MOORE
RECYCLING ASSOCIATES INC.
Recycling Implementation Specialists

2013 National Postconsumer Plastic Bag & Film Recycling Report

Prepared by Moore Recycling Associates Inc. for the American Chemistry Council

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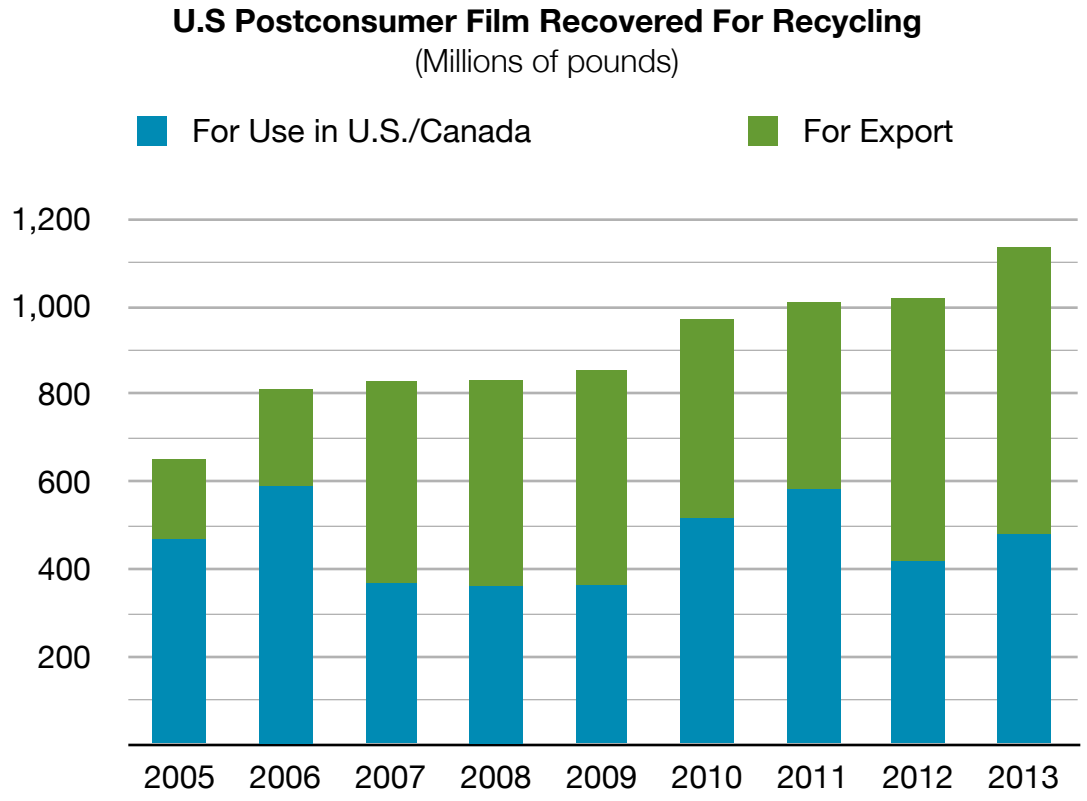
Introduction

This 2013 National Postconsumer[1] Plastic Bag and Film Recycling Report is the ninth annual report on the amount of plastic bags and film[2] recovered in the United States for recycling. Research was conducted and the report finalized by by Moore Recycling Associates Inc. for the Plastics Division of the American Chemistry Council (ACC).



[1] The Environmental Protection Agency (EPA) defines "postconsumer" as a material or finished product that has served its intended use and has been diverted or recovered from waste destined for disposal, having completed its life as a consumer item. According to this definition, a business qualifies as a consumer of those goods. The EPA's definition for "postconsumer" is used throughout this report. Commercial materials are often recovered outside of curbside or drop-off collection programs and include items such as pallets, crates, and other commercial packaging. (This report does not cover the recycling of *post-industrial* materials, which the EPA defines as materials, such as scrap and trimmings, that are generated in manufacturing and converting processes.)

[2] In this report plastic bags and film will generally be referred to as "film." Film is thin, flexible sheets of plastic. The majority of plastic films are made from polyethylene resins such as high density polyethylene (HDPE), low density polyethylene (LDPE), and linear low density polyethylene (LLDPE).

