

Designing Packaging For The Environment — Part I

How effectively we meet the challenges of designing environmentally friendly packaging will determine the future quality of life.

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Designing packaging for the environment not only has become the preferable method of achieving market acceptance for products, but also has resulted in an almost mandatory requirement to attack the current packaging waste problem that plagues our industrial society.

Through the years, the growth of one-way packaging; the trend toward outdoor living which requires special packaging; the preference for fast-food packaging and the continual decreases in municipal and state budget funds for packaging waste disposal and control have all contributed to shifting waste disposal cost to the packaging industry.

The importance of designing packaging to meet environmental needs and concerns is high on the list of challenges facing us today. How we address and efficiently tackle these problems will determine the health and quality of life of future generations.

Historical Perspective

Packaging waste management has now evolved into a working concept to confront the past problems of huge amounts of packaging waste created by our society when containers, components, cartons and wrapping materials — including paper and polymer films of every conceivable makeup — were either burned or plowed into landfills.

The scientific community finally discovered the atmospheric pollution created by burning and the ground pollution generated by landfills. In the late '60s, manufacturers of packaging components, consumer goods, and packaging materials started working together to address the packaging waste problem and translate the problem into an economic advantage for our industrial community and for the consumer.

The results were incineration systems keyed to heat recovery, recycling systems based upon reuse and re-fabrication, and last but not least, the concept of source reduction, based upon lightweighting, decreasing packaging overlays and total packaging components, yet still offering optimum product protection. All these approaches to solving our waste dilemma have required new thinking in order to design packaging efficiently and proficiently for the environment.

Material Selection

When selecting materials and designing a package, engineers must now:

- Balance a variety of factors.
- Take product safety into consideration.
- Design a package to maintain product quality.
- Produce a design with efficiency concepts.
- Employ a design leading to good distribution channels.
- Design a package which has minimal impact on the environment.

Source Reduction Objectives

Source reduction has now become an important factor in designing packaging for the environment. Following are its objectives.

1. It conserves resources.
2. It prolongs landfill life.
3. It minimizes the need for landfills and incineration.
4. It reduces the amount of hazardous products entering the atmosphere and our land surfaces.
5. It saves our resources for future generations.
6. It reduces the amount of packaging needed with an accompanying reduction in costs.
7. In many applications, it speeds packaging material production and fabrication, thereby lowering costs.

All these factors should be balanced with the primary goal of maintaining optimum product protection.

Designing for the environment in conjunction with source reduction needs to employ the following criteria: weight reduction, volume reduction, composite material use, product concentration (less packaging required), product reformulation (less packaging required), product design change, package design change, bulk packaging and complete package elimination (select applications).

ENVIRONMENT

Source reduction is only feasible when it can be achieved; without compromising product protection; when the packaging material can be recycled; when consumer safety is taken into consideration; when the product is fully protected from environmental conditions; when sanitary considerations are required; when recycled packaging can be used (depending upon the product; this cannot always be accomplished).

Regulation Compliance

Packaging design has taken on new dimensions to meet federal, state and local municipality regulations. Seeking to design environmental packaging, manufacturers have begun new environmental directions. Some product development areas are a result of intensive research conducted at university and company laboratories, much of it based upon joint ventures between academia and industry.

Research and product development have created products unheard of a few decades ago. These include:

- More use of required resin.
- Thin-walled plastic film containers/pouches.
- Decrease in secondary packaging.
- Using popcorn to replace polystyrene foam in filling voids in a shipping carton.
- New biopolymer films that are degradable.
- Use of recycled paperboard.
- Eliminating heavy metals in packaging materials.
- Converting solvent-based pigments to water-based pigments.
- The complete removal of chlorofluorocarbon (CFC) molding agents.
- Returnable and reusable shipping containers.
- The development of metals, plastics and paper products which are environmentally friendly.

Other development areas which have required new packaging design concepts are the *lightweighting of glass, plastic, aluminum and steel containers*; reduction of multilayer barrier films; *development of steel and plastic reusable drums and containers*; new polymer coatings on returnable glass containers to increase handling capabilities; *development of the stand-up pouch*; detergents coming to the market in a concentrated form, ready for reconstitution; *less secondary packaging such as folding cartons and corrugated master cartons*; increased bag-in-the-box packaging; and increased bulk buying by the consumer, decreasing the total amount of individual unit packaging materials and components.

Development Areas

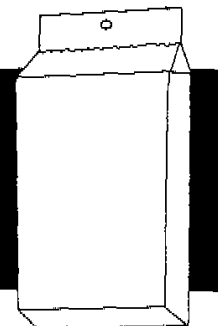
There are many recorded cases of companies redesigning their packaging because of environmental concerns. Manufacturers have switched from the steel coffee can to the flexible aluminum-foil-composite vacuum pack. One produced a pudding snack pack, 10% lighter than the original, through redesign and thin-walling. The aluminum can has been reduced in weight from 0.046 pounds/can in 1972 to 0.034 pounds/can in 1990. This 0.012 pound difference does not seem like much of a savings in weight/can, but multiplied by the number of aluminum cans produced and consumed per year, it has a great impact.

The steel can has also been decreased in wall thickness and corresponding weight per unit. *Lightweighting and thin-walling* employ less raw materials, but fabrication procedures require tighter quality-control methods and much tighter material specifications. The 16-ounce glass beverage bottle has undergone a reduction in weight, from 255 grams/bottle weight in 1980 to a 177 gram bottle in 1990.

The high-density polyethylene milk container weighed 95 grams in the early 1970s; by 1990, the same volume jug has been reduced to 60 grams. A new double-lamination film has reduced the volume of many polystyrene food service items by as much as 40 percent. Today, diapers are packaged in plastic wrappers which create 50 percent less waste by volume. Plastic grocery sacks were 2.3 mils thick by 1984. In 1989, technology has provided the same strength and durability in a bag that is only 0.7 mils thick.

The two-liter polyethylene terephthalate container has been redesigned and reduced in weight from 68 grams per bottle in 1977 to 51 grams per bottle in 1990. Source reduction, by lightweighting and thin-walling, reduces packaging

Flat-bottom pouches are replacing rigid plastic containers.



waste, decreases consumption of the earth's resources and eliminates raw materials that could damage the environment. Source reduction by redesign helps improve quality, increase efficiency and reduce packaging costs.

Stand-Up Pouches

Stand-up pouch packaging has had slow growth and acceptance in the marketplace, principally due to possible environmental concerns about the recyclability of multilaminated pouch structures. As pouch material costs have decreased and high-speed packaging technology has become more prevalent, the space-saving advantages of these stand-up, collapsible packages are now an ideal packaging concept to benefit the environment.

Developed using high-barrier film, these pouches were engineered to meet stringent and rigid processing protocols, such as hot-fill applications, with the objectives of replacing the traditional glass bottle, steel can, and rigid paper and plastic container.

Editor's Note: Part II will continue the discussion of designing packaging for the environment and focus on reducing packaging waste, new packaging technologies, degradable products and package recycling.