MOORE
RECYCLING ASSOCIATES INC.
Recycling Implementation Specialists

2014 National Postconsumer Non-Bottle Rigid Plastic Recycling Report

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

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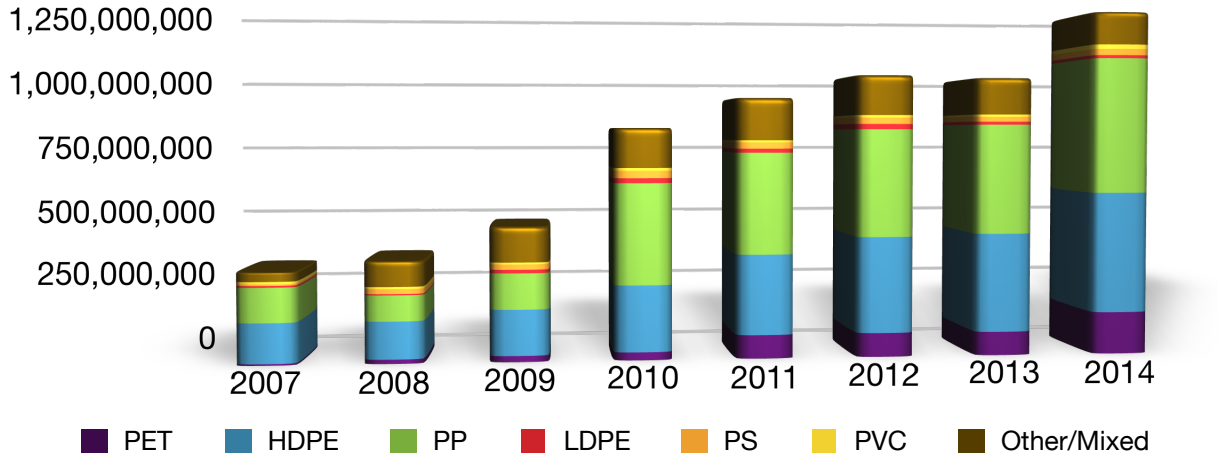
Introduction

The 2014 National Postconsumer[1] Non-Bottle Rigid Plastic Recycling Report is the eighth 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 1.284 billion pounds of postconsumer non-bottle rigid plastic was reported as recovered for recycling in 2014:an increase of 276 million pounds or 27% compared to 2013. Most of the increase was due to the growth in mixed resin rigid bales predominantly collected from curbside programs Reported purchases of mixed resin rigid material increased by 58% in 2014 compared to 2013. Domestic purchases increased 20% and export purchases increased 42% compared to 2013. U.S. and Canadian reclaimers procured 64% of the non-bottle rigid plastic scrap. Domestic markets continued to dominate resin segregated plastic purchases and to increase purchases of mixed resin rigid material.

U.S. Non-Bottle Rigid Plastic Recovered Year over Year by Resin[2] (pounds)



[1] The Environmental Protection Agency (EPA) defines “postconsumer" as a material or a finished product that has served its intended use and then is diverted or recovered before it is disposed. It is the material consumers and businesses recycle; it does not include manufacturers' waste that is commonly reused in the original manufacturing process. EPA defines “preconsumer" on the EPA Web Site as material that is recycled before it is used by a consumer (EPA Home. Pacific Southwest. Waste. Solid Waste. Reduce, Reuse, Recycle, Buy Recycled, Oct. 15, 2015. <http://www3.epa.gov/region9/waste/solid/reduce.html#br4>). 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 that have met their intended use 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 postindustrial (preconsumer) materials. An example of postindustrial material is scrap and trimmings that are generated in manufacturing and converting processes.

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

To arrive at an estimate for pounds of postconsumer plastic recovered for recycling in 2014, Moore Recycling surveyed both domestic and export markets for all postconsumer plastic (as well as some key players within the value chain such as MRFs, brokers, and end users). This report's findings are based on data reported voluntarily, for the recovery of U.S.-sourced, postconsumer material. Thirty-two U.S. and Canadian plastic reclaimers[3] and 22 exporters contributed to the non-bottle rigid totals in this report. The 2014 results are representative of reporting from five additional reclaimers and two fewer exporters than in 2013. 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 are collected during a voluntary, annual plastic recycling survey, which also gathers data on plastic bottles, film and other plastics. 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 material from the commercial sector. 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.