Executive Summary

A minimum of 1.14 billion pounds of postconsumer film (which includes plastic bags and packaging) was recovered for recycling in 2013, an increase of 74 percent since 2005. In 2013, more than half of the film recovered in the United States for recycling was sold to overseas markets. U.S. and Canadian processors recycled approximately 42 percent of the material, the remainder was exported. China's Green Fence, a policy strictly controlling the import of postconsumer scrap into China, had a dramatic effect on the demand for contaminated scrap film. The higher grades of film, which include clean polyethylene film, continued to see strong demand from both domestic and export buyers. The volume of higher grade recycled film increased by more than 190 million pounds in 2013 over 2012 levels, whereas lower grade volume decreased by nearly 77 million pounds over the same period. The result was an overall 11 percent increase over 2012 in postconsumer film recovered for recycling. Film recycling grew as a result of better reporting and increased collection in the commercial sector, which includes postconsumer bags and packaging returned to retail locations for recycling.

Commercial Clear Film continued to make up the largest category of film recovered for recycling with an estimated 516 million pounds. Mixed Film, the category that includes postconsumer bags and packaging recovered for recycling, remains the second largest category of film recovered for recycling at 248 million pounds. Growing by 80 million pounds, Commercial Mixed Color Film had the largest increase from 2012 to 2013 and is the third largest category of film at 236 million pounds (see page 4 for film category descriptions).

Most grades of scrap film saw a decrease in value in the first quarter of 2013. With the exception of Commercial Film nationwide and Mixed Film in the eastern region of the U.S., scrap film prices decreased following the implementation of the Green Fence. Curbside Film had little to no value after the first quarter of 2013 (see the **Discussion and Recommendations** section for more information about the Green Fence, Supply and Demand, and Collection and Quality).

To arrive at an accurate estimate of pounds of film recovered for recycling in 2013, Moore Recycling surveyed both domestic and export markets for postconsumer plastic. This report's findings are based on voluntarily reported data for the recovery of U.S.-sourced, postconsumer material. Moore Recycling received responses from 175 companies—predominantly from the U.S. and Canada—out of over 600 surveyed every year; 18 U.S. and Canadian plastic reclaimers[3] and 29 exporters contributed to the bags and film totals in this report.

[3] Moore Recycling surveys and counts material from reclaimers, defined as companies that wash postconsumer material or otherwise process unwashed material into a clean feedstock or end product.

Methodology

Data on recovered postconsumer plastic is collected during the Postconsumer Plastic Recycling Survey, which also gathers data on plastic bottles and non-bottle rigid plastics.

To prepare the report:

- Moore Recycling continually updates its markets database to include current exporters, reclaimers, and other handlers of plastic scrap;
- Moore conducts an electronic survey of market participants in plastic recycling to collect data (usually around March of each year); and
- Moore provides a verification step for survey-collected data, checking the accuracy of the data through follow-up calls, conversations with industry contacts, and reviews of other sources of recycling industry information.

Data Collection and Analysis

Moore Recycling continually updates an in-house database of plastic exporters, processors, reclaimers, and key brokers with the goal of having the survey reach all the key plastic scrap buyers.[4]

Moore Recycling uses a custom-designed, web-based survey system to gather data.[5] Although the overall methodology has not changed since the first report, Moore Recycling continually seeks ways to improve the completeness and timeliness of survey responses. For example, beginning in 2013, Moore asked responders to report film acquired in bale form separate from film acquired that had already been densified. These changes allow for better material flow tracking and assist with avoidance of double counting.

As an initial step of the survey, an email with a unique link and message is sent to each contact in Moore Recycling's database. After an appropriate amount of response time has passed, Moore Recycling staff send follow-up emails and make telephone calls to retrieve data. This follow-up process can take weeks or months depending on responses. Data are entered in the online survey tool, either directly by the company being surveyed, or by Moore Recycling staff when the survey is completed over the phone, by email, or fax. As it is received, the data are reviewed for accuracy and follow-up calls are made, as needed. After data collection is complete, the data are compiled and categorized based on the detail reported.

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[4] Through its project work in the industry and industry-supported web sites—PlasticsMarkets.org, RecycleMorePlastic.org and PlasticFilmRecycling.org—Moore Recycling regularly receives requests from new contacts for information on material and markets. Moore also identifies potential buyers through published market databases and conversations with suppliers, such as materials recovery facilities (MRFs) and key reclaimers.

