MOORE
RECYCLING ASSOCIATES INC.
Recycling Implementation Specialists

2013 National Postconsumer Non-Bottle Rigid Plastic Recycling Report

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

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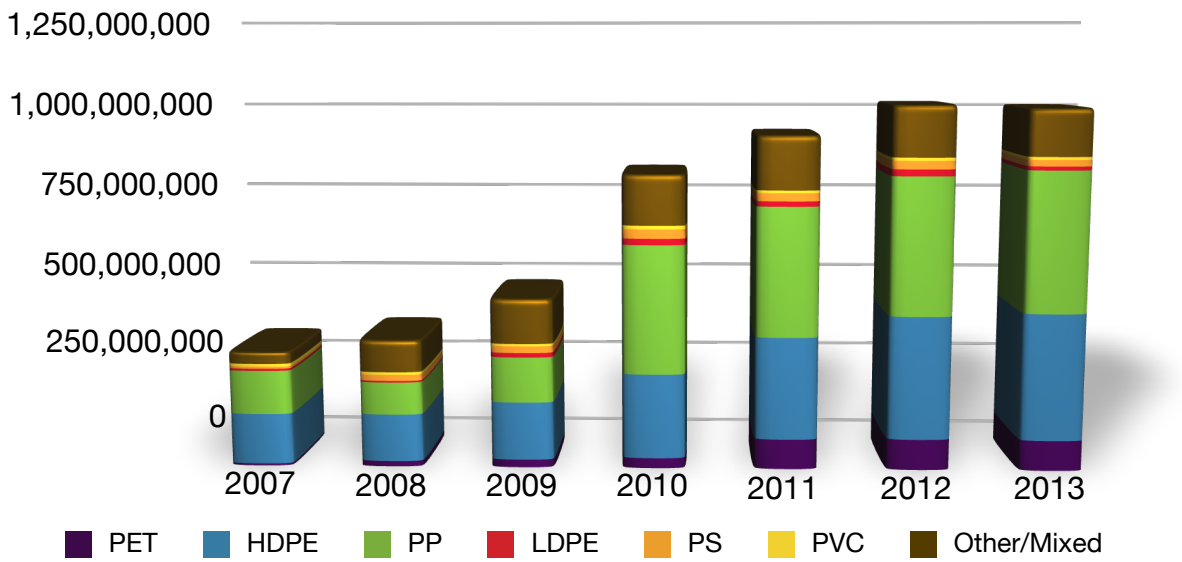
Introduction

The 2013 National Report on Postconsumer Non-Bottle Rigid Plastic Recycling is the seventh annual report on pounds of postconsumer non-bottle rigid plastics—packaging and non-packaging—recovered for recycling in the United States. Research for this report was conducted by Moore Recycling Associates Inc. for the Plastics Division of the American Chemistry Council.

Executive Summary

A minimum of 1.007 billion pounds of postconsumer non-bottle rigid plastic was reported as recovered for recycling in 2013, a decrease of 1% compared to 2012, but an overall increase of 210% since 2007. The slight year-over-year decrease 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. Implementation of the program resulted in significantly reduced recycled plastic exports from North America and Europe, and increased volatility in scrap pricing.[1] Specifically, the Green Fence resulted in a substantial shift in where material was sold: domestic purchases increased by 17% and export purchases dropped by 25%.[2] U.S. and Canadian reclaimers procured 67% of non-bottle rigid plastic scrap. Domestic plastic scrap procurement is up from fifty-seven percent in 2012.

U.S. Non-Bottle Rigid Plastic Recovered Year over Year by Resin[3] (pounds)



Although the Green Fence caused a temporary drop in postconsumer non-bottle rigid plastic recycling in 2013, it led to increased domestic processing and a focus on quality, benefiting

[1] Dramatic fall in China's plastic scrap imports." *Recycling International*. July 18, 2014

[2] Harler, Curt. "Fencing plastics in or out?" *Recycling Today*. July 9, 2014

[3] PET - polyethylene terephthalate, HDPE - high-density polyethylene, PP - polypropylene, LDPE - low-density polyethylene, PS - polystyrene, PVC - polyvinyl chloride

plastics recycling over the longer term. Recycling of other commodities, notably mixed paper, were also impacted by the Green Fence.