Data Collection and Analysis

Moore Recycling continually updates a proprietary database of plastic exporters, processors, reclaimers and key brokers to ensure that the survey reaches the key plastic scrap buyers from North America.[4]

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

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[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.

[4] Through Moore Recycling's project work in the industry and web sites it manages—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.

continually seeks ways to improve the completeness and timeliness of the survey responses. For example, beginning in 2013, Moore Recycling updated the names for many of the mixed rigid plastic categories to reflect bale specifications released by the Association of Plastic Recyclers (APR) bale terminology.[5] In 2014, Moore added new categories to the segregated resin section e.g., PET x-ray film, PP bulky, and expanded the postindustrial plastic section.

An email with a unique link and message is sent to each contact. After an adequate amount of response time has passed, Moore Recycling employees 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 into the online survey tool, either directly by the company surveyed, or by Moore Recycling staff. Incoming data are reviewed for accuracy, and follow-up calls are made as needed. After data collection is complete, Moore Recycling compiles the data and categorizes them based on the detail reported.[6]

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 are 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 surveyed for mixed rigid plastic categories, as well as non-bottle rigid categories segregated by resin and product type. All the mixed rigid plastic 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. The non-bottle rigid plastic portion[7] of the mixed rigid bales reported by respondents is calculated for this report by applying content percentages of resin and product type from the 2014/15 mixed rigid bale composition study.[8] Previous reports back to 2011 used the 2011 study.[9]

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

[6] 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.

[7] 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.

[8] *National Mixed Rigid Plastic Bale Composition Study*, Association of Plastic Recyclers (APR), July 2015

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

The 2014 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 containers - Primarily HDPE bottles, with some HDPE or PP household containers, no bulky items.
- Mixed Resin Clamshell Bale - A mixture of PET, PP, 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

Participation in the survey is voluntary 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 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—predominantly U.S. and Canadian—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.

Again, since participation in the survey is voluntary, 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 receives 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 because it is often purchased by companies also handling industrial scrap. The survey now specifically includes a detailed section on postindustrial plastic recycling to encourage responses from industrial/commercial scrap recyclers. Having an additional focus on postindustrial recycling, enables us to engage these recyclers about material handled that they may not realize is considered postconsumer—that is, it has met its intended use.

As mentioned, Moore Recycling applied the bale composition results from the 2014/15 study[10] commissioned by the Association of Plastic Recyclers (APR) to the mixed rigid plastic bale volumes reported by responders to arrive at the non-bottle portion of these bales, separated by 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 some key players in these sectors and the total reported is likely less than the actual amount of plastic recycled from these two key recycling efforts. In 2014, Moore Recycling was able to improve the response rate for PP battery casing recycling, but there are still key players that have not responded to date.

[10] *National Mixed Rigid Plastic Bale Composition Study*, Association of Plastic Recyclers (APR), July 2015

Findings

Volume

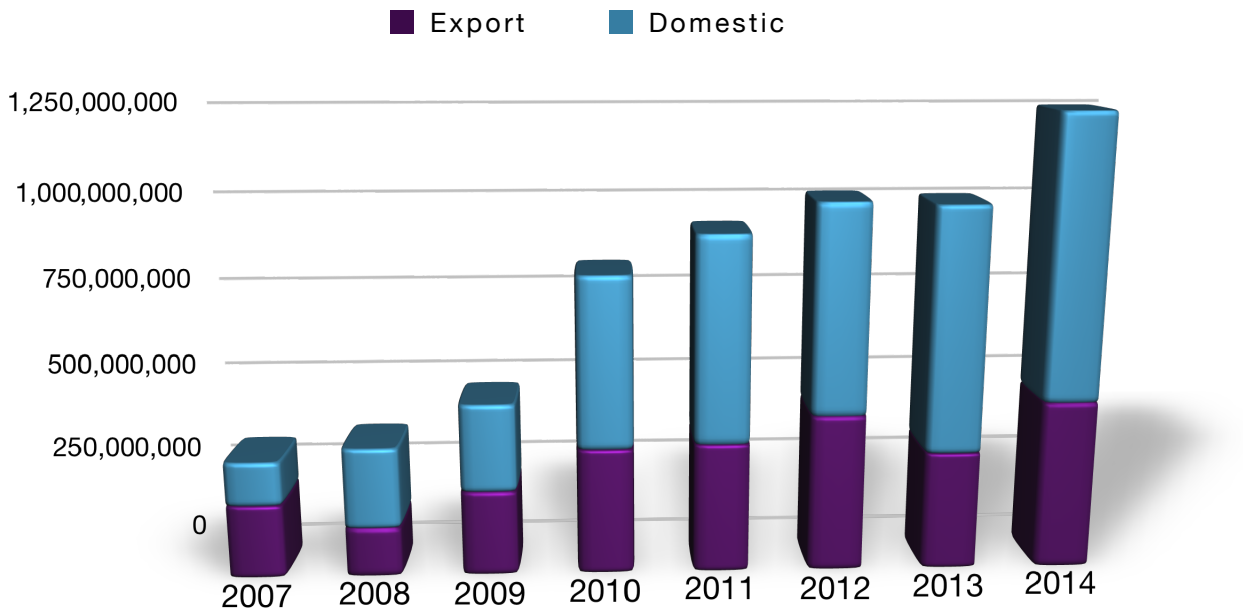
In 2014, the amount of non-bottle rigid plastic reported as recovered in the U.S. for domestic and overseas recycling rose to 1.284 billion pounds, an increase of 27% over 2013 and an almost three hundred percent increase since 2007. Approximately 64% of the 1.284 billion pounds was reclaimed in the U.S. or Canada in 2014, 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%	325,440,000
2008	137,133,000	223,643,000	62%	360,776,000
2009	236,105,000	243,115,000	51%	479,220,000
2010	350,870,000	475,783,00	58%	826,653,000
2011	361,527,000	572,400,000	61%	933,927,000
2012	437,207,000	579,451,000	57%	1,016,658,422
2013	328,974,000	678,738,000	67%	1,007,712,000
2014	467,778,000	816,481,000	64%	1,284,259,000