[5] Moore Recycling conducts the survey and maintains confidentiality of individual responses; no individual company data are released, nor any specific data that does not have at least three companies reporting.

The final data totals are reviewed and analyzed, then provided in this report with as much detail as possible without compromising confidentiality. In order to determine trends and identify anomalies that may require further vetting of data, the analysis includes year-to-year comparisons of totals, material categories, and buying trends among export and domestic buyers. Clearly describing how the data are collected, and what is and is not included in the survey, provides readers of this report with the transparency they need to cross-reference results with other industry data.

Film Categories

The 2013 survey used the following material categories:

- Commercial Clear Film - Clear, clean PE (polyethylene) film, including stretch wrap and poly bags
- Commercial Mixed Color Film - Mixed color PE film, including stretch wrap; no postconsumer bags
- Mixed Film - Mixed color, clean PE film, including stretch wrap and retail collected postconsumer bags, sacks, and wraps
- Curbside Film - Mixed PE film generated at MRFs
- Dirty Ag Film - Film that has been in contact with the ground; up to 50% contamination, including mulch film
- Clean Ag Film - Dry film and in applications that do not involve contact with the ground; up to 10% contamination, including greenhouse film
- Other Film - A catchall for film that does not fit in any of the categories above; mostly non-PE films such as polyvinyl chloride (PVC) and polypropylene (PP), including boat wrap film

Data Gaps and Assumptions

This is a voluntary survey and the data reported are based on responses received. Many companies have limited resources to put towards participation in the survey and some companies may choose not to respond due to their confidentiality policies. Without 100 percent participation, the assumption is that the totals presented represent the minimum amount of plastic recovered for recycling and sold into the marketplace. Only data provided by North American reclaimers—predominantly U.S. and Canadian—and exporters selling directly overseas are included in the totals reported, unless it is determined that data is missing in areas where substantive information from other reliable resources is available. Data provided by brokers and material recovery facilities (MRFs) is primarily used as references to better understand the flow of material.

Many companies enter and leave the export market, which makes it difficult to survey all exporters. Moore Recycling tracks exporters handling plastic through a number of industry

resources, and most of the large exporters respond to the survey. Because this is a voluntary survey Moore Recycling sometimes receives new responders that are not new players, but those that did not participate in previous surveys. Increases year-over-year are often a combination of increased collection and material that was recycled in previous years, but not reported. Where possible, Moore Recycling reports such distinctions.

Often, Moore Recycling has to follow up with responders due to their inconsistent placement of data in survey categories. Follow-up is essential to determine an actual shift versus an entry error. Clarification is often needed to determine if material reported can be counted as post-commercial or is in fact post-industrial. Post-commercial material can be difficult to track since it is often purchased by companies also handling post-industrial scrap. The survey does not include industrial scrap recycled. A combined survey of industrial and postconsumer plastic could provide more accurate data collection and reporting.

Determining the amount of postconsumer bags recovered for recycling is not straightforward because bales containing bags are reported by reclaimers and exporters in the Mixed Film category. This is because most retailers combine bags with other film for transport to markets that can reclaim a mixture of polyethylene film. Moore Recycling estimates recovery of postconsumer bags and packaging by adding a percentage of the Mixed Film total to the total for Curbside Film. The percentage used is based on on-going bale audits (see more explanation of the postconsumer bags and packaging total on page 7).