To arrive at an accurate estimate of pounds of non-bottle rigid plastic recovered for recycling in 2013, Moore Recycling surveyed both domestic and export markets for postconsumer[4] 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, out of over 600 surveyed: 27 U.S. and Canadian plastic reclaimers[5] and 24 exporters contributed to the non-bottle rigid totals in this report. The 2013 results are representative of reporting from three additional reclaimers and nine fewer exporters than in 2012. There are also over 30 U.S. and Canadian PET reclaimers that respond to a separate survey specific to PET bottle reclaimers, which contributes to the non-bottle rigid PET results in this report.

Methodology

Data on recovered postconsumer non-bottle rigid plastic is collected during a voluntary, annual postconsumer plastic recycling survey, which also gathers data on plastic bottles and film. For this report, the survey gathers data on both mixed rigid plastic and non-bottle material segregated by resin. The latter is often, but not exclusively, postconsumer commercial material. Commercial material includes products such as packaging for transport—pallets, crates and totes—and material, such as battery casings, collected through special programs.

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; 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 public sources of recycling industry information.

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[4] 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. This study uses EPA's definition; throughout this report "postconsumer" refers to plastics that have been used for their intended purpose by consumers and by businesses. Commercial materials are often recovered outside of curbside or drop-off collection programs and include items such as totes, 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.)

[5] 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.

Markets Database

Moore Recycling continually updates a proprietary database[6] of plastic exporters, processors, reclaimers and key brokers to ensure that the survey reaches all the key plastic scrap buyers from North America.

Data Collection and Analysis[7]

Moore Recycling uses a custom-designed web-based survey system to gather data. Although the overall methodology has not changed since the first report, Moore Recycling continually seeks ways to improve the completeness and timeliness of the survey responses. For example, beginning in 2013, Moore Recycling asked responders to separately report rigid plastic categories segregated by resin, depending on whether it was acquired in bale form versus already ground into flake. This change allows for better material flow tracking and helps to avoid double counting. Moore Recycling also updated the names for many of the mixed rigid plastic categories to reflect bale specifications released by the Association of Postconsumer Plastic Recyclers (APR) bale terminology.[8]

An email with a unique link and message is sent to each contact. After an adequate amount of response time has passed, Moore Recycling staff sends follow-up emails and makes telephone calls to retrieve data. This follow-up process can take weeks or months, depending on responses. Data is entered into the online survey tool, either directly by the company surveyed, or by Moore Recycling staff. As it is received, the data is reviewed for accuracy and follow-up calls are made, as needed. After data collection is complete, Moore Recycling compiles the data and categorizes it based on the detail reported.

The final data totals are reviewed and analyzed, then reported with as much detail as possible without compromising the participating companies' 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. Describing how the data is collected, as well as what is and is not included in the survey, provides readers of this report with the context necessary to cross-reference the results with other available industry data.

Survey Categories

To collect data on non-bottle rigid plastic, Moore Recycling asked for mixed rigid plastic categories, as well as categories segregated by resin and product type. All the mixed rigid plastic

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[6] Through Moore Recycling's project work in the industry and its 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 material recovery facilities (MRFs) and key reclaimers.

[7] Moore Recycling conducts the survey and maintains confidentiality of individual responses.

[8] Bale specifications released by APR utilize the "Terms and Tools," found at http://www.recycleyourplastics.org/recycling-professionals/education/terms-tools-app/.

bale categories contain some non-bottle material. The categories may be a mixture of resins, or some combination of bottles, containers, bulky items and other non-bottle rigid plastic. Most are a combination of both resin and product type. Although some of these categories include bottles, the non-bottle rigid plastic portion[9] of the mixed rigid bales reported in the survey is calculated for this report by applying content percentages of resin from the 2011 mixed rigid bale composition study.[10]

The 2013 survey included the following mixed rigid plastic bales that are generated from curbside or drop-off collection:

- All Rigid Plastic: No Bulky (mixed bottles and containers) - All bottles, all household non-bottle containers (includes thermoform packaging, cups, trays, clamshells, food tubs), with no bulky items.
- All Rigid Plastic: With Bulky - All bottles, all household non-bottle containers (includes thermoform packaging, cups, trays, clamshells, food tubs), and all bulky rigid plastic (includes carts, crates, buckets, baskets, toys, lawn furniture).
- Pre-picked Rigid Plastic: No Bulky (bottles and containers with PET & HDPE bottles removed, primarily non-bottle containers) - All household non-bottle containers (includes thermoform packaging, cups, trays, clamshells, food tubs), with very few bottles and no bulky items.
- Pre-picked Rigid Plastic: With Bulky (all rigid plastic with PET & HDPE bottles removed) - All household non-bottle containers (includes thermoform packaging, cups, trays, clamshells, food tubs), all bulky rigid plastic (includes carts, crates, buckets, baskets, toys, lawn furniture) with very few bottles.
- Bulky Rigid Plastic - All bulky rigid plastic (includes carts, crates, buckets, baskets, toys, lawn furniture), and no bottles or containers.
- Tubs & Lids - Non-bottle household containers, including buckets, predominantly PP and PE, with no bulky items.
- PE/PP Bottles, Containers & Bulky (Olefin) - Primarily polyethylene and polypropylene bottles, non-bottle containers and bulky items (includes carts, crates, buckets, lawn furniture).
- PP Bale - Primarily polypropylene bottles, non-bottle containers and bulky items (bulky as described above).
- HDPE Colored Bottles with PP/PE containers - Primarily HDPE bottles, may contain some HDPE or PP household containers, no bulky items.

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[9] Only the plastic portions of the mixed rigid bales are included in the volume; the waste is removed, unlike gross volumes used for most other recycled commodities.

[10] *National Mixed Rigid Plastic Bale Composition Study & Analysis of Non-Bottle Rigid Plastic Available for Recycling*, Association of Postconsumer Plastic Recyclers (APR), 2011

- Mixed Resin Clamshell Bale[11] - A mixture of PP, PET, PS, PVC clamshell-type containers.
- Other Mixed Rigid Plastic - A "catch-all" category, defined on a case-by-case basis.

Moore Recycling also asks for data in these categories:

- Post-Commercial Mixed Rigid Plastic - A "catch-all" category for mixed resin rigid plastic that is generated from businesses, defined on a case-by-case basis
- Mixed Electronic Scrap - Primarily high impact polystyrene (HIPS), acrylonitrile butadiene styrene (ABS), polycarbonate (PC)
- Categories for Non-Bottle Rigid Plastic Segregated By Resin - A list of recovered products that are generated as segregated commodities or have been sorted into segregated categories and then sold. The list is based on categories respondents have offered in previous surveys (e.g., PET thermoforms, HDPE injection (drums-buckets-crates), PP hangers, PVC Flooring, PC CDs). Moore Recycling also provide an "other" category for PET, HDPE, PP, PS, PVC, ABS, and PC.
- Other Rigid Plastic - A "catch" all category for non-bottle rigid plastic segregated by resin, but other than the specific categories listed above

The APR and the National Association for PET Container Resources (NAPCOR) conduct a separate, but similar survey of domestic PET reclaimers. Moore Recycling does not survey these reclaimers and receives the following domestic non-bottle rigid plastic data from APR/NAPCOR: strapping, thermoforms—both from PET bottle bales and purchased separately—and cap and label material from the PET bottle reclamation process.

Data Gaps & Assumptions

The survey is a voluntary effort and the data reported is 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 confidentiality policies. Therefore, as there is not 100% participation, the totals presented represent the minimum amount of plastic recovered for recycling and sold into the marketplace. Only data provided by North American reclaimers and exporters selling directly overseas are included in the totals reported, unless it is determined that data are missing in areas where substantive information from other reliable resources is available. Data provided by brokers and MRFs are primarily used as reference to better understand the flow of material, but Moore Recycling may include their data if enough information is provided that would enable us to attribute material sold to a non-responder.

Except for the largest exporters, players in the export market come and go, and may frequently change the materials purchased. This can make the export market difficult to track. Moore Recycling tracks exporters handling plastic through a number of industry resources and most of the large exporters respond to the survey.

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[11] Bale composition data is not available for the Mixed Resin Clamshell Bale. In this study, volumes reported under this category are designated "Other/Mixed" resin.

Based on separately available industry statistics for lead-acid battery and e-scrap recycling, it is likely that Moore Recycling did not receive survey responses from key players in this sector and the total reported is less than the actual amount of plastic recycled from these two key recycling efforts. Unless Moore Recycling can improve the response rate, an alternate methodology is needed in these two areas to better represent the total plastic recycled form these programs.