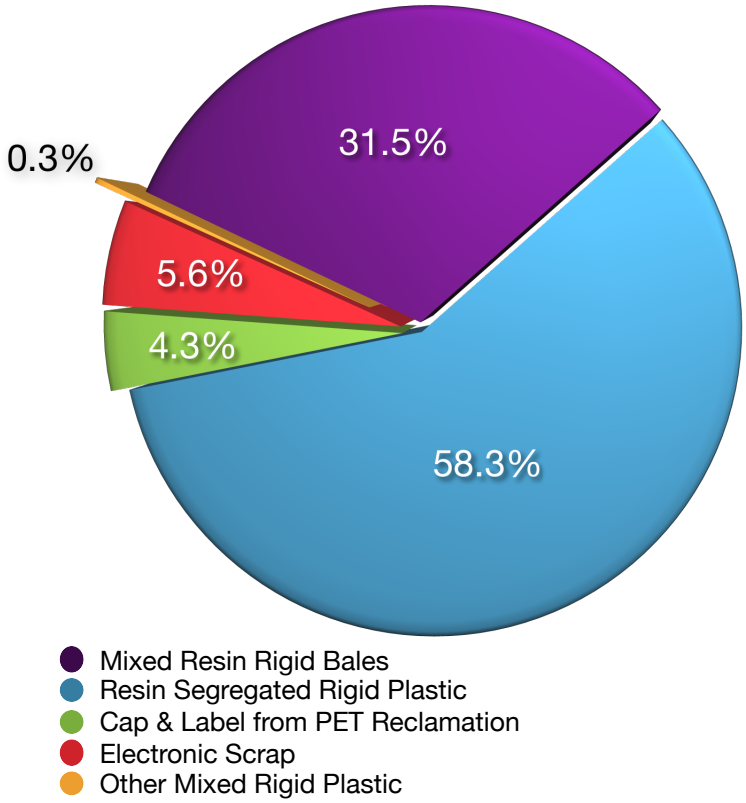
2014 non-bottle rigid plastic recovery increased 276 million pounds over 2013 . Domestic and export market volumes are each responsible for half of the increase. Although domestic buyers continued to increase their purchases of mixed resin rigid bales, export buyers purchase 60% of mixed resin rigid bales and reported a substantial increase of this material in 2014. This is likely in part to a rebound from the Green Fence enforcement in 2013, as well as better reporting on this category.