Findings

Volume

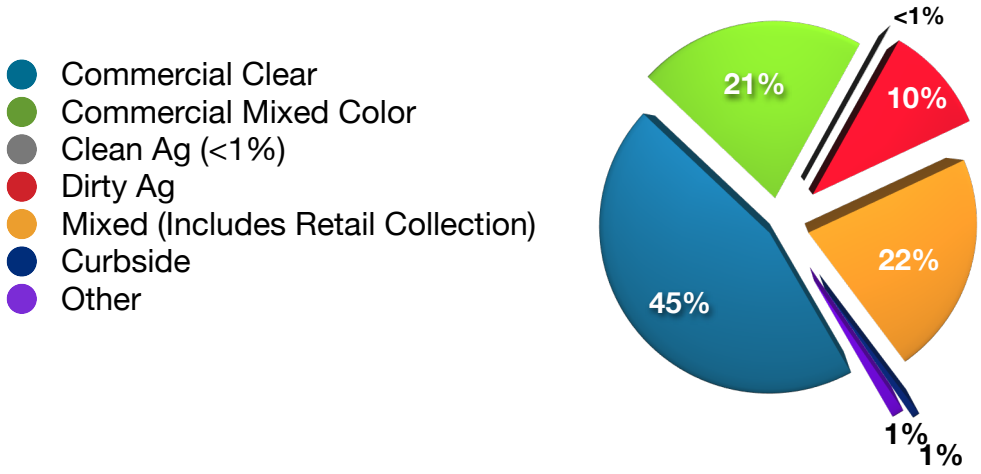
In 2013, the amount of plastic bags and film reported as recovered in the U.S. for domestic and overseas recycling was 1.14 billion pounds. Approximately 42 percent was reclaimed in the United States or Canada, and the remainder was exported overseas, primarily to China. The amount of material reported as recycled by domestic processors went up 15 percent over 2012. Because participation in the survey is voluntary, the data in the report do not reflect 100 percent of the film recovered for recycling. At least 5 reclaimers that may have recycled postconsumer film, and 10 exporters that responded previously, did not participate or report film in the 2013 survey.

U.S. Postconsumer Film Recovered for Recycling (pounds)

Year	Exported	Acquired for use in US or Canada	TOTAL
2005	183,701,000	468,776,000	652,477,000
2006	221,082,000	590,928,000	812,010,000
2007	462,611,000	367,569,000	830,180,000
2008	469,968,000	362,426,000	832,394,000
2009	490,718,000	363,659,000	854,377,000
2010	455,984,000	515,823,000	971,807,000
2011	426,738,000	583,023,000	1,009,761,000
2012	601,890,000	418,641,000	1,020,531,000
2013	656,347,000	479,710,000	1,136,057,000

Depending on how and where it is collected, recovered film may contain combinations of HDPE, LDPE, and LLDPE resins or it may be a single resin. For example, stretch film is either collected separately and marketed as Commercial Clear Film, or it may be mixed with other polyethylene film—including postconsumer bags and wraps—and marketed as Mixed Film. Stretch film represents a significant majority of the postconsumer film recovered.

2013 Percentage of Pounds Recovered Film by Category



Commercial Clear Film, Commercial Mixed Color Film, and Mixed Film recycling experienced growth in 2013. The growth was shared between domestic and export buyers. The remaining categories of recycled film saw decreases ranging from 12 to nearly 30 million pounds compared to 2012. This is most likely attributable to China's "Green Fence" effort, a program implemented in early in 2013, that strictly enforced regulations pertaining to the quality of imported postconsumer scrap (see the Discussion and Recommendations section for more information about the Green Fence). The largest drop was in Clean Ag Film. No domestic buyers reported purchasing Clean Ag Film in 2013 and export purchases dropped approximately 26 million pounds.

Another significant drop was in Curbside Film; the number of companies reporting and the amount reported both decreased in 2013.The pounds reported in Other Film included PVC and boat wrap. Both domestic and export buyers reported lower pounds of Other Film purchases compared to 2012.

2013 Pounds of Recovered Film by Category

Recovered Film Category	Pounds Recovered in 2013	Change Over 2012
Commercial Clear	515,839,000	10%
Commercial Mixed Color	236,555,000	51%
Clean Ag	500,000	-98%
Dirty Ag	113,561,000	-11%
Mixed (incl. retail)	247,574,000	37%
Curbside	8,254,000	-71%
Other	13,775,000	-47%

Determining Total Postconsumer Bags and Packaging

Plastic bags are commonly commingled with stretch film wrap and other retailer-generated scrap film for efficient collection at retail locations; therefore "bag only" bales are rare. Thus, as indicated in the **Data Gaps and Assumptions** section, to determine the total amount of recovered postconsumer bags and packaging, this study adds a specific percentage of the Mixed Film bale to all of the Curbside Film.

