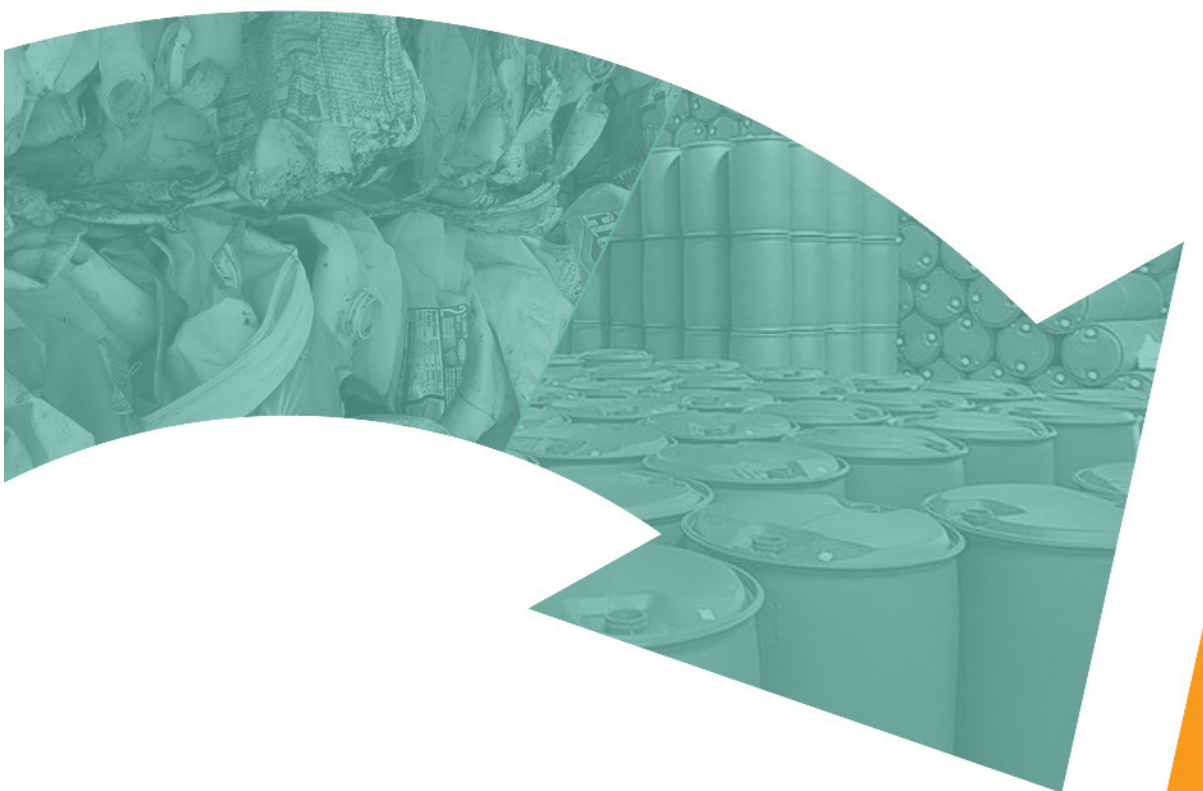
MORE RECYCLING

FEBRUARY 2018

Prepared by More Recycling for the American Chemistry Council

2016 National Post-Consumer Non-Bottle Rigid Plastic Recycling Report



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