Since the survey is a voluntary effort, Moore Recycling sometimes receives responses from existing companies that did not previously respond. Increases in year-over-year recovery rates are often a combination of increased collection along with material that was recycled in previous years but not reported. When Moore Recycling can conclude the nature of an increase (or decrease), the reasoning is indicated; although, it can be difficult to make a solid determination in any given year, depending on the depth of information Moore Recycling receive from plastic handling companies for previous years and taking into account confidentiality concerns.

Often, Moore Recycling must follow up with responders due to inconsistent placement of data in survey categories. Quality control is essential to determine if there has been an actual shift or just an entry error. Clarification is often needed to determine if material reported can be counted as postconsumer commercial or is in fact industrial scrap. Mixed rigid bale commodities often require follow up and a data quality check due to the inconsistent terminology used in the marketplace to describe these commodities.

Postconsumer commercial material can be difficult to track since it is often purchased by companies also handling industrial scrap. The survey does not include industrial scrap. In Moore Recycling's opinion, including industrial plastic scrap could have a very positive impact on identifying more postconsumer material, because many commercial scrap recyclers do not realize that much of what they handle is considered postconsumer—that is, it has met its intended use. An industrial survey could also document that a considerable amount of industrial scrap plastic is recovered for recycling.

To characterize the mixed rigid bale data, Moore Recycling applies the bale composition results from the 2011 Association of Postconsumer Plastic Recyclers (APR) report, *National Mixed Rigid Plastic Bale Composition Study & Analysis of Non-Bottle Rigid Plastic Available for Recycling*. Because the packaging material mix has evolved since 2011, some of our assumptions on resin-split and the percentage of waste are likely dated. A new mixed rigid bale analysis is underway and is expected to be completed in early 2015.

Background on Collection

Non-bottle rigid plastic continues to be captured in a variety of ways. Material is generated by residents and businesses and is collected in combination with other plastic and recyclables, or through material-specific recycling efforts.

Collection of Mixed Plastic

Programs collecting mixed plastic vary widely—both curbside and drop-off—depending on which materials are accepted and how material recovery facilities (MRFs) segregate and market their materials. Once mixed plastic is collected, MRFs generate non-bottle rigid plastic bales in a wide range of types and quality, in part because of the many possible combinations of items and resins in this broad category, and in part because community programs vary widely in terms of the level of consumer education and which non-bottle rigid plastics they accept for recycling. Most municipalities that collect non-bottle rigid plastics accept household containers, and a growing number are adding bulky rigid plastics, such as lawn furniture, laundry baskets, buckets and other items.[12]

A partial list of community recycling programs that expanded plastic recycling beyond bottles in 2013 and 2014:
Berkeley CA, New York NY, Las Vegas NV, Kingsport TN, Biddeford ME, Charleston WV, Minneapolis MN, Evansville IN, Tampa FL, Salem MA, Milwaukee WI, Rhode Island, Austin TX, Boston MA, Manchester CT

In 2013, the most common non-bottle rigid bale sorted at MRFs was the Pre-picked bale,[13] in which the higher value PET and HDPE bottles are sorted out and the remaining rigid plastics are baled together. While not as common, some small MRFs mixed all rigid plastic together. Still others tailored their sorting operations to meet domestic or local market specifications. Mixed plastic bales are sold to a buyer—an exporter, reclaimer, or Plastic Recovery Facility[14] (PRF)—that further sort the plastic into specific categories to meet their needs or for resale.

Material Specific Collection Efforts

Material-specific collection efforts are often ongoing programs at drop-off locations, or they may be special events or programs to collect specific plastic materials. Material specific collection also includes consolidation of large quantities of products (e.g., transport packaging and containers) coming out of the commercial sector.

Special programs exist to collect items such as battery casings, e-scrap or bulky rigid plastic. For example, many cities do not allow electronic products or other specified scrap to be placed in the garbage, provide designated drop-off locations for the recycling of those items. According to the Battery Council, most states require that lead-acid automobile batteries be recycled and not disposed of in a landfill; lead-acid plastic battery casings make up a significant part of the non-bottle polypropylene recycled every year.

Some consumer product manufacturers—often with support from their package manufacturers—have created community programs to recycle their own products or to collect

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[12] *Plastic Recycling Collection National Reach Study: 2012 Update*

[13] Pre-picked model bale specification can be found on the APR website: http://www.plasticsrecycling.org/images/pdf/PE_PP_Resins/For-MRFS-Reclaimers/Prepicked_APR_bale_specs.pdf

[14] These are facilities that act as a secondary processing facility for mixed plastic from MRFs.

specific resins and avoid contamination from the curbside stream. These are typically mail-back or drop-off programs. Companies conduct these programs at their own expense as corporate responsibility initiatives and for the supply of raw material.