Since the 2012 Report,[6] an on-going private national bale audit in the retail sector provides the percentage of bags in Mixed Film bales. Retail bags (grocery or carryout) make up approximately 20-25 percent of these bales, consumer-returned packaging wrap and other bags about 35 percent, and stretch wrap accounts for most of the remainder.

The bale audit study[7] is ongoing; it is being conducted by members of the Flexible Film Recycling Group (FFRG), which represents more than half of the domestic processing capacity for postconsumer film. The 2012 National Postconsumer Plastic Bag & Film Recycling Report, used 62 percent as the bag-and-wrap portion of Mixed Film bales. Based on the findings of the bale audit study, this report assumes 57 percent of Mixed Film bales are bags and wraps. Given the historical variability in percentages, the estimate of consumer-returned bags and wraps recovered

[6] Prior to the 2012 Report, Moore Recycling used an average of the percentages of bags in Mixed Film bales reported by reclaimers.

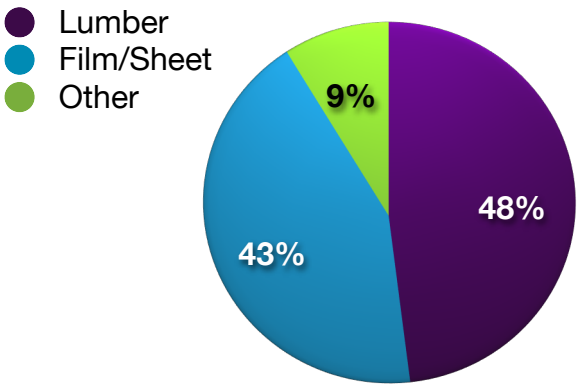
[7] The bale audit study is conducted to assess the impacts of specific signage and education at the retail level on the quality and volume of recovered film. The FFRG will publish bale audit data when the study including the retail sector is complete in 2015.

for recycling is rough and also conservative. Using available data, Moore estimates that 149 million pounds of postconsumer bags and wraps were recovered for recycling, which is an increase of 6 percent over the previous year.

U.S. Capacity and End Markets

In the U.S. there is approximately 800 million pounds per year of plastic film reclamation capacity,[8] which includes washing or processing unwashed material directly into regrind, pellets, or end products. The utilization rate[9] was approximately 59 percent in 2013, which is up nearly 10 percent from 2012.

Reclaimed U.S Postconsumer Film: 2013 End Uses



Most of the U.S. film processing capacity is for Commercial Film. End uses for this clean, clear polyethylene are varied, and there are fewer processing obstacles, such as resin sorting and contamination, compared to other film categories. The primary domestic end uses for all plastic film are composite lumber, film and sheet, pipe, automotive products, lawn and garden products, crates, buckets, and pallets.

Of the U.S. and Canadian recycled material, composite lumber manufacturers recycled 48 percent, purchasing 25 percent more than they did in 2012. The film and sheet market used 43 percent compared to 21 percent in 2012 for a total of 196 million pounds. This increase in material sold into the film and sheet market represents new data rather than a true increase, given that in previous years, the end uses of some reclaimers were unknown. If the end use is not reported, Moore Recycling groups material into the "Other" end use category, which was the case for about 100 million pounds in 2012.[10] Therefore, as reported, the film and sheet market actually used

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[8] Capacity for processing postconsumer film often overlaps with capacity to process post-industrial film and in some cases bottles and non-bottle rigid plastics. The annual United States National Postconsumer Plastic Bottle Recycling Report and the annual National Postconsumer Non-bottle Rigid Plastic Recycling Report likely report some capacity that is also reported here. Thus, adding the non-bottle rigid, bottle and film capacities from this report and the others could result in some double counting.

[9] Utilization, or the rate at which potential production levels are being met, can be determined by dividing the total pounds reported as acquired for recycling by the estimated capacity.

[10] To protect the confidentiality of respondents, only end uses reported by more than 3 companies are listed.

about the same amount of postconsumer film in 2013 as in 2012, but because Moore received more information on the end uses, the percentages reported show a large increase in 2013.

The survey asked responders to make a historical characterization of supply and demand in 2013 as compared to previous years. While demand for Commercial Film remained fairly steady, several domestic buyers reported an increase in available supply after the Green Fence was implemented (discussed in more depth below). Many buyers observed significant volumes of Curbside Film in the market with little demand.

