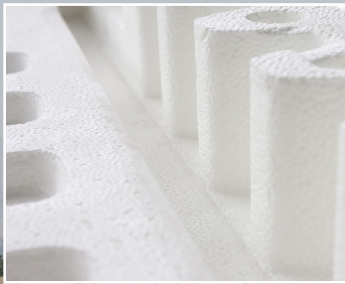


EPS Cold Chain SOLUTIONS



FRESH SEAFOOD



AGRICULTURAL
PRODUCE
& FRESH FOOD



PHARMACEUTICAL
& LIFE SCIENCES

EPS COLD CHAIN SOLUTIONS

Of all of the ways expanded polystyrene protects valuable resources, cold chain packaging really stands out. It is synonymous with added value and exceptional performance, particularly with products which are very sensitive to changes in temperature. EPS is an ingenious solution thanks to two intrinsic properties – insulation performance and shock resistance.

Today's demanding global commodity chains hinge on exact timing and coordination. Compounding this challenge is the fast-paced, short-lived perishable supply chains in which products can flow from source to customers within a matter of weeks, days and sometimes hours. To ensure that cargo does not become damaged or compromised throughout this process, the pharmaceutical, medical, agricultural and fishery industries rely on cold chain technology.

Not all cold chains are created equal – some are longer, more rigorous and more time consuming from end to end. Land, sea and air modes all have different structures for keeping perishable products fresh throughout the transport chain. Certain supply chains may only require one transportation mode, but many times ground shipments are one link in a combination of transport modes. Cold chain concerns include:

- Destination of the shipment and the weather conditions for those regions (especially extreme cold or heat);
- Reliability of refrigeration equipment in the storage areas, transport vehicles and at the point of sale;
- Care and skill of individuals handling the packaging;
- Efficacy of a package and its ability to survive the shipping environment.

Cold chain technology demands packaging that provides the stable and reliable insulation necessary for products where an increase in temperature would be detrimental to their quality and safety. In addition to thermal impacts, sensitive food and life science products must be protected from physical impacts during transit and storage to protect their integrity.

EPS is an ingenious solution thanks to two intrinsic properties – insulation performance and shock resistance.

PHARMACEUTICAL & LIFE SCIENCES ●●

According to the Global Healthcare Cold Chain Logistics Market Report & Forecast (2012-2017) the demand for cold chain in the pharmaceutical and life science industry is experiencing explosive growth – the size of the healthcare cold chain market is expected to expand from its current figures of \$6.7 billion to nearly \$10.7 billion by 2017¹. Improper packaging failures involving products ranging from flu vaccines to topical creams resulted in a staggering financial loss of \$1.5 million in 2012². The environmental loss is also staggering; wasted manufacturing, products and transportation does more harm to the environment than any negative impact of the packaging system itself.

Of the close to 200 billion dollars in pharmaceutical distribution, about 10% are drugs that are temperature sensitive³. Within the pharmaceutical industry testing, production and movement of drugs relies heavily on controlled and uncompromised transfer of shipments. If these shipments should experience any unanticipated exposure to variant temperature levels, their safety, efficacy and quality are impacted.

EPS packaging is the gold standard for pharmaceutical and life science products; it maintains product safety, security

and temperature throughout the cold chain. For pharmaceutical leaders such as Merck, Wyeth and Abbott patient safety is paramount which is why they rely on EPS packaging to deliver life saving medicine and vaccines around the world.



The healthcare cold chain market is expected to expand to nearly \$10.7 billion by 2017.

¹ Global Healthcare Cold Chain Logistics Market Report & Forecast (2012-2017), International Market Analysis Research and Consulting Group, 2012

² Case Study: Pharmaceutical Cold Chain Packaging, AIT Worldwide Logistics

³ The Effects of Cold Chain Logistics and Technology on Global Freight Distribution, Hofstra University, 2007.

AGRICULTURAL PRODUCE & FRESH FOOD ●●

Food waste is often considered environmentally benign because it is 'biodegradable' but consider this: globally, about a third of the food produced for human consumption goes to waste — which means that a third of the water, land use, energy and financial resources that went into producing it are also squandered. For perspective, over 100 billion pounds of food, or more than a quarter of the 400 billion pounds of edible food, is spoiled each year during transport. When it comes to protecting food, the right package can dramatically reduce waste and have a major positive impact on the environment.

The U.S. fresh grape industry is approximately 851 million tons with most grapes distributed to supermarkets or exported. For food products such as table grapes time has a direct impact on their shelf life and potential revenue. Cold chain packaging keeps agricultural produce fresh for extended periods and eliminates doubts over the quality and safety of fresh food products. Any break in the cold chain can increase risk of decay and disease development.