Many businesses generate large quantities of a single plastic resin or product type, as a byproduct of their primary business, which they consolidate for recycling. Transport and shipping containers (e.g., crates for produce) or hangers originating from large retailers are plastic products meeting their intended use and businesses are the consumers. Reclaimers that specialize in processing industrial plastic scrap frequently accept commercial plastic, which is a subset of postconsumer material, because it tends to be cleaner than plastic scrap coming from a curbside stream.

Findings

Volume

In 2013, the amount of non-bottle rigid plastic reported as recovered in the U.S. for domestic and overseas recycling exceeded 1 billion pounds, an increase of 210% since 2007. Approximately 67% of this 1.007 billion pounds was reclaimed in the U.S. or Canada in 2013—the highest percentage since the inception of this report in 2007—the remainder was exported overseas, primarily to China. As noted previously, because participation in the survey is voluntary, the data in the report does not reflect 100% of the non-bottle rigid plastic acquired for recycling.

U.S. Postconsumer Non-Bottle Rigid Plastic Recovered (pounds)

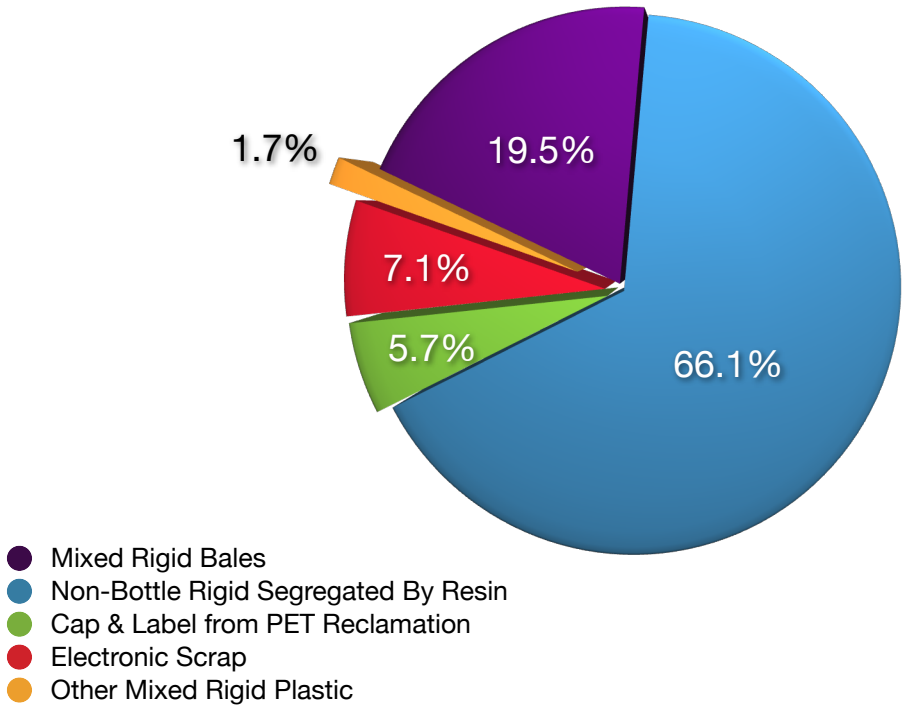
Year	Exported	Purchased for use in US or Canada		Total
		volume	percent	
2007	204,040,000	121,400,000	37.00%	325,440,000
2008	137,132,799	223,642,898	62.00%	360,775,697
2009	236,104,896	243,115,190	51.00%	479,220,086
2010	350,869,617	475,783,142	58.00%	826,652,759
2011	361,527,178	572,400,066	61.00%	933,927,245
2012	437,207,078	579,451,344	57.00%	1,016,658,422
2013	328,973,883	678,737,754	67.00%	1,007,711,637

The change since 2012 in non-bottle rigid plastic recovered represents a drop of just under 9 million pounds, which is less than one percent. Interestingly, there was a substantial shift in where material was sold: domestic purchases increased by 17% and export purchases dropped by 25%. These changes in recovered volume and destination were likely due to China's Green Fence effort.[15] The impacts of the Green Fence are looked at further in the Discussion section of this report.