Note: *The remaining sections of this Report present Discussion and Recommendations reflecting Moore Recycling's expertise and industry knowledge.*

Discussion and Recommendations

Green Fence

In February 2013, China's government began an effort to control all postconsumer scrap imports in an initiative known as the "Green Fence." During the first half of the year, nearly all scrap containers imported into China were opened and inspected, and spot inspections continued throughout the year. Chinese custom officials continue to impose very tight contamination standards.

The Green Fence increased the difficulty of exporting certain grades of postconsumer film, mostly the lower grades. This resulted in a shift from some export demand to very limited markets for lower grades of film, resulting in a change in collection strategies that rewarded suppliers with better-quality material. One example of how collection strategies changed in 2013 compared to previous years is that commercial and postconsumer materials were generally separated when the material was destined for the export market. These shifts may also lead to the discontinuation of collection programs where handlers are unwilling or unable to improve quality. These Green Fence restrictions could create opportunities for market development in the U.S., but collection of good-quality material must continue and postconsumer resin must be more attractive than virgin resin.

Supply and Demand

The difficulty in exporting curbside film to China had a significant impact on the total Curbside Film reported for recycling in 2013. U.S. supply of Curbside Film outpaced demand, likely resulting in material used for energy recovery, or in some cases landfilled in 2013. Moving forward, demand sufficient to absorb the potential volume of Curbside Film, will likely require significant investment, including research and development into new end products. Technology may exist to handle the contaminated film, but many question whether it is cost effective, both at the MRF and the reclaimer level

Curbside Film will continue to be generated; even if carryout bags were to become obsolete, MRFs will continue to receive plastic film wrap and other bags. Plastic wrap and film packaging beyond bags exists in the majority of households and businesses. An important part of

increasing the usable supply of postconsumer plastic film packaging is education at the consumer, community, retail, and brand company levels. A multi-faceted approach is required. Providing more education and incentives to consumers could increase the recycling of bags and wrap through retail. Education could be provided on the package, in the store, or by communities that are trying to reduce the impact of bags in their MRFs. Regardless, some amount of dirty film material or mixed resin film material will exist and solutions are needed to capture this resource.

The commercial sector generates more than twice as much film as the residential sector, and film use is growing as businesses strive to reduce product loss and improve their carbon footprint. Fortunately, new recycling programs are emerging and recycling access for small and midsize businesses is slowly expanding.[11] There is strong demand for the higher grades of commercial film, especially from those sourcing scrap film for use in new film applications.

Quality and Collection

Commercial Film

Many large chain stores have collected film and bags for over two decades because they derive revenue from the scrap material, avoid disposal costs, and garner community goodwill. The scrap value for Mixed Film has been strong enough that some retail businesses accept film and bags from smaller, neighboring businesses (as well as their own customers). This business-to-business (B2B) model can be found in a number of locations but is by no means widespread. Large retailers have efficient reverse logistics, for example, as their trucks return to distribution centers, they backhaul scrap film, cardboard, and other materials. However, collection is less common among small to medium businesses, as not all areas have efficient collection options available.

Commercial Film collection methods include:

1. Co-collection with cardboard, most commonly by private haulers;
2. Drop off at a recycling center;
3. Utilizing existing reverse logistics:
    a. Business-to-business: small neighboring businesses utilize larger retailer's recovery program;
    b. Backhaul of film after delivery of product by wholesale distributor (some distributors offer their small businesses an after-delivery recycling service, accepting scrap material as they return to their distribution centers); and
4. Vocational centers provide a consolidation option as well as collection in some regions.

[11] Moore Recycling,through funding from the ACC, provides technical assistance to businesses and communities interested in establishing new plastic recycling programs. The Flexible Film Recycling Group also supported several commercial pilot projects in 2013. For more information visit, http://plastics.americanchemistry.com/Product-Groups-and-Stats/FFRG.

Due in part to the work by groups like the Flexible Film Recycling Group over the last few years, there is more access than before to recycling for small to medium-sized businesses. However, because recyclable film exists in nearly every business, much greater access is needed to allow even more businesses to contribute to the growth in film recovery. Tips sheets for collecting quality material are available at http://www.PlasticFilmRecycling.org.