Unlike other fruits such as bananas and pears, grapes do not ripen after harvest, they only deteriorate. To retain peak condition, harvested grapes must be transported as quickly as possible to a facility where they can be cooled rapidly to reduce field heat and deterioration. This fast cooling is followed by storage at a constant temperature (0-1°C) with high humidity (90-98%) to prevent water loss from the stems and berries. Temperature affects all causes of deterioration - every hour of delay in the pre-cooling of table grapes equates to a one day loss of shelf life. A 3-5% weight loss in table grapes results permanent deterioration and rejection by markets.

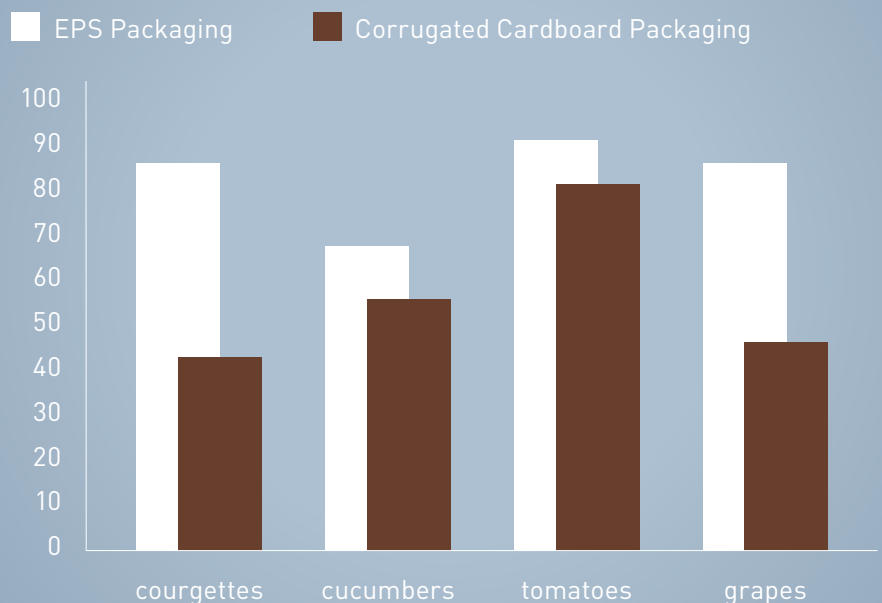
A study by the Korean Food Research Institute shows that EPS packaging is the most efficient material for storing fruits and vegetables⁴. Results show produce packaged in EPS retains its vitamin C content longer than food packaged in other materials. EPS provides improved cold chain maintenance, lower microbiological growth and improved physical appearance of perishable foods.

For the mail-order and online food industry that distribute items such as cheesecake, meat and dietary meals, prolonged thermal insulation and temperature control of these perishable goods saves money, increases customer satisfaction and improves the bottom line. Specialty foods have a very limited shipping and delivery timeframe, generally 24-48 hours. Because of the delicate nature of mail order food products EPS cold chain containers are often custom designed to prevent cargo damage. Cost-efficient and lightweight, EPS is the established cold chain container for specialty food mail-order business around the globe.

EPS packaging is the most efficient material for storing fruits and vegetables.



Percentage of remaining vitamin C after one week of storage.



⁴ Effects of EPS Packaging Box on the Freshness Extension of Agricultural Produce, Korea Food Research Institute, 1997.

FRESH SEAFOOD ●●●

The delicate nature of seafood presents a cold chain scenario that challenges any packaging solution to its very core. Fresh, chilled, frozen and processed fishery products are a global cold chain that crosses nearly every ocean and touches almost every principal land mass. Spoilage cannot be stopped in fresh fish but it can be controlled to a great degree. Maintaining fish at the core temperature from catch until delivery ensures optimum safety, freshness and quality and reduces post-harvest losses.

Fish starts to spoil from the time it is caught and this spoilage continues throughout its shelf-life. The main reasons for fish spoilage are enzyme activity and bacterial growth. In addition, oil-rich fish such as mackerel and herring will spoil due to oxidation. All of these biological and chemical reactions occur more rapidly at higher temperatures which can lead to rapid spoilage, decreased shelf-life and possible food safety risks. Chilling and freezing slows down the bacterial, enzymatic and chemical actions and prolong shelf life.

International regulatory measures require food industry and food safety professionals to comply with strict temperature requirements to ensure both their protection from contamination and their preservation under hygienic conditions. The U.S. Food and Drug Administration operates a mandatory safety program for all fish and fishery products under the provisions of the Federal Food, Drug and Cosmetic (FD&C) Act, the Public Health Service Act and related regulations. As a cornerstone of that program, FDA publishes the Fish and Fisheries Products Hazards and Controls Guidance, an extensive compilation of



the most up-to-date science and policy on the hazards that affect fish and fishery products around the world and effective controls to prevent their occurrence.

The insulating properties of EPS ensure that seafood is kept at an even temperature. It protects against sudden temperature changes, for example when products are removed from a cold room or a refrigerated truck. Factors that impact the temperature stability of fresh fish include transfer of product to storage facilities, from storage to the logistic center and from there to the point of sale. Other parameters of uncertainty that come into play are the reliability of the refrigeration equipment in the storage areas, transport vehicles and point of sale display units.

EPS is the preferred cold chain solution for seafood protection from sea to sales counters across the globe. This leading market position is due to EPS' proven thermal performance, impact resistance and sustainability attributes. EPS ensures seafood products are kept at an even temperature throughout the distribution chain and that products

arrive at the point of sale in optimal conditions.

A recent life cycle analysis by PricewaterhouseCoopers measured the environmental impacts of several fish box packaging systems, including EPS and cardboard. Results show EPS is a sustainable material for fresh fish, with similar or better results than alternative packaging. The advantages of EPS are its low carbon impacts and clean manufacturing technologies which result in minimal energy and water inputs with no production waste.



EPS is the preferred cold chain solution for seafood protection from sea to sales counters across the globe.

Comparative results of the three packaging solutions in an average 6kg European situation.

Indicator	EPS	PP	Cardboard
Non renewable primary energy (MJ)	1	1.3	1
Depletion of Non Renewable Resources (kg eq. Sb)	1	1.3	1
Emission of Greenhouse gases (kg CO2 eq., 100 years)	1	1	1.3
Air acidification (g SO2 eq.)	1	1.2	1.9
Photochemical Oxidants formation (g eq. ethylene)	1	0.3	0.2
Water consumption (m3)	1	0.8	3.5
Water Eutrophication (in g eq. PO43)	1	1.2	5.1
Total waste production (kg)	1	2.3	5.2

Life Cycle Analysis by PricewaterhouseCoopers, November 2011



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Advancing innovative EPS product solutions that contribute to a sustainable future.

EPS COLD CHAIN PACKAGING SUSTAINABILITY ●●●

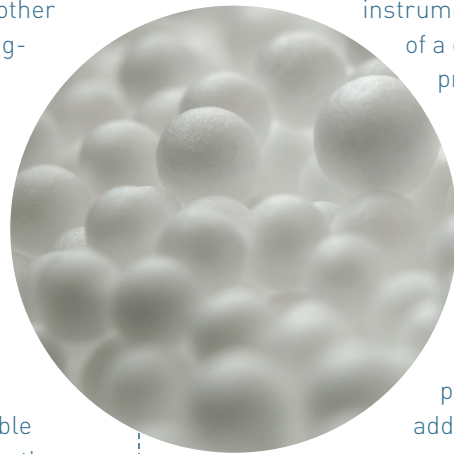
Packaging's most important function is to deliver products safely to market, which is critical to achieving a net positive environmental impact. It is important to consider packaging's role in the full life cycle of a product – from protection during shipping, to safe delivery, to end-of life. Damaged products costs millions of dollars in wasted product as well as wasted environmental resources. By avoiding transport damage, the optimum protection saves significantly more energy than the energy used for the entire life of the packaging. With cold chain products it is vital to choose packaging that has been designed and properly tested to maintain the required temperature compliance of the shipment.

EPS is proven to maintain product integrity. The impacts of using EPS in cold chain applications far outweighs the impacts and risks of food damage and waste which would otherwise occur – for example when more energy might be needed for cooling less thermally-efficient packs. At every stage, from manufacture to disposal, EPS offers numerous environmental attributes during its life cycle.

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EPS is 98% air; its high strength to weight ratio minimizes fuel and transportation impacts. And EPS is recyclable where facilities exist. Most used EPS is converted into other EPS products, including long-life applications. These include coat hangers, picture frames and wood-substitute products. When used in fish boxes, EPS is less likely to be collected due to the fact that it has been contaminated by the fish it has protected. However, the EPS industry is constantly striving for viable recycling options that enable the growth of end use markets.

In all, cold chain distribution presents formidable challenges for product protection. Packaging can't meet those challenges alone, but it is an instrumental component of a damage control program. For cold chain technology, expanded polystyrene (EPS) guarantees the quality and safety of perishable products. In addition to its unsurpassed thermal and protective properties, EPS is hygienic and moisture resistant. EPS also offers exceptional stacking strength which helps overcome problems with collapsed pallets and spoiled goods. And because EPS is lightweight it reduces overall transportation cost, fuel and pollution impacts. When food safety and life safety are in the balance, EPS is the best packaging choice. EPS keeps products cold – reliably and sustainably.



EPS is 98% air; its high strength to weight ratio minimizes fuel and transportation impacts. And EPS is recyclable where facilities exist.

EPS manufacturers are invested in sustainability and the effective use of resources, using less material and concentrating on efficient processing for production, distribution and disposal. These challenging behind the scenes actions have resulted in measurable positive environmental impacts.

EPS Cold Chain SOLUTIONS

Performance
Reliability
Quality