[15] "Dramatic fall in China's plastic scrap imports." *Recycling International*. July 18, 2014 and Harler, Curt. "Fencing plastics in or out?" *Recycling Today*. July 9, 2014

Purchases of U.S. Recovered Non-Bottle Rigid Plastic (pounds)

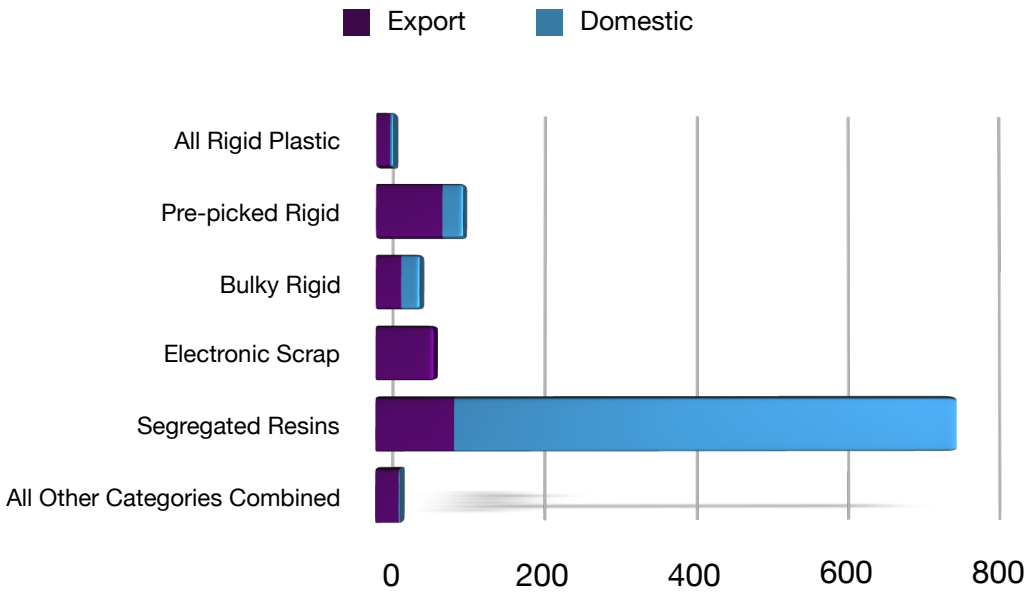
Sources of U.S. Non-Bottle Rigid Plastic, 2013[16]



[16] Broken out by the survey categories reported. These categories are the data source for the non-bottle plastic.

Material reported as segregated resins (e.g., HDPE injection: drums, buckets, crates; PP Battery Casings; PET Thermoforms) made up 66.1% of the total material reported as recycled, an increase of 7% over 2012. The non-bottle rigid plastic portion of Mixed Rigid Bales, predominantly from municipal programs, made up 19.5% of the volume reported (a drop of 6.5%). As noted, the majority (57%) of the mixed rigid plastic bales reported as purchased in 2013 were Pre-picked Rigid bales (with and without bulky); the next largest category of mixed rigid plastic was Bulky Rigid bales (23% by weight).

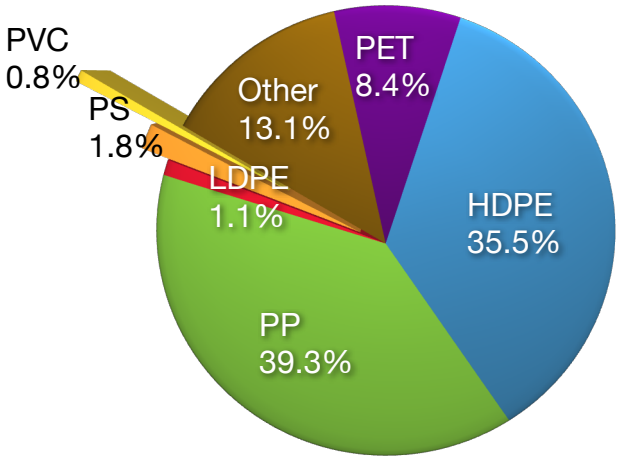
U.S. Non-Bottle Rigid Plastic Recovered by Source (millions of pounds)



In 2013, 87%—625.8 million pounds—of the resin-segregated plastic was reclaimed in the U.S. or Canada. Eighty-one percent of non-bottle rigid plastic as part of mixed rigid bales was exported offshore, primarily to China. The percentage of non-bottle rigid in mixed rigid bales going export is based on purchases reported by export buyers (as opposed to bale sales by MRFs). The growing number of PRFs in North America indicates that a growing percentage of mixed rigid bales generated by MRFs are sold to domestic buyers, then further sorted (and reported in the survey) as segregated resins. For the first time since the inception of this report in 2007—over half (54% vs 39% in 2012) of mixed resin rigid bales were sold to domestic buyers. As the chart shows, once the material has been sorted into segregated resins at PRFs, it is very likely to stay domestic, because most of the existing reclamation capacity in the U.S. is for resin-segragated materials.

