# RECYCLING LAMINATED FLEXIBLE-PACKAGING MATERIALS

I. FRANK GAVITT

**FACING SPIRALING LANDFILL COSTS AND THE LONG-TERM POSSIBILITY OF LEGISLATED RECYCLING MANDATES, FRITO-LAY SET UP A PROGRAM TO RECYCLE PRECONSUMER FLEXIBLE-PACKAGING MATERIALS.**

After more than five years of effort, Frito-Lay has established a stable program for recycling preconsumer flexible-packaging waste. This article recounts the history of the company's recycling program and identifies factors to be considered by anyone contemplating development of a similar program.

Frito-Lay, Inc. is a division of PepsiCo, Inc., a worldwide corporation comprising three major business segments—beverages, snack foods, and restaurants. Frito-Lay, the major element of the snack-food business, manufactures its products in 40 plants in 24 states, with an additional 4 facilities in Canada. The other snack-foods component, PepsiCo Foods Intl., operates in 25 countries throughout South America, Europe, the Middle East, Asia, and the United Kingdom. Virtually all the snack foods produced by Frito-Lay and PepsiCo Foods Intl. are marketed in flexible film packages. The film structures of these packages are developed to be as economical as possible while providing an optimum level of protection against environmental factors (moisture, oxygen, light) that can degrade the product.

To ensure that the package structure for a particular product provides the required protection, shelf life is tested extensively under conditions simulating those experienced during storage, distribution, and merchandising. This testing has improved product protection while reducing to three the number of basic package structures for all of our snack-food products.

1. Metalized polypropylene/clear polypropylene
2. Clear polypropylene/clear polypropylene coated with polyvinylidene chloride (PVDC)
3. Clear polypropylene/polypropylene.

In 1994, the company purchased over 92 million lb of these materials to package its products for the U.S. market.

Frito-Lay relies on its suppliers in the flexible-packaging industry to provide the materials needed to package snack-food products. But we don't just expect it to happen. We are very involved in the development process to make certain that the raw-material producers, film producers, and converters address the company's specific needs. The result has been many collaborative advances: thinner films, better barrier coatings and sealants, enhanced surface treatment, and gas-flushable metalized polypropylene.

## THE NEED TO REDUCE PACKAGING WASTE

In early 1990, concerns over the future impact of environmental policy led the company's then CEO to initiate a program addressing the issue of packaging-film waste. All of Frito-Lay's major film and converter suppliers agreed to participate in the program. The group established itself as the Packaging Waste Alternatives Task Force and initially consisted of Mobil Chemical, Toray Plastics (America), Quantum Performance Films (QPF), Hercules Films (now AET), Plintpack, Bryce Corp., and James River. Exxon Chemical joined the task force in 1991, and Curwood came aboard in 1994. The primary mission was to identify, develop, and implement alternatives to landfill disposal of preconsumer flexible-packaging waste. Alternatives had to:

- Be environmentally sound.
- Leverage existing technology.
- Be cost neutral.
- Demonstrate potential for application to post-consumer waste if and when mandated and supported by the necessary collection, sorting, and secondary-use infrastructure.

*Examples of product applications*

## CAUTIOUS FIRST STEPS

Base-film manufacturers reprocess clean scrap, edge trim, and waste back into the process,so little scrap winds up in landfills. However, the complexity of the converting and laminating operations was such that the majority of scrap generated was going to landfills. The majority of packaging waste generated at Frito-Lay's manufacturing plants was also going to landfills.

The task force wanted to proceed cautiously while maximizing the probability of success. Consequently, the initial approach was to work with just the converter waste stream, since it was completely under the suppliers' control and could be collected at a minimum of locations. Moreover, the volume of waste from the converting process was significantly greater than that from the Frito-Lay plants.

The task force looked at several alternatives, the most obvious being a reduction in the amount of waste generated. The next tier of alternatives focused on energy conversion and recycling. Given the high heating value of the waste, we thought that utilities would be glad to buy the material as a fuel. Wrong. Even when we agreed to segregate the problematic films containing PVDC, no utility that we contacted wanted the scrap,even for free.So we looked at converting the scrap into plastic wood. Wrong again. It seemed that every garage-shop recycler was making that product, and there was absolutely no demand.

The task force's mission was beginning to complicate life for the converters. The end use for their waste would determine whether in-plant handling could stay the same or whether new segregation and handling methods would be required. Striking out with the two easy alternatives—either of which would have allowed commingled waste collection—meant a change in converter operations. Waste polyester, PVDC-coated material, adhesive-laminated materials,and polypropylene structures would have to be separated.