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

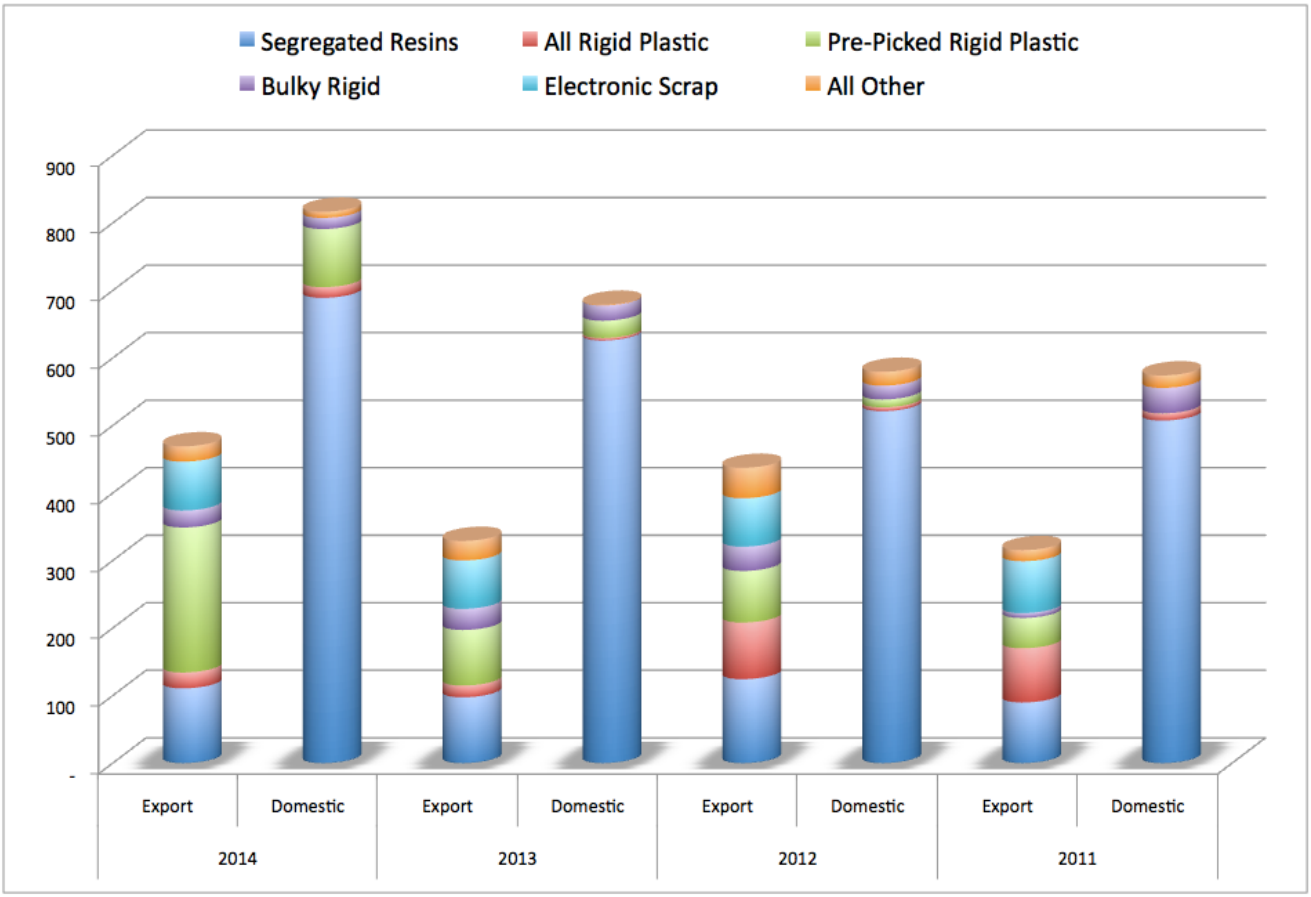


Material reported as segregated resins (e.g., HDPE injection: drums, buckets, crates; PP Battery Casings; PET Thermoforms) made up 58.3% of the total material reported as recycled, down 8% compared to 2013.The non-bottle rigid plastic portion of Mixed Resin Rigid Bales, predominantly from municipal programs,made up 31.5% of the volume reported (an increase of 12% over 2013). Pre-picked Rigid bales (with and without bulky) make up the largest volume of mixed resin rigid bales reported at 69% by weight; this is up by 14% compared to 2013, The next largest category of mixed resin rigid plastic was All Rigid Plastic (with or without Bulky) at 15% with Bulky Rigid bales dropping down to third at only 8% in 2014, compared to 23% in 2013.