U.S. Postconsumer Non-Bottle Rigid Plastic Recovered in 2013 by Resin

RESIN	POUNDS
PET	85,030,970
HDPE	357,379,363
PP	396,451,139
LDPE	10,908,104
PS	17,678,224
PVC	8,200,790
Other Mixed/ Unknown[15]	132,063,048



As in previous years, polypropylene was the largest proportion of the non-bottle rigid plastic recycled, with HDPE following closely. PP and HDPE together make up the majority of the non-bottle rigid plastic in mixed rigid bales, and the majority of reported segregated resin material. HDPE and PP showed modest increases in 2013 compared to 2012. All other resin categories decreased from 2012 to 2013.

Domestic Capacity and End Markets

Based on survey responses, there is at least 803 million pounds[18] per year of non-bottle rigid plastic reclamation capacity in the U.S., which includes washing or processing unwashed material directly into regrind, pellets, or end products. Compared to 2012, eight additional reclaimers with capacity were identified and three reclaimers stopped processing postconsumer non-bottle rigid plastic in 2013. Given the existing capacity, it is possible that the reclaimers that ceased handling postconsumer scrap could shift their current post-industrial capacity back to postconsumer in coming years. There is also an additional 200 million pounds of non-bottle reclamation capacity in Canada that draws on U.S. and Canadian material. It is important to acknowledge that there is significant grind capacity, in both the U.S. and Canada, for plastic scrap that is clean enough to be

[17] The "Other" resin category includes three sources. The first is material reported as "Other Mixed Rigid Plastic" or "Post-Commercial Mixed Rigid Plastic," without further information provided on the specific mix of resins. The second source is material reported as a resin other than the six primary postconsumer resins (PET, HDPE, PVC, LDPE, PP, PS), such as polycarbonate or ABS. The third source is the percentage of mixed bales allocated as "other" during the APR-sponsored hand-separated bale sorts. Some are other resins than those identified as #1-6 Resin Identification Codes, and others were unidentifiable.

[18] Capacity for processing non-bottle rigid plastic often overlaps with capacity to process plastic bottles or film. The annual *United States National Postconsumer Plastics Bottle Recycling Report* and the annual *National Postconsumer Plastic Bag & Film 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.

used unwashed; much of this is not included in the reclamation capacity reported above. This material is often sold as regrind to manufacturers that use it as they would a washed flake or pellet.

Most of the U.S. capacity is for relatively clean—and often larger—PE and PP items, because it it can be handled more cost effectively than small items and often does not need washing. Many buyers are seeking bulky rigid materials such as buckets, crates, battery casings, storage bins and hangers. A small portion (6.5%) of the domestic capacity is reported as making mixed-resin products such as lumber and other extruded products.

The primary domestic end uses for non-bottle rigid plastics are automotive products, crates, buckets, pipe, lawn and garden products, and other relatively thick-walled injection products. As noted, a small portion of the non-bottle rigid plastic recovered is used in composite products, such as lumber, and other extruded products. In addition, many companies blend or compound these materials and sell them to manufacturers that make a wide variety of products including tanks, drums and carts.

Discussion

The remaining sections of this Report present Discussion and Recommendations, which reflect Moore Recycling's expertise and industry knowledge.

Moore Recycling tracks the non-bottle rigid plastic recycling market throughout the calendar year. Generally, demand for high-grade material (clean, single resin) is strong because it requires less processing and is therefore less costly to reclaim than dirtier or mixed resin material. This was especially true in 2013.