## DEVELOPING MARKETS FOR CONVERTER WASTE

QPF had been investigating options for recycling converter waste and had successfully demonstrated that waste from metalized polypropylene/polyethylene laminations could be extension-melted to form pellets suitable for injection molding and profile extrusion. Analysis indicated that the pellets had properties similar to those of wide-spec polypropylene homopolymer. A few months later, Exxon Chemical offered to accept truck loads of the metalized polypropylene waste film for trials at its new plastics recycling center in South Carolina.Thanks to QPF's efforts, we already knew it would work.

After some initial problems,such as accidental mixing of PVDC and polyester in a few loads, volume and pricing were agreed upon, and two converter plants began sending regular shipments of waste to Exxon's recycling center.

The task force also assigned a team to work with Exxon in identifying potential markets for the recycled resin.One development was food-service trays for PepsiCo's KFC restaurants. Things were looking good. We had a process, and we had an outlet. But virgin polypropylene prices had been declining, and in late 1993 the bottom fell out. With that, the sale price of recycled resin dropped also.It got so bad that the sale price of recycled pellets was 30% lower than the recyclers' cost of manufacturing, so subsidies were used to keep the recycling program going.

Fortunately, the market eventually turned around in 1994,and more outlets for both waste material and recycled pellets were developed.Currently, five recyclers are purchasing waste material from the converters.Over 5 million lb a year of metalized polypropylene film waste—representing about 40% of the converters' Frito-Lay-related waste—is now being recycled rather than going into landfills.

As Frito-Lay introduces new snack-food products, the overwhelming majority are being packaged in metalized polypropylene structures, so the

*Examples of product applications*

percentage of waste that can be recycled will continue to increase.But what about the PVDC-coated, clear material?

## PROBLEMATIC MATERIALS

Structures containing PVDC-coated polypropylene cannot be melt-reprocessed using conventional extrusion equipment,since the temperature required to melt the polypropylene is above the degradation temperature of the PVDC. When PVDC degrades, chlorine gas and hydrochloric acid are formed,creating health concerns for operating personnel and corrosion for equipment.Despite efforts to develop recycling opportunities for scrap containing PVDC, most of this material is still going to landfills. However, alternative solutions to the PVDC problem are being pursued. Frito-Lay is working with its packaging suppliers to replace PVDC coatings with materials that would be recyclable in the current waste stream while providing equivalent barrier protection.Aluminum oxide coatings and resin modification are two of the approaches being pursued.

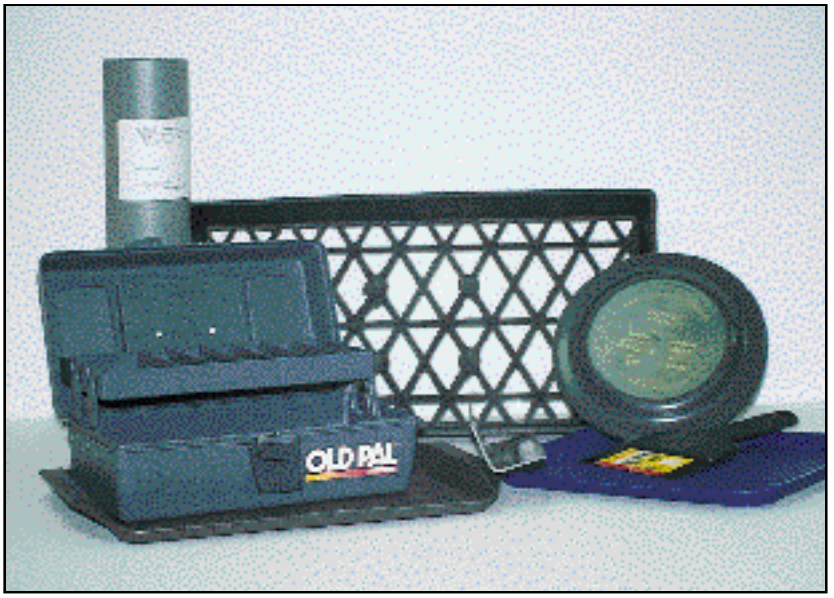
## OPERATIONAL IMPACTS AND COSTS

Without recycling, all converter lamination scrap is waste and is ultimately placed in a landfill.Depending on the location of the plant,the cost of landfilling is US$ 0.02–0.06 per pound.