Sources of U.S. Non-Bottle Rigid Plastic, 2014



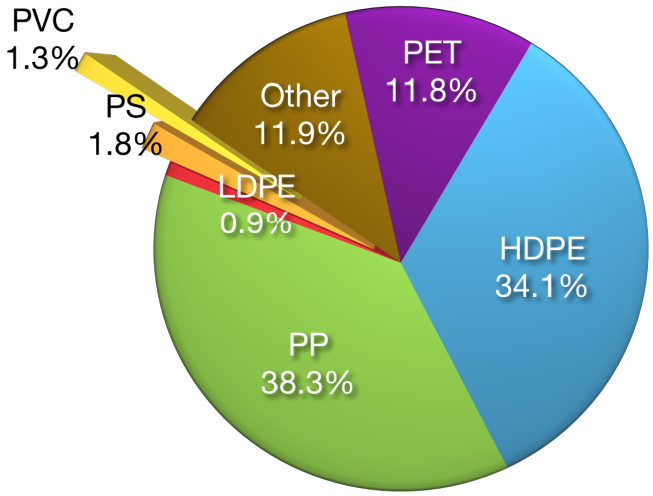
U.S. Non-Bottle Rigid Plastic Recovered by Source (millions of pounds)



Resin-segregated plastic reclaimed in the U.S. or Canada increased in 2014 to 692 million pounds, maintaining a strong market share at 86% of the total resin segregated plastic reported. Domestic buyers purchased 40% of mixed resin rigid bales reported. Increasing domestic purchases, particularly of the Pre-picked Rigid Plastic category which has grown substantially in the last few years, is in part due to domestic markets opening up and in part to clearly defined bale specifications leading to higher demand and more accurate reporting.

U.S. Postconsumer Non-Bottle Rigid Plastic Recovered in 2014 by Resin

RESIN	POUNDS
PET	151,778,000
HDPE	438,011,000
PP	491,730,000
LDPE	11,143,000
PS	22,515,000
PVC	16,417,000
Other Mixed/ Unknown [15]	152,664,000



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. PP, HDPE and PET showed significant increases in 2014 compared to 2013. PP and HDPE increases were mostly due to the increase in mixed resin rigid bales, whereas the increase in PET was primarily due to material reported as segregated resin and secondarily to the mixed resin rigid bale increase. LDPE, PS, PVC and Other also increased again mostly due to the mixed resin rigid bale increase from 2013 to 2014.

Domestic Capacity and End Markets

Based on survey responses, as of 2014 there is over 1.030 billion pounds 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. The non-bottle capacity is based on 39 companies, compared to the 36 for 2013. There is also at least an additional 150 million pounds of non-bottle reclamation capacity in Canada that draws on U.S. and Canadian material. The Canadian capacity estimate is down from 2013, given a large reclaimer went out of business. 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 used unwashed; not all of it is 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. reclamation 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 clean PE and PP-based bulky rigid materials such as buckets, crates, battery casings, storage bins and hangers. A small portion (5%) of the domestic capacity reported making mixed-resin products such as lumber and other extruded products.

Very few reclaimers reported their end market information in the 2014 survey, but based on previous year's reporting, 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. Demand and value for high-grade material (clean, single resin) remains strong because—unlike dirty or mixed resin material—it requires very little processing thus is less costly to reclaim. Unlike 2013, the competition for and value of mixed resin rigid bales was strong and steady in 2014 with very little volatility. Nonetheless, the plastic recycling industry did still feel some impact of the Green Fence: a 2013 enforcement effort to control postconsumer scrap imports into China. The primary impact was a focus on bale quality that continued into 2015.

MRFs have a limited capacity to sort specific resins beyond PET and HDPE as indicated by the prevalence of mixed resin rigid bales. And, most domestic reclaimers are not structured to handle mixed resin material. Therefore, the continued growth in the collection of plastic beyond PET and HDPE bottles is dependent on a healthy sorting and reclaiming infrastructure for all the non-bottle resins. The growth of domestic Plastic Recovery Facilities (PRFs) are key to the future growth of non-bottle rigid plastic recycling.

Recommendations

Market Development

As the PRF infrastructure grows, it is essential that there is market demand for all the resins found in the mixed bales. Research is needed to identify existing and potential buyers for the recycled resins now being created in greater amounts; especially as communities continue to expand recycling beyond bottles. The success of the expanded plastic recycling system depends on assurance that there will be buyers for the collected material.

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.

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: from raw material to postconsumer resin. Public research and development regarding potential technology and potential end markets is needed to determine the viability of investments in sortation and reclamation infrastructure; this is especially true for the minority resins found in mixed bales. 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 26 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 2014 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.