

# Expanded Polystyrene Environmental Profile

Report for The Honorable Camila Zapeda

Director General, Global Affairs, Mexican Ministry of Foreign Affairs



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October 2023

Dear Director Zapeda:

The EPS Industry Alliance (EPS-IA) and the Global EPS Sustainability Alliance (GESA) provide the following to assist in the development of an instrument to eliminate plastic pollution. The EPS Industry Alliance is the North American trade association for expanded polystyrene (EPS) transport packaging. The Global EPS Sustainability Alliance is comprised of allied associations from Europe, Asia, North America, Africa, and Australia. Together, we want to provide information and act as a resource for member states as they chart a course to eliminate plastic pollution and to help move all nations towards achieving sustainable development goals.

Sr. Salvador Sanchez-Lan, representing Styropek USA and Productos Styropek en México, is an esteemed member of the EPS-IA Board of Directors and our lead point to coordinate international efforts that are designed to emphasize proactive industry environmental stewardship and advance expanded polystyrene waste management solutions. We appreciate the opportunity for Sr. Sanchez to meet with you earlier this month and he has asked us to follow up with relevant background information on EPS transport packaging and its environmental performance indicators.

Sincerely,

Global EPS Sustainability Alliance





# 1

## Essential Markets & Global Distribution Networks

*Abc?*



All protective packaging, whether plastic, fiber, pulp, or aluminum, exists to serve an essential purpose in global trade. The plastic pollution policy options under consideration will greatly impact packaging and product distribution channels and careful consideration of nuances and subtleties will allow these objectives to be achieved while avoiding unintended outcomes.

Of particular importance, cold chain shipping ensures delicate and perishable agriculture and pharmaceutical products are safe, of high quality and never compromised. The EPS industry was instrumental in producing strictly specified, extreme low temperature-controlled shipping containers that allowed for the quick and safe distribution of COVID 19 vaccines around the world. EPS packaging is instrumental for wide-range of global medical applications, such as organ transport and pharmaceuticals.

The FedEx Guides, which are based on test procedure requirements, recommend EPS packaging for essential products due to its ability to reduce the weight of containers and provide maximum inner protection during shipment. Electrolux has also deemed EPS essential for product protection, they found replacing EPS with paper-based materials increased environmental impacts for heavy and fragile products.

Australia's National Plastics Plan imposed a ban on single use plastics, that included EPS, however, they concluded EPS used for business-to-business and business-to-consumer packaging and specialized packaging used in medical and agricultural applications is out of the ban's scope and has been deemed essential. AAPLIA, the home appliance association of Europe, stated the implications of a proposed EPS ban in France "are significant to the home appliance industry."

## Essential Uses



Appliances



Pharmaceutical



Fresh Food  
Distribution



Electronics



Automotive

# 2

## Source Reduction

*Conserving Resources*



Expanded polystyrene protective packaging use has largely been reduced to essential applications that require the unique performance properties of this material. Large appliances, electronics, pharmaceuticals, perishable, and delicate food products rely on EPS for global distribution.

Through careful design and testing by knowledgeable packaging engineers, EPS packaging is specified to meet stringent delivery requirements, particularly in remote delivery areas, by using the least amount of material necessary. This is achieved by using void space, fluted wall design, and the latest packaging science technology such as CAD design to improve prototyping. This ensures the packaging is right sized and there is no material waste. In addition to safety, health and legal factors when designing packaging, packaging engineers are concerned with efficient use of materials and production facilities as well as energy conservation and cost reduction.

EPS manufacturers incorporate recycled content into their products by blending in used expanded particles from products they take in and grind down to the bead level. The average recycled content rate is 30%. Additionally, EPS resin also incorporates recycled content by extruding and repelletizing 100 percent recovered EPS.

EPS source reduction opportunities continue to evolve as the industry continues to establish innovative ways to boost recyclability and levels of recycled content while maintaining product performance.

