Foundation (EMF) Recognized EPS Packaging Meets Their Definition for Global Recyclability In Practice & at Scale.



Must also meet one or more criteria to be considered problematic or unnecessary



NOT CONSIDERED PROBLEMATIC OR UNNECESSARY



“EPS stands out as one of the proven protective materials used worldwide. While numerous innovative alternatives are being proposed, their performance in distribution activities is yet to be fully demonstrated.”

Dr. Jay Singh

Director, Packaging Value Chain
California Polytechnic State University



EPS CONTRIBUTES TO CIRCULAR ECONOMY SOLUTIONS

Proven Recyclability

EPS Recycling Demonstrates Consistent Growth, From 33.6 MLBS In 2008 To 145.5 MLBS In 2019

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

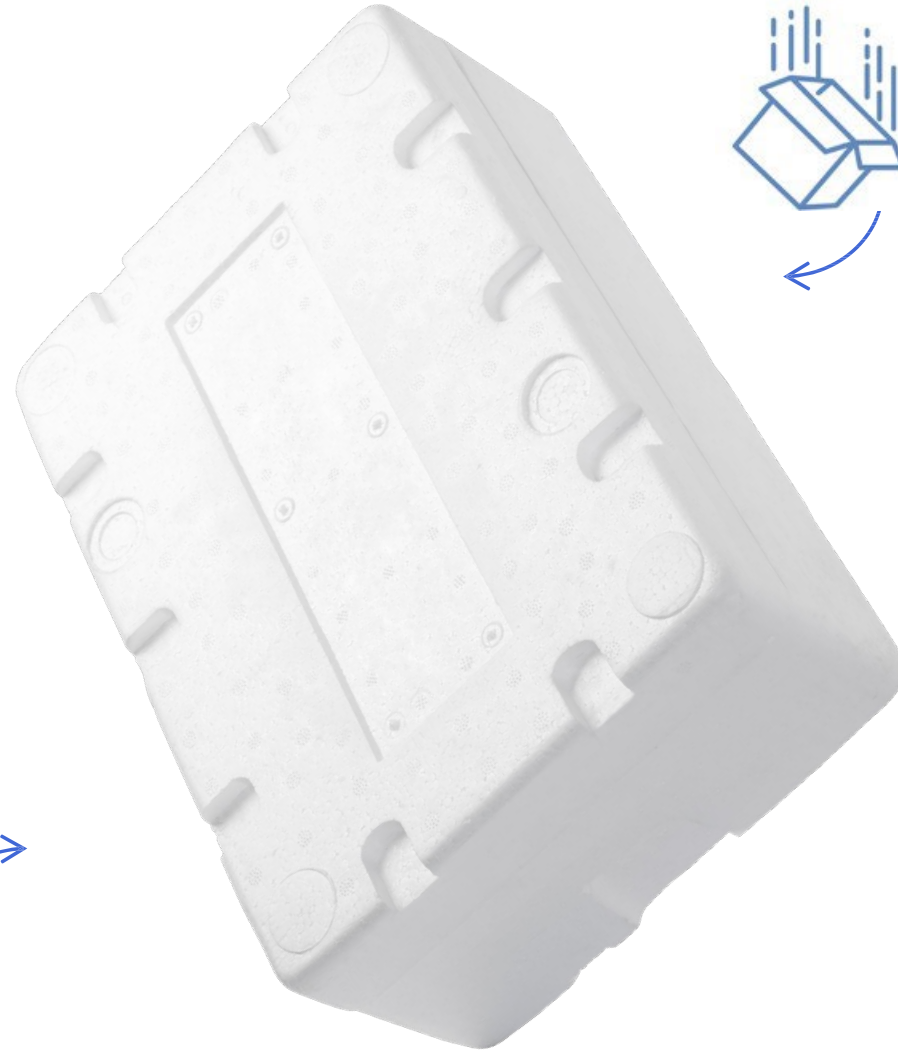
THERMAL INSULATION

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



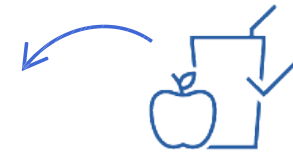
ULTRA LIGHTWEIGHT

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



SHOCK ABSORPTION

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



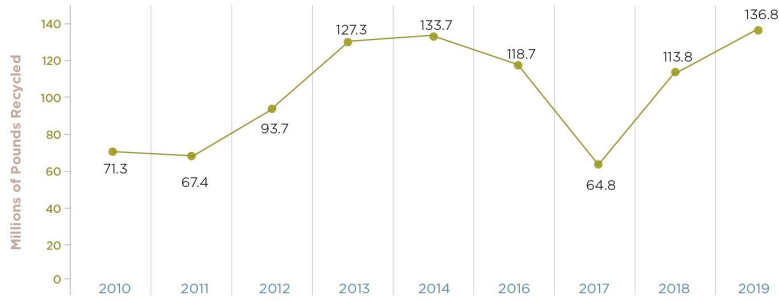
SAFE TO USE

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



RECYCLABLE

U.S. EPS Recycling 2010-2019*

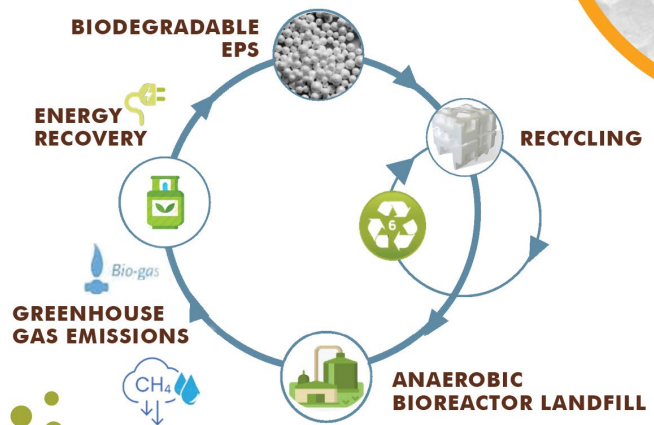


136.8 MILLION POUNDS RECYCLED IN 2019

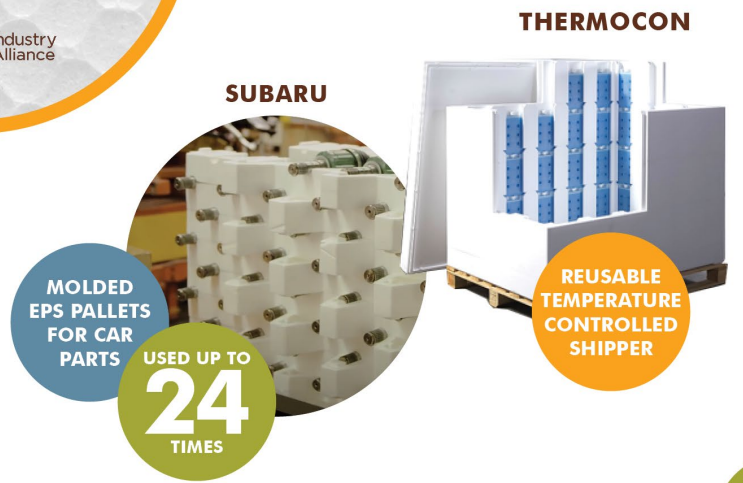
RECYCLED CONTENT



EPS TRANSPORT PACKAGING CIRCULAR ECONOMY



BIODEGRADABLE



REUSE



EPS Is More Sustainable Than Most People Imagine



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