Postconsumer Film (Bags and Plastic Film Packaging)

Most consumer film packaging and bag collection programs in the United States are facilitated through drop-off sites at major grocery and retail stores. There are currently more than 18,000 of these locations in operation across the country. These programs help to keep collected material clean and away from potential contaminants until it can be baled and sold. Though curbside collection is the easiest option for residents, the presence of bags and other film materials in a MRF can wrap around sorting equipment, decreases processing efficiency for other recyclables and adds cost, especially for facilities that rely on rotating screens to separate containers from fiber. Historically, Curbside Film has held just a fraction of the scrap value of retail-collected bags and film, which is mostly free of contaminants. Furthermore, retail-collected material often has an extremely efficient path from collection to reclamation. Catching a ride with other materials that get hauled back to distribution centers for baling and shipping cuts out transportation and handling costs incurred in municipal collection programs. With more retailers using the Wrap Recycling Action Program (WRAP) signage,[12] the amount of usable postconsumer bags and wraps is expected to increase.

There are two primary types of contamination. The first type of contamination comes from general residue. It occurs where collection practices fail to keep the material clean and dry. Improved education and best practices address this first type of contamination, whereas the other type of contamination comes from non-polyethylene resin. Most current end users are seeking polyethylene postconsumer resin with a specific properties; therefore, non-polyethylene film can create problems for the majority of end users. When reclaimers are unaware in changes in packaging, they have no ability to adjust their operations to meet the needs of their buyers. Greater communication between packaging designers and reclaimers reduces the risk of this type of contamination.

[12] Free signage and other educational material are available at PlasticFilmRecycling.org

One driver of increased interest in recyclability from brand companies is the How2Recycle label, which is now on the packages of more than 12 major brands, including retailers' private-label products.

The Association of Postconsumer Plastic Recyclers, GreenBlue's Sustainable Packaging Coalition and the American Chemistry Council's Flexible Film Recycling Group are supporting design for recyclability through the development of design guidelines and use of the How2Recycle label (shown at left). Packaging designed for recyclability and a robust demand for postconsumer resin are two critical elements of a sustainable plastic recycling industry.

As the packaging landscape continues to evolve, greater challenges will emerge for recyclers. For example, products that were once packaged in rigid plastic containers are moving into plastic pouches, which are typically made using multi-layered films. This move towards pouches is in response to the growing demand for packaging that allows companies to reduce their carbon footprint. More coordination between recyclers and producers could ensure the continued recyclability of most film packaging products and perhaps improve the recyclability of pouches. Further, if packaging companies reaped some reward for the recyclability of their product or the availability of recycled content resin, that might result in a design feedback loop, or a mechanism in which producers realize the positive or negative impact of their product in the system.

Additional Information

The Plastics Division of the American Chemistry Council, which provided funding to Moore Recycling Associates to prepare this report, provides resources to assist communities, businesses and consumers in increasing awareness and education on the recycling of plastic bottles, containers, bags, and film. Moore Recycling is a recognized expert in the field of plastics recycling and has been conducting recycling studies for over 25 years. This work has been conducted and evaluated in an objective manner by persons qualified to do so, using procedures generally accepted in the profession to yield accurate and reliable results. For information about recycling plastic bags and film, visit www.PlasticFilmRecycling.org. Also, visit www.PlasticsMarkets.org, maintained by Moore Recycling Associates, for additional markets and information on handling guidelines. This report and others on plastic recycling can be found at www.MooreRecycling.com.

Disclaimer

The 2013 National Report on Postconsumer Plastic Bag and Film Recycling has been prepared to provide information to parties interested in the recycling of plastics, in particular plastic bags and film. Facilities developing a recycling process and all entities involved in the chain of collection, processing, distribution, and sale of recycled products have an independent obligation to ascertain that their plans, actions, and practices meet all relevant laws and represent sound business practices for their particular operations. Facilities may vary their approach with respect to particular operations, products, or locations based on specific factual circumstances, the practicality and effectiveness of particular actions and economic and technological feasibilities. This report is not designed or intended to define or create legal rights or obligations. ACC does not make any warranty or representation, either express or implied, with respect to the accuracy or completeness of the information contained in this report; nor does ACC assume any liability of any kind whatsoever resulting from the use of or reliance upon any information, conclusion, or options contained herein. The American Chemistry Council sponsored this report.