In the task force's experience,the recycler is as likely to pay for shipping of the scrap as not.The cost of shipping is comparable with the cost of landfilling if the load can be densified sufficiently. This might lead one to conclude that recycling is no more expensive than landfilling and, therefore, is obviously the better choice. However, the overall requirements of recycling and associated costs must also be considered.Scrap is an inherent part of the process.It is generated setting up jobs, as trim during operation,and as out-of-specification production.Rollstock can also become scrap if the graphics are changed by the packaging customer. Converters do not normally segregate scrap that is to be landfilled.When the scrap stream contains materials that are incompatible in melt form—such as laminations containing polypropylene and PVDC—recyclable material must be separated from material that is not. In such cases, the converter must identify the materials coming from each scrap stream so that they can be segregated into compatible groups.

Compatible recyclable materials are combined in a baling process. If the scrap was previously all going to landfill, the converter probably does not have a baler but will now need to purchase one. Another capital cost will be for a guillotine to cut rollstock off cores. Very few recyclers will accept material on cores,so the converter must cut the rollstock into slabs using a guillotine and remove the core prior to baling. However, a guillotine can be a valuable tool, even in the absence of a recycling program. For example, our converters have been approached by brokers who wanted to sell waste rolls—imprinted with our trademarks—as roofing material overseas. Brokers may also try to buy waste rolls for use in developing nations, where the material can be used to package counterfeit products. Destruction of waste rollstock with a guillotine is an effective way to prevent unauthorized use of a company's packaging.

An operation generating one truckload of baled scrap per week will likely require 1–2 persons several hours per day to slab down rollstock, collate the segregated scrap, and make bales.Management time is required to develop a procedure for handling the scrap to ensure that incompatible product does not get mixed and to keep the scrap-collection process from interfering with production.In addition,management must pay close attention to the safety aspects of these operations.They are labor intensive and typically are conducted under less-than-ideal conditions. Shipping must track baled material like any order and will have to devote time to loading trucks.




*Baled scrap snack-food packaging*

Depending on the number of shipping bays available,one or two trailers may be spotted at all times, or warehouse space will be needed to store bales prior to shipment.

Given this additional handling by the converter, another US$ 0.03–0.06 per pound of scrap generated can be added to the cost of the recycling operation.

What happens to the waste at the recycler? As mentioned earlier, metalized polypropylene laminations—printed or unprinted—can be reprocessed and pelletized using conventional melt compounding and extrusion equipment.The polyethylene that is used as the laminate accounts for about 30% of the film's weight and actually aids in the reprocessing. After initial setup to optimize for the waste material, pellets of uniform property can be produced by the recycler. But like all recycled material,there are limitations.Metalized film contains a small amount of aluminum that makes the pellets gray. Printed film will, depending on the amount and colors, further darken the pellets.This restricts the pellets to end-use application where brown or black is acceptable.

End-use products such as automotive underhood components are a good application,as are the fast-food trays mentioned previously. Such markets are also desirable because they represent a large and steady demand,a factor that is essential for long-term success of a recycling program.

In most cases,the end-use application is sourced through the recycler. So a successful waste-reduction program depends on finding financially stable recyclers who are likely to stay competitive in the business for the long term. This is easier said than done. In 1990, many companies tried their hand at recycling, such as the garage shops making plastic wood. Those companies were not financed adequately, nor did they have higher-value end-users as customers.When polypropylene prices declined,those operations went out of business.

When raw-material prices increased in 1994, the market for recycled materials also improved.But even in a good market,the scrap generator may only be able to command a few pennies per pound for this scrap.In a down market,the scrap generator may have to pay to get the material to the recycler, just as the task force did.Development of solid relationships with the recycler—and the end user, if possible—to accept a constant supply at agreed-upon prices during the good times also helps in not-so-good times.

When virgin prices are high or rising,there will be many opportunities to sell the waste material for prices much higher than to your regular recycler. The temptation is there, but those outlets disappear just as quickly as they appear when prices drop. The long-term relationship with well-run, well-financed, reputable recyclers cannot be emphasized enough.

## THE FUTURE

The task force began addressing its specific waste issue five years ago. Since that time, a tremendous team effort on the part of Frito-Lay employees and those of its suppliers has significantly reduced the amount of packaging waste going to landfills.Everyone involved with the task force has learned the difficulties in establishing and maintaining the business of recycling. Despite these difficulties, our experience shows that converters can adapt and include recycling as a normal part of their operations.

The future holds additional challenges. Having established a market for our packaging scrap, we must move forward and develop higher-value-added applications to cover more of the costs of recycling.More importantly, we must continue to demonstrate that the flexible-film industry can adapt to the changing marketplace without the need for government regulation or intervention. **TJ**

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