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**RECYCLED  
CONTENT EPS  
HAS REDUCED  
VIRGIN RESIN  
CONSUMPTION  
BY AN AVERAGE  
OF 30 MILLION  
POUNDS OVER  
THE LAST  
DECADE**

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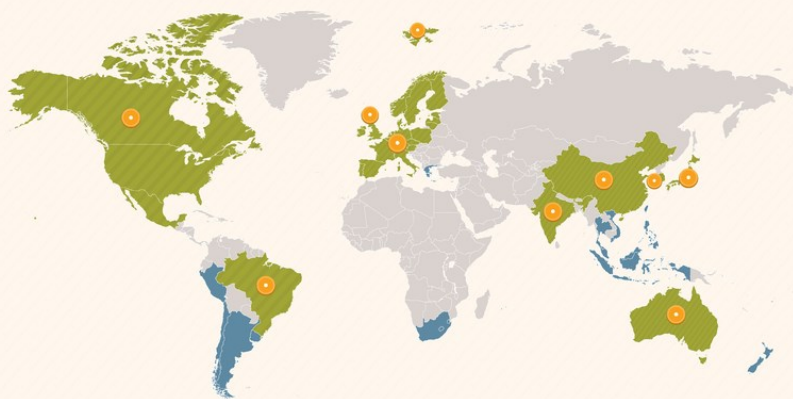
# 3

## Recycling

*EPS Protective Packaging is Recyclable*

## Global EPS Packaging Recycling

Interactive Global Recycling Map **Double Click on location marker to activate region stats**



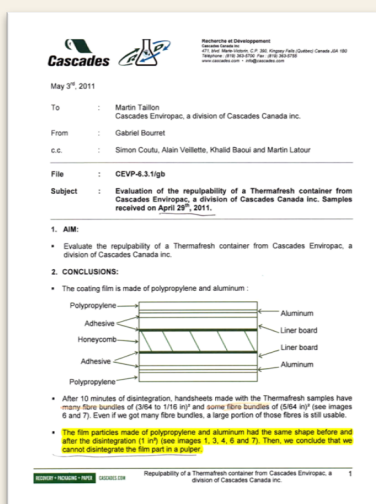
INFO: ■ Post - Use Recycling **Above 30 %** ■ Post - Use Recycling **10-30 %** ■ Information Unavailable

EPS packaging is globally recycled at scale and in practice with statistical data being reported in more than 38 countries. In 2019, 65.6 tons, more than 30%, of EPS were diverted from the landfill in North America. In Europe, the average recycling rate for EPS packaging is 40% while Japan, China, and South Korea have recycling rates above 50%. These statistics reflect recycling calculation rates as specified in ISO 1402 *Environmental Labels & Declaration*.

EPS transport packaging is considered a difficult-to-recycle material in consumer waste streams due to cross contamination, disproportionate weight to volume ratios and, as it only represents less than 1% of the total solid waste stream, insufficient quantities to interest waste management companies. However, in commercial waste streams, there are much higher volumes that are concentrated in various industry sectors that justify an investment in densifying equipment. This creates a cost-efficient scenario for recycled EPS feedstocks to be transported for reprocessing.

Many companies, including Walmart, Whirlpool and BestBuy, internally recycle EPS. It is now standard operating procedure for every BestBuy building in America to have EPS densification equipment to reduce labor and disposal costs. Densified. Recycled EPS packaging is used in numerous end-market industries such as building and construction, safety helmets, furniture, packaging, and automotive applications among others. Stable end-markets and resale value, increasing investment in infrastructure, progress in recycling technology and collaborative collection programs are driving growth in end-use industries.

Consumer access to EPS recycling is growing within municipal recycling facilities (MRF) in North America. Foam Cycle is a closed loop EPS collection and recycling system designed to be placed at outdoor municipal recycling drop-off centers. With over 30 U.S. locations this turn-key recycling solution provides more than 12 million residents with EPS recycling.



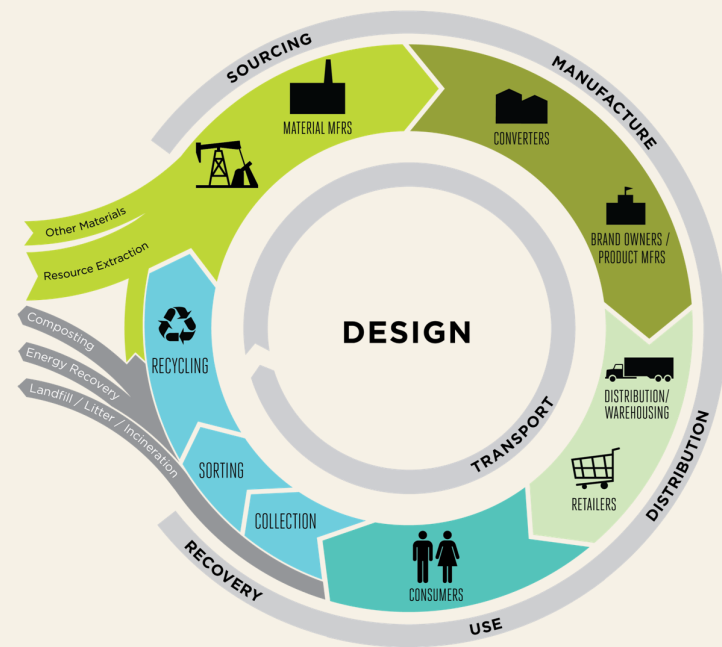
There is an incorrect assumption that paper and cardboard (OCC) are always recyclable. For example, ThermaFresh's recyclability is limited to within the Cascades collection system. Further limitations are indicated in the internal Cascades report "Evaluation of the repulpability of a ThermaFresh container" (2011). This report says that even when using the Cascades repulping process, "the adhesive used to laminate the honeycomb with the liner is insoluble; and the film itself cannot be disintegrated in a pulper can only be incorporated at a 5% rate because: it is a polymer coated material."

These results are echoed in other life cycle studies comparing cardboard versus expanded polystyrene foam packaging.

# 4

## Life Cycle Impacts

### Quantifying Environmental Impacts



Environmental emissions are key to evaluating environmental performance indicators throughout the product life cycle. Therefore, life cycle analysis is an invaluable tool focused on scientific data sets backed up a vigorous third-party review. Key life cycle impact metrics that should be taken into account when making material comparisons are: water eutrophication, CO<sub>2</sub> emissions, solid waste production, energy consumption, air acidification and nonrenewable resources. For materials that don't provide data on these life cycle tenets, it is far too easy to substitute emotional beliefs — most likely based on societal myths — to take the place of facts.

The EPS industry is committed to quantifying environmental impacts through like life cycle analysis, product category rules and environmental product declarations. Identifying system boundries, the processes and stages of the product's life cycle ,and impact categories provides a clear picture of a product's complete environmental profile, including carbon neutrality.

The environmental emissions for expanded polystyrene transport packaging are quantified below.

#### 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	<b>CO<sub>2</sub></b> (Carbon Dioxide)	1867	99% Fuel-Related	2%	4%	9%
	<b>N<sub>2</sub>O</b> (Nitrous Oxide)	N/A	N/A	N/A	N/A	N/A
	<b>CH<sub>4</sub></b> (Methane)	0.029	100% Fuel-Related	0%	3%	6%
ACIDIFICATION	<b>SO<sub>x</sub></b> (Sulphur Oxides)	7.33	83% Fuel-Related	2%	4%	8%
	<b>NO<sub>x</sub></b> (Nitrogen Oxides)	5.85	90% Fuel-Related	2%	6%	9%
	<b>NH<sub>3</sub></b> (Ammonia)	0.02	99% Process-Related	5%	10%	20%
EUTROPHICATION	<b>NO<sub>x</sub></b> (Nitrogen Oxides)	5.85	90% Fuel-Related	2%	6%	9%
	<b>N<sub>2</sub>O</b> (Nitrous Oxide)	N/A	N/A	N/A	N/A	N/A
	<b>NH<sub>3</sub></b> (Ammonia)	0.02	99% Process-Related	5%	10%	20%
PHOTOCHEMICAL	<b>C<sub>5</sub>H<sub>12</sub></b> (Pentane)	15.7	100% Process-Related	0%	0%	0%
	<b>CO</b> (Carbon Monoxide)	2.5	98% Fuel-Related	2%	4%	8%
	Other Organics	0.53	100% Fuel-Related	2%	4%	8%
	<b>CH<sub>4</sub></b> (Methane)	0.029	100% Fuel-Related	0%	3%	6%
	<b>HC's</b> (Hydrocarbons)	19.7	65% Fuel-Related	4%	7%	14%

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



A peer reviewed study<sup>1</sup> on a variety of fish box packaging systems covering three sizes demonstrates that in eight (8) life cycle categories, paper is better than EPS in six (6) instances, worse than EPS in 11 instances and equivalent to EPS in seven (7) instances. Here's the bottom line when comparing three different packaging materials.

- Paper and polypropylene both produce more solid waste during manufacture production than EPS;
- Paper manufacture results in higher water eutrophication & water consumption than EPS;
- EPS produces more photochemical oxidants than paper or polypropylene based packaging; and
- EPS compares favorably to other materials in the area of non-renewable resources and energy, air acidification and greenhouse gas emissions.

#### LIFE CYCLE ASSESSMENT OF THE INDUSTRIAL USE OF EXPANDED POLYSTYRENE PACKAGING IN EUROPE CASE STUDY: **COMPARISON OF THREE FISHBOX SOLUTIONS**

INDICATOR	FRANCE			SPAIN			SCANDINAVIA		
	EPS	PP	Cardboard	EPS	PP	Cardboard	EPS	PP	Cardboard
	4kg	4kg	4kg	6kg	6kg	6kg	20kg	20kg	20kg
Non Renewable Primary Energy in MJ	1.0	1.1	0.9	1.0	1.3	1.0	1.0	0.8	0.6
Depletion of Non Renewable Resources in kg q. SB	1.0	1.2	0.9	1.0	1.3	1.0	1.0	0.9	0.6
Emission of Greenhouse Gases in kg CO <sub>2</sub> eq. 100 yrs	1.0	0.9	1.0	1.0	1.0	1.4	1.0	0.8	0.7
Air Acidification in g SO <sub>2</sub> eq.	1.0	1.0	2.0	1.0	1.2	2.0	1.0	0.8	1.0
Photochemical Oxidants Formation in g eq. Ethylene	1.0	0.3	0.2	1.0	0.3	0.2	1.0	0.2	0.1
Water Consumption in m <sup>3</sup>	1.0	0.8	3.3	1.0	0.7	3.5	1.0	1.0	4.1
Water Eutrophication in g eq. PO4-3	1.0	1.3	5.9	1.0	1.2	5.3	1.0	0.9	2.4
Total Waste Production in kg	1.0	3.4	7.6	1.0	2.1	4.1	1.0	1.5	2.4



Where performance is **within 20% of the EPS value**, the two are considered equivalent.



Where performance is **worse than EPS by more than 20%**

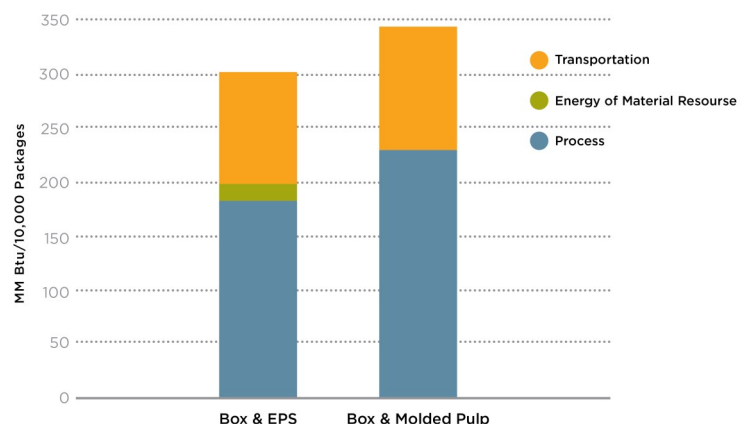


Where performance is **better than EPS by more than 20%**

#### EPS VS. MOLDED PULP COMPARISON

Oregon Dept of Environmental Quality, "Energy & Environmental Results for Packaging Options for Shipment of Retail Mail-Order Soft Goods," Franklin Associates 2003

In another life cycle study comparing EPS to corrugated, paper-based alternative, expanded polystyrene production and transportation shows more favorable results when considering total environmental impacts.

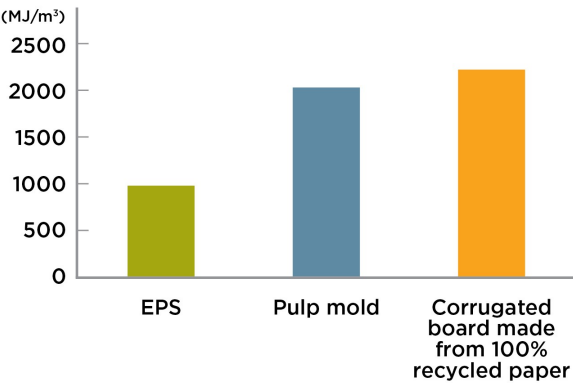




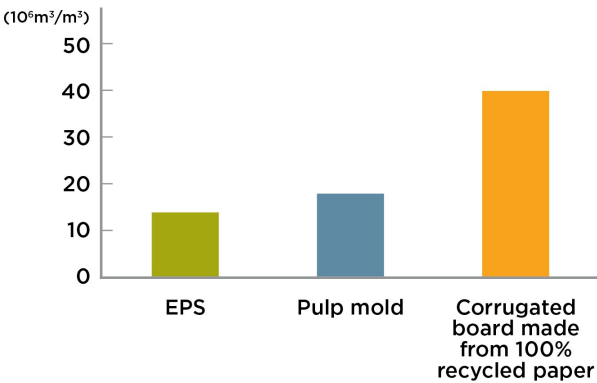
A life cycle analysis by InFo Kunststoff e.V. compared EPS to corrugated cardboard. The study quantified the energy use, global warming potential, air pollution and water pollution associated with 1 cubic meter of EPS packaging or corrugated cardboard packaging. EPS packaging clearly has lower energy consumption and CO<sub>2</sub> emissions than cardboard packaging.

*Note: Does not take other ThermoFresh system materials, including polypropylene, aluminum and adhesives, under consideration.*

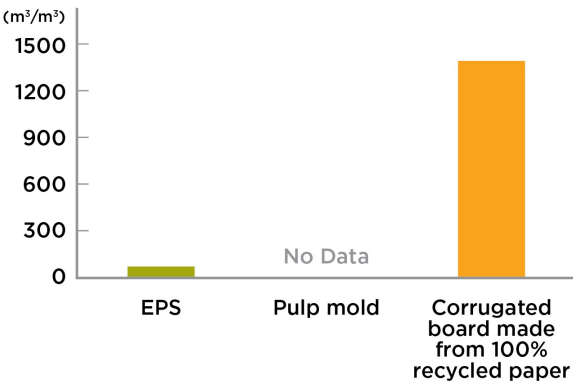
**ENERGY CONSUMPTION**



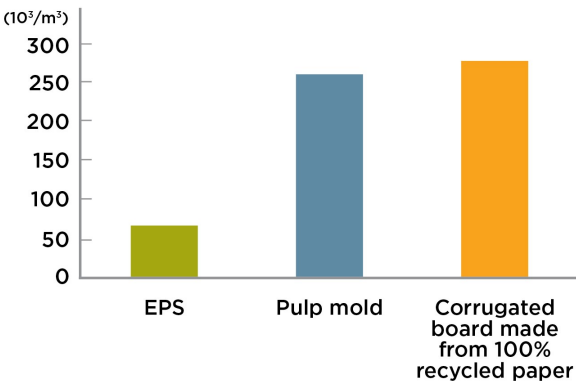
**AIR POLLUTION**



**WATER POLLUTION**



**GLOBAL WARMING POTENTIAL**





# 5

## Policy Considerations

### *Building Upon Previous Conventions*



**BASEL / ROTTERDAM / STOCKHOLM  
CONVENTIONS**

1. Development of an instrument to prevent plastic pollution, for efficiency and to avoid possible inconsistencies, should build upon and incorporate work done previously and set out in the Basel, Rotterdam, and Copenhagen conventions. These treaties already address chemicals of concern (human health)
2. Problematic and avoidable packaging requires development of robust science-based criteria. The attached Decision Tree on Problematic and Avoidable Plastic Applications contains many elements that should be considered in defining criteria.
3. Adequate science
4. Remediation language ongoing assessment of policy effectiveness

Similarly, the adequacy of existing regional and national regulations regarding production should also be considered. Expansion of effective existing regulations should follow as production of current materials and new alternatives, transitions non-producing countries to producing countries.

This same principle should extend from countries with effective waste management and recovery systems as those capabilities expand into previously under resourced areas and countries.

Expanded polystyrene protective packaging does not present an inherent health and safety risk. EPS protective packaging is approved for direct food contact by the most rigorous food safety regulatory authorities. Further, styrene is a natural occurring chemical, found in strawberries, coffee, and nuts, as well as in paper production making it difficult to determine the source of styrene in ocean environments. Please see the attached EPS Chemical Transparency Bulletin for more details.

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An advocate proposing elimination of EPS protective packaging recently cited a document in support of the contention that the material is inherently dangerous because of the presence of trace amounts of monomer persisting after polymerization. However, the proponent failed to qualify that the report stipulates leachate only occurs under the right conditions, one being temperatures of 95°C. This study produces positive results only using a temperature that is too high for the product's intended purpose.

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# Glossary of Terms

<i>Acidification</i>	A process whereby compounds like ammonia, nitrogen oxides and sulphur dioxides are converted in a chemical reaction into acidic substances.
<i>End-of-Life</i>	The management of all used and discarded products, components and materials with an objective of recovering as much of the economic (and ecological) value as reasonably possible, thereby reducing the ultimate quantities of waste.
<i>Environmental Emissions</i>	Substances that are released into the air as waste. Many times, these emissions are the result of combustion, manufacturing and natural waste.
<i>Global Warming</i>	A gradual increase in the overall temperature of the earth's atmosphere generally attributed to the greenhouse effect caused by increased levels of carbon dioxide, chlorofluorocarbons and other pollutants.
<i>Laboratory Handsheet Test</i>	This procedure describes the testing of pulp handsheets, prepared in accordance with TAPPI T 205 for their strength and other physical properties as well as their light scattering coefficient. Information derived from handsheet testing is a measure of the potential contribution of the pulp to the strength of the finished paper product.
<i>Life Cycle</i>	Consecutive and interlinked stages of a product or service system, from the extraction of natural resources to the final disposal.
<i>Life Cycle Analysis (LCA)</i>	A technique to assess the environmental aspects and potential impacts associated with a product, process or service.
<i>Life Cycle Inventory (LCI)</i>	The process of quantifying energy and raw material requirements, atmospheric emissions, waterborne emissions, solid wastes and other releases for the entire life cycle of a product, process or activity.
<i>Nonrenewable Resource</i>	A resource of economic value that cannot be readily replaced by natural means on a level equal to its consumption.
<i>Photochemical Oxidants</i>	Formed when sunlight falls on a mixture of chemicals in the air, creating smog.
<i>Water Eutrophication</i>	A process by which a body of water becomes enriched in dissolved nutrients (as phosphates) that stimulate the growth of aquatic plant life usually resulting in the depletion of dissolved oxygen.

## References

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