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



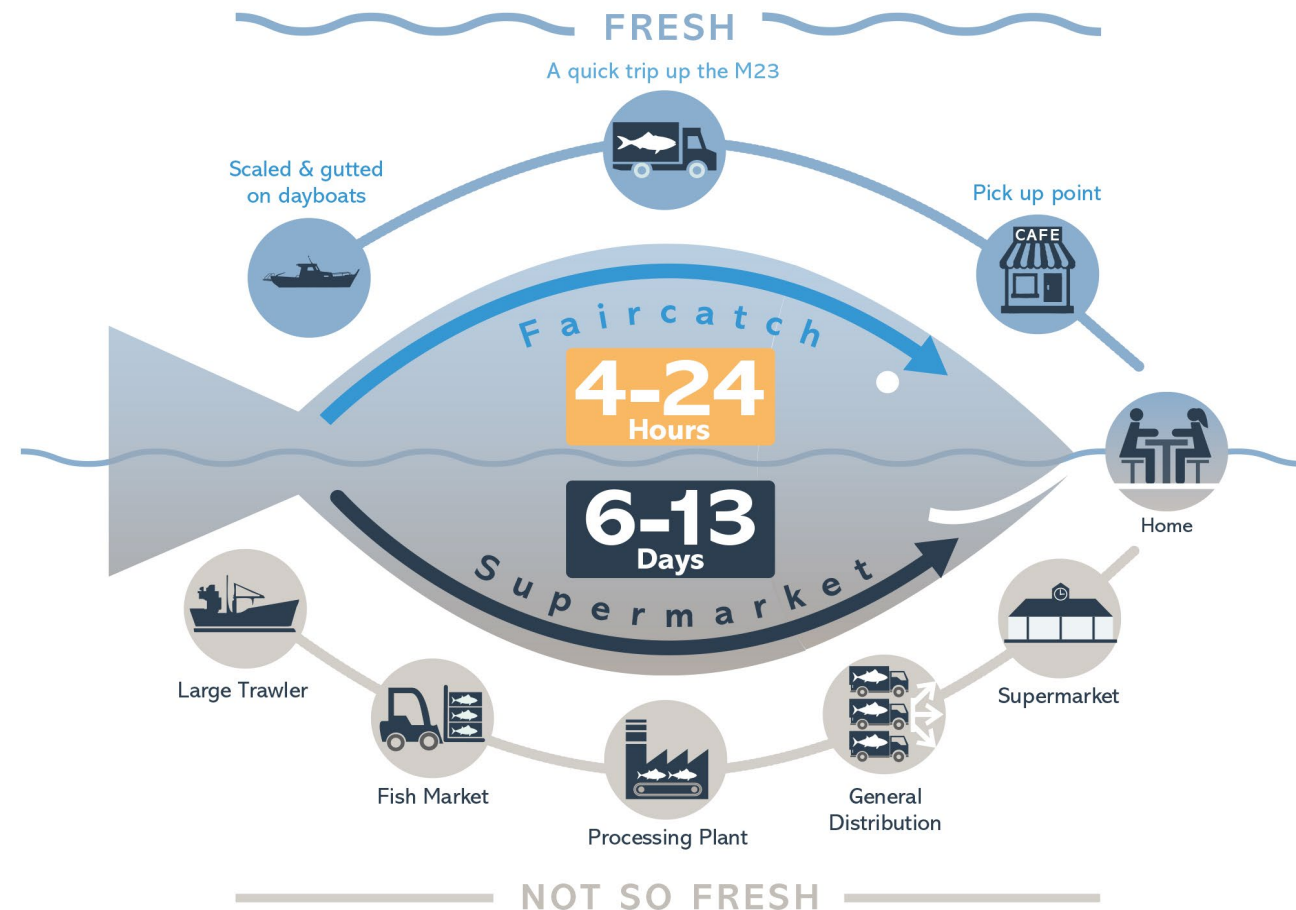
EPS Is The Gold Standard for Cold-Chain Packaging

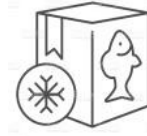
Fish Spoilage 101

- Begins at Catch, Continues Throughout Shelf Life
- Tipping Point is at Core Temperature (~40°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”

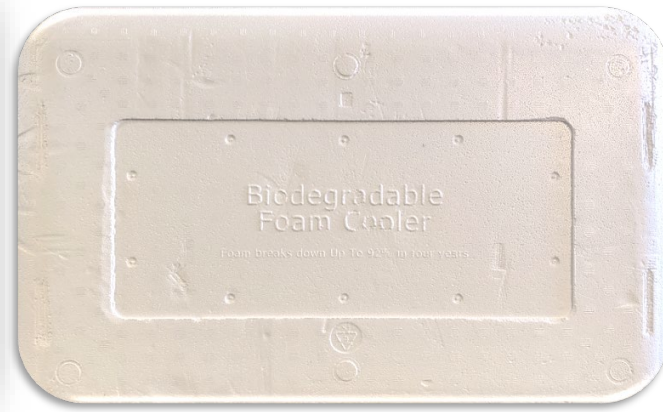
Here in Puerto Montt, fishing is a way of life, and salmon is king. During the summer, we can sometimes spend weeks out at sea, and once we make a catch, the clock starts running. Fish must arrive as fresh as possible in places as far as the USA, and every penny we spend getting it there matters to us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