Green Fence

In February 2013, China's government began an effort to control postconsumer scrap imports as part of an initiative titled the "Green Fence." During much of the first half of the year, nearly all postconsumer scrap containers imported into China were opened and inspected, and spot inspections continued throughout the year. Chinese customs officials imposed very tight contamination standards on the imported scrap. For certain mixed rigid bale commodities—predominantly All Rigid Plastic and Pre-picked Rigid Plastic—the Green Fence resulted in a shift from previously strong demand to limited markets in a very short period of time. As a result, prices for mixed grades of plastic scrap were volatile in 2013. They started strong with a rapid drop in the early part of the year and made a slow recovery back to—or near—the starting value. Moore Recycling is not aware of any communities that stopped collecting non-bottle rigid plastics because of the Green Fence and the resulting diminished scrap market.

The recycling industry addressed the impacts of the Green Fence in a few ways. Initially, some materials recovery facilities (MRFs) and intermediate processors continued to make and store mixed rigid bales; whereas others further sorted the mixed plastic into categories that met China's import requirements or domestic buyers' specifications. Due to the fact that not all MRFs are have the resources to conduct additional sorts, the Green Fence opened up the supply of mixed rigid bales to the domestic market, which spurred new interest and investment in the infrastructure to

separate non-bottle rigid plastic for recycling. These facilities—plastic separation facilities, or PRFs—process mixed rigid bales. The PRFs sort the mixed plastic into various resin categories and often "high-grade" the plastic through grinding and, in some cases, washing and pelletizing. The PRF infrastructure, while growing, is still inadequate for the volume of mixed plastic collected in most of the U.S. and Canada; the facilities are predominantly located in the Eastern U.S., although there is one in Southern California.

Moore Recycling staff visited China in September 2013 and again in early 2014 to better understand China's plans for the Green Fence program. As a result of the Green Fence, some Hong Kong traders and Chinese end users are working with partners in Southeast Asia to grow the infrastructure in that region for sorting and high grading. However, this infrastructure does not have the capacity to process all the mixed material that formerly went to China. During 2014, China's demand for mixed rigid bales increased as global suppliers responded to Chinese custom's quality requirements and inspections decreased, thus a significant amount of mixed material moved to China in competition with the growing PRF infrastructure in the U.S.

Nonetheless, Moore Recycling believes that North American suppliers are aware of the volatile nature of the export market—especially for mixed rigid bales—and are ready to embrace the development of a domestic separation infrastructure. Before the Green Fence, potential U.S. buyers could not be assured of a regular quality supply, which—as noted above—inhibited investment.

The Green Fence also raised awareness of the need for quality material. It accelerated a trend among domestic and export buyers of placing a higher value on material with a higher yield. Moore Recycling continues to expect that producers of good-quality material will reap economic benefits for the extra effort involved. In the future, producers of low-quality material may eventually find themselves unable to move material at all.

Recommendations

Design for Recyclability

While suitability for use is the first rule of product and packaging design, manufacturers and consumer product companies that want their products and packages to be recycled at end of life must carefully consider the ease of recyclability—including material composition and use of additives, inks and labels—at the design phase. A respected guidance in the field is that offered in APR's Design for Recyclability™ Guidelines. Moore Recycling recommends that designers, manufacturers and brand owners adhere to these Guidelines in order to maximize product and package recycling.

Determine depth of demand

As noted, MRFs and other plastic scrap processors are increasingly willing to expend the necessary resources to create good-quality bales, often single-resin bales. Research is needed to determine the depth of demand for the types of bales now being created in greater amounts;

especially as many communities want to expand recycling beyond bottles and are looking for assurance that there will be buyers for their collected material.

Invest in Infrastructure: Sorting, Reclamation, End Markets

Potential investors in recycling infrastructure need to know that they will have reliable supply, viable technology, and demand for the end product. If the plastic recycling industry wishes to foster such investment, the industry must continue to facilitate the documentation of these variables. For example, funders need independent documentation of the potential supply. Public research and development regarding potential technology and end markets is needed to determine the viability of investments in sortation and reclamation infrastructure. Lastly, to expand the infrastructure, waste generators must be willing to create quality bales and enter into bankable supply agreements with reclaimers.

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 and plastic 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 non-bottle rigid plastics, visit www.AmericanChemistry.com/Plastics. Also, visit www.PlasticsMarkets.org, maintained by Moore Recycling Associates, for markets and information on handling guidelines. This report and others on plastic recycling can be found at www.MooreRecycling.com/m_02_00.html.

Disclaimer

The 2013 National Report on Postconsumer Non-Bottle Rigid Plastics Recycling has been prepared to provide information to parties interested in the recycling of plastics, in particular non-bottle rigid plastic materials. 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.