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



REfoam
EPS Using an Additive to
Catalyze Degradation





EPS LIFE CYCLE EPS IS RECYCLABLE



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

WHICH WAS USED TO CREATE
SOMETHING NEW

THAT'S EQUAL TO
THE WASTE GENERATED BY
13,233
U.S. HOUSEHOLDS



surfboards



picture frames



recycled content eps



coat hangers



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

TAKE A LOOK AT EPS RECYCLING



2019 U.S. EPS RECYCLING REPORT



COLLECTION OPTIONS & RESOURCES

Not everything can be recycled all the time. In order for materials to be recycled, you need stable markets and a demand for end products. Each community has its own guidelines for which plastics are accepted, and these can vary widely. To find out if EPS recycling is available in your area, visit www.epsindustry.org. For consumers that do not have access to a local drop-off center, the EPS-IA sponsors a National Mail-Back Program intended for smaller quantities of EPS which can be mailed via USPS or UPS to more than 50 locations nationwide. Full instructions and a list of Mail-Back locations are available on the EPS-IA website.

2019 Post-Use
46.4
million lbs
(21,700 tons)

2019 Post-Industrial
90.4
million lbs
(45,200 tons)



EPS-IA has been committed to expanded polystyrene foam recycling advancements for over three decades. In 2019, EPS recycling trended upward as a result of expanded collection programs and major advancements in reprocessing technologies. This includes pyrolysis, a recycling process that can convert EPS waste into new polystyrene applications via reverse engineering to meet existing market demands. Another is radio frequency fusion technology, a new manufacturing process that can produce a variety of EPS applications with a minimum of 70% recycled content.



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



CBS THIS MORNING **BILL COOPER**
AGILYX CHIEF FINANCIAL OFFICER

Chemical Recycling: "A Game Changer"


CBS News visited our Tigard plant to speak with Bill Cooper, Chief Financial Officer, about our solution for hard-to-recycle plastics.



THE FUTURE OF RECYCLING

The Future of Recycling

John Desmarteau, Director of Business Development, talked to KPTV Oregon about our process to keep polystyrene out of landfills.



Turning Everyday Plastics Into A Renewable Resource

Forbes featured Regenyx, our new joint venture with AmSty, dedicated to recycling post-consumer polystyrene products.



“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

Science Shows EPS Chemical Composition Is Below Established Risk Levels

This Health Hazard Evaluation (HHE) report and any recommendations made herein are for the specific facility evaluated and may not be universally applicable. Any recommendations made are not to be considered as final statements of NIOSH policy or of any agency or individual involved. Additional HHE reports are available at <http://www.cdc.gov/niosh/hhetreports>.




NIOSH HEALTH HAZARD EVALUATION REPORT


HETA #2005-0243-3016
ACH Foam Technologies
Fond du Lac, Wisconsin

September 2006

DEPARTMENT OF HEALTH AND HUMAN SERVICES
 Centers for Disease Control and Prevention
 National Institute for Occupational Safety and Health



Independent Govt Investigation



Environment

California Proposition 65 Styrene Exposure Assessment for Expanded Polystyrene Foam Insulation Materials


UL Report Number:
18798EAR3

Prepared for:
 Elizabeth Bowers
 Executive Director
 EPS Industry Alliance
 1298 Cronson Boulevard, Suite 201
 Crofton, Maryland 21114

Prepared by:
 Eric Rosenblum
 Senior Toxicologist
 (916) 201-9475
 Eric.Rosenblum@ul.com

Date:
August 19, 2019

Styrene Risk Assessment



TEST REPORT

REPORT NUMBER: 10227683MID-001d
ORIGINAL ISSUE DATE: Jan 11, 2015
REVISED DATE: na

EVALUATION CENTER
 Intertek
 Verification Center
 8431 Murphy Dr
 Middleton, WI 53562


RENDERED TO
 Betsy Steiner
 EPS Industry Alliance
 1298 Cronson Blvd Ste 201
 Crofton, MD 21114-2035
 emsteiner@epsindustry.org

PRODUCT EVALUATED: Cooler PIN 1012-5 Bx from Sonoco Protective Solutions

EVALUATION PROPERTY: California Specification 01350: Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers

Report of for compliance with the applicable requirements of the following criteria: Californian Specification 01350: Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers

"This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to permit copying or distribution of this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program."



VOC Emissions
 CA Specification 01350



EPS PACKAGING LIFE CYCLE ASSESSMENT

CONFIDENTIAL

PREPARED FOR:
 EPS Industry Alliance
 1298 Cronson Boulevard, Suite 201
 Crofton, MD 21114 USA

PREPARED BY:
 Intertek Health Sciences Inc.
 Health, Environmental & Regulatory Services (HERS)
 2233 Argenta Road, Suite 201
 Mississauga, Ontario, Canada
 L5N 2K7

DATE:
August 15, 2019

VERSION:
Final



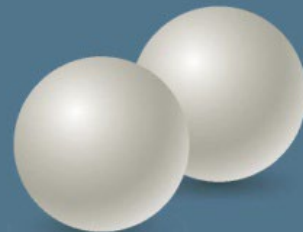
Life Cycle Assessment
 Eco-Toxicity

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

EPS AND STYRENE ARE COMPLETELY DIFFERENT SUBSTANCES

WHAT'S THE DIFFERENCE?

Styrene



EPS

These two unique substances have a very different chemical makeup. Styrene, a **clear liquid**, is the monomer that becomes EPS, a **white solid**.

STYRENE IS A NATURAL ORGANIC COMPOUND FOUND IN EVERYDAY FOODS:



1.6 – 6.4 ppb



0.37 – 3.1 ppb



170 – 39,000 ppb



10-200 ppb

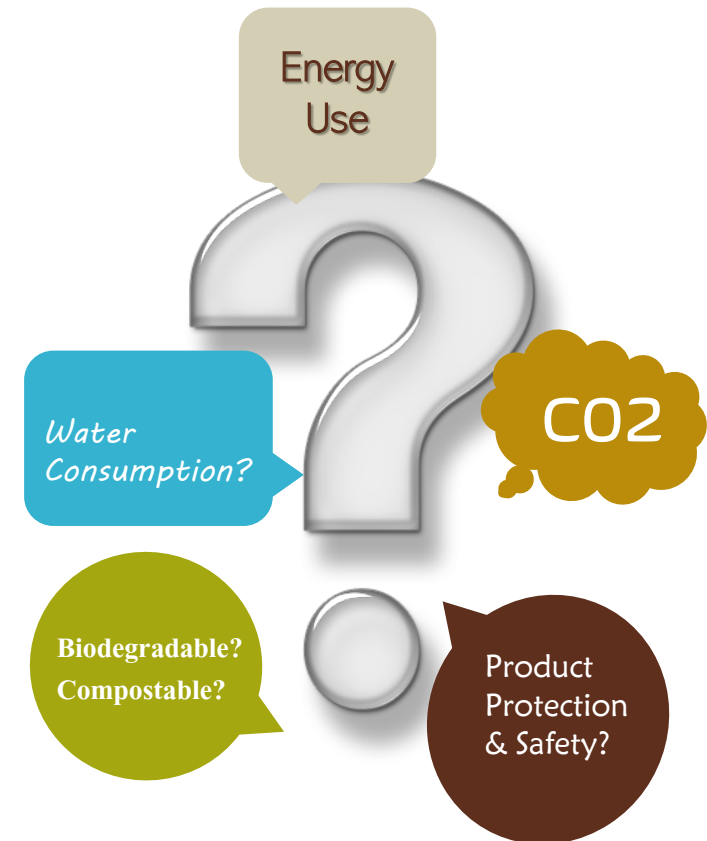


1 – 2.2 ppb

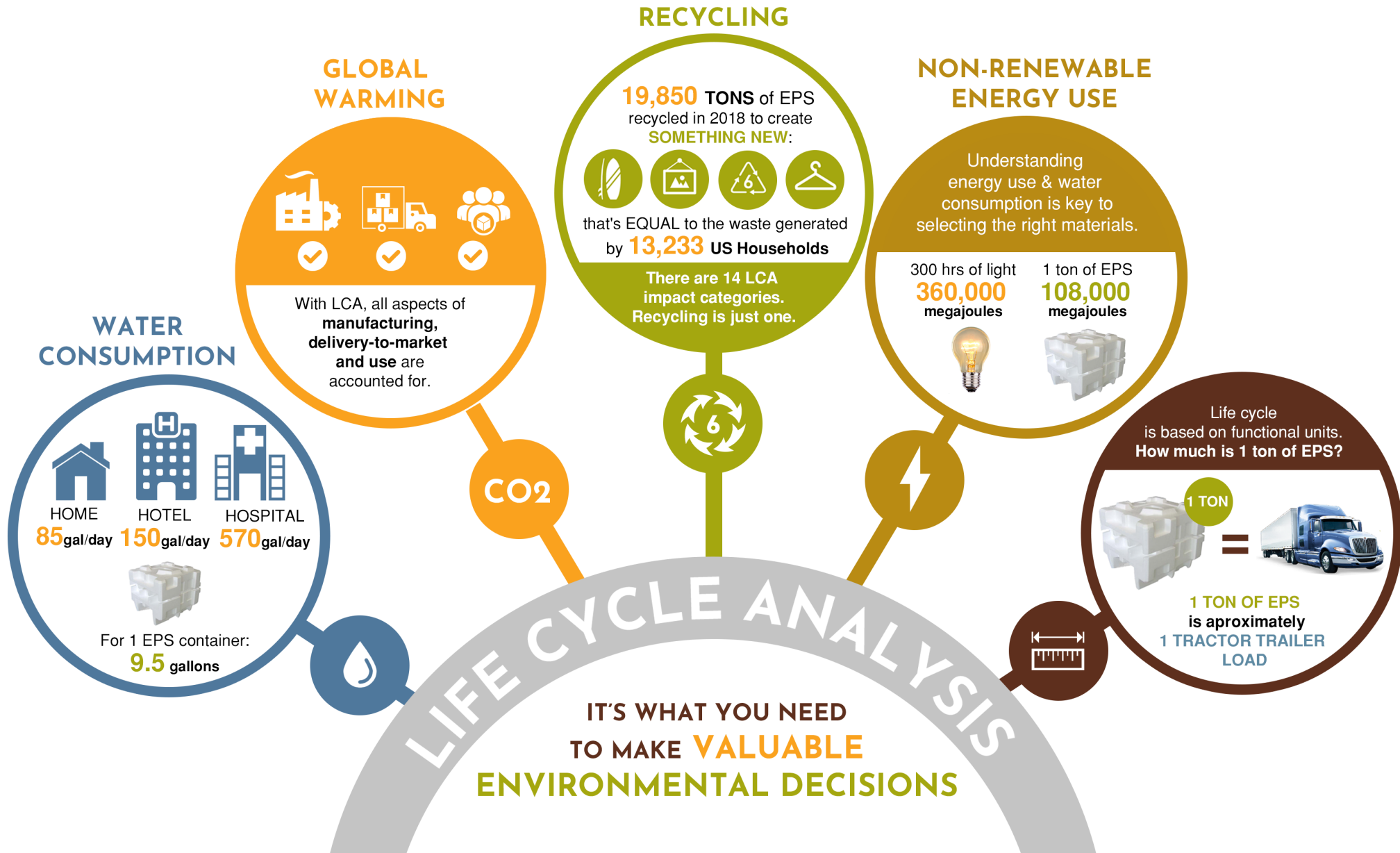
Styrene is a naturally occurring organic compound found in many kinds of plants, as well as a variety of foods such as fruits, vegetables, nuts, beverages and meats.

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 ₄)	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

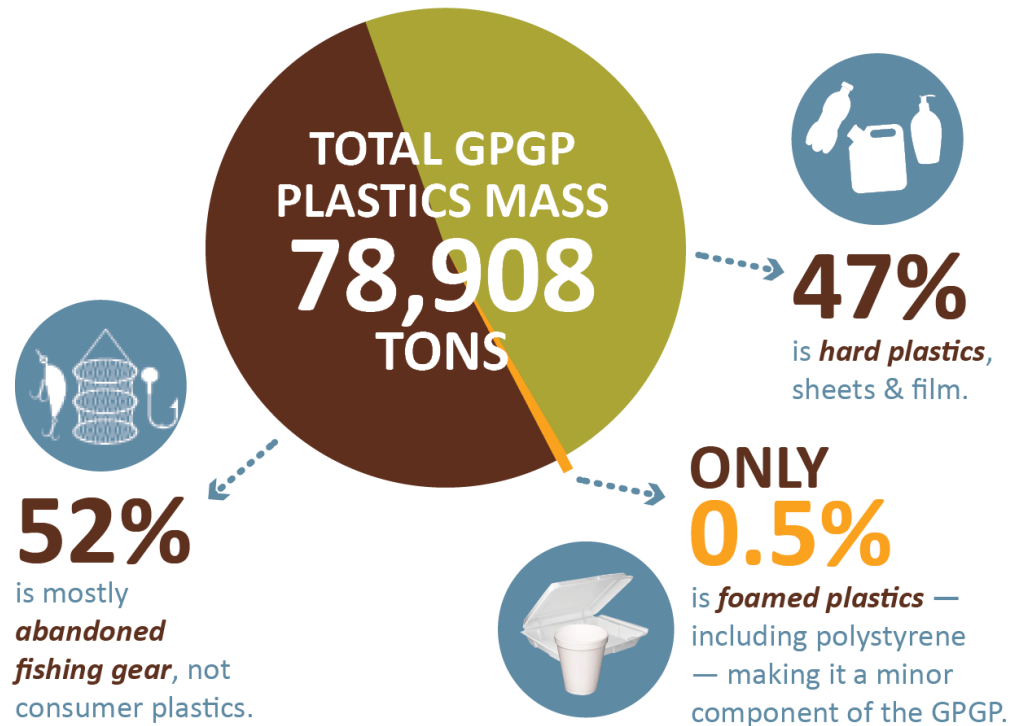
EPS Transport Packaging Is 2.7% of U.S. Litter & Less Than 0.5% of Plastic Marine Debris

A recent report on the Great Pacific Garbage Patch (GPGP) sheds light on previous assumptions about the role plastics play in marine debris, where they come from, and how different plastics contribute to the problem.

LET'S TAKE A CLOSER LOOK...



www.epsindustry.org



Polystyrene Bans Aren't the Answer.



“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

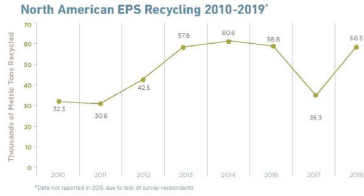


EPS PACKAGING PERFORMANCE &
ENVIRONMENTAL CHARACTERISTICS ARE
HARD TO BEAT

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?

2019 NORTH AMERICAN
EXPANDED POLYSTYRENE
(EPS) RECYCLING REPORT



66.0
thousand
metric tons
recycled

42.6%
North America
EPS Recycling
Rate

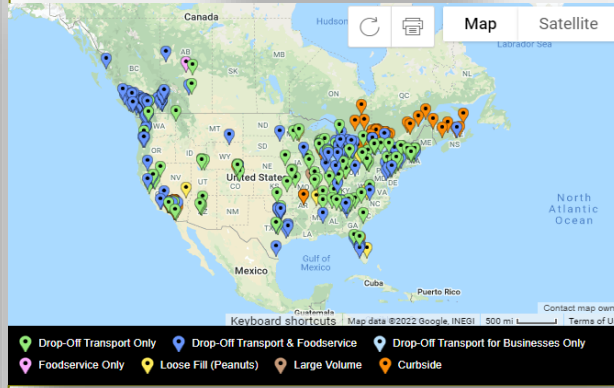
Resin Production
153,963
metric tons

Regional Population
496.9
million

“ EPS transport packaging meets the 30% threshold for global recycling criteria. ”

EPS Recycling Access Map

Find an EPS recycling location



U.S & Canada
www.epsindustry.org

EPS Sustainability & Environmental Stewardship



Expanded Polystyrene Biodegradable Foam Packaging

The EPS industry is dedicated to providing environmental packaging solutions and strives to increase product performance while providing optimized end-of-life solutions. For more than 30 years, efforts to increase EPS recycling have been successful due to an ongoing evolution of innovative technologies that support sustainable manufacturing practices and circular economy principals. On that front, the industry recently introduced biodegradable and oxo-biodegradable EPS packaging to its sustainability portfolio.

captured are converted to electricity. Anaerobic bioreactor landfills may not exist in many areas.

Oxo-biodegradability is most easily described as a conventional plastic mixed with an additive in order to initiate biodegradation. Degradation rates for biodegradable and oxo-biodegradable plastic will vary based on individual material formulations and the specific disposal conditions.

Adherence to FTC Green Guides prevents false or misleading environmental claims. Products using unqualified claims must degrade within one year. Otherwise, a qualified claim is needed to specify the time to degrade and proper disposal availability.

Biodegradable & Oxo-Biodegradable Solutions

The terms biodegradability and oxo-biodegradability are frequently a source of confusion. Although these terms are often used interchangeably, they are not synonymous. Biodegradable plastics, when disposed of in a biologically active landfill, are converted into water, carbon dioxide (CO₂) and biomass with the help of micro-organisms. Biologically active landfills, also called anaerobic bioreactor landfills, rapidly transform and degrade organic waste through the addition of liquid to enhance microbial processes. Biodegradation occurring in the absence of oxygen (anaerobically) produces landfill gas, i.e. methane. The landfill gas may be used to produce electricity, thereby minimizing the greenhouse gas emissions from the landfill. According to the EPA, in bioreactor landfills approximately 75% of the methane emissions

Biodegradable and oxo-biodegradable EPS are safe for food contact and meet FDA 21 CFR, EU framework 1935/2004 and EU regulation 10/2011 requirements for direct food contact applications. Biodegradable and oxo-biodegradable EPS may be recycled with other polystyrene solid waste without having to be segregated and is fully compatible within the existing EPS recycling infrastructure. Best practices have shown that they can be easily recycled within mechanical and advanced recycling processes. Biodegradable and oxo-biodegradable EPS are not compostable. Biodegradable products of any kind are not a license to litter.

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.



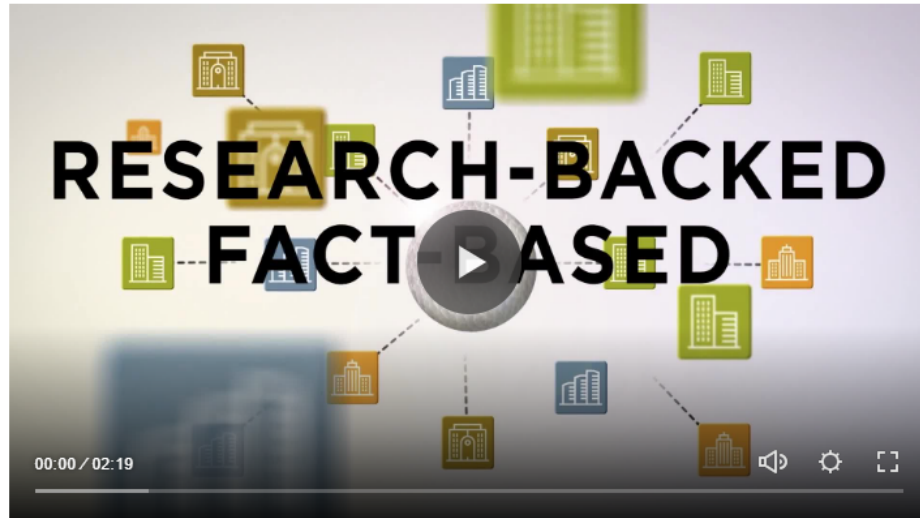
1298 Cronson Boulevard, Suite 201
Crofton, MD 21114 USA
(800)607-3772
www.epsindustry.org

SEE POLYSTYRENE RECYCLING IN ACTION



EPS Industry
Alliance

Foam Recycling With Manufacturers
(1:00) — 2019



WHAT IS EPS?

Expanded Polystyrene (EPS) is a sustainable solution that can be used to keep us warm, safe, and healthy while remaining cost-effective and recyclable. This video offers insights into the world of EPS, highlighting the positive contributions EPS makes in our lives.

Environmental Impacts of EPS Packaging Systems

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

1,000 Units
of EPS for
Vacuum
Cleaner
Packaging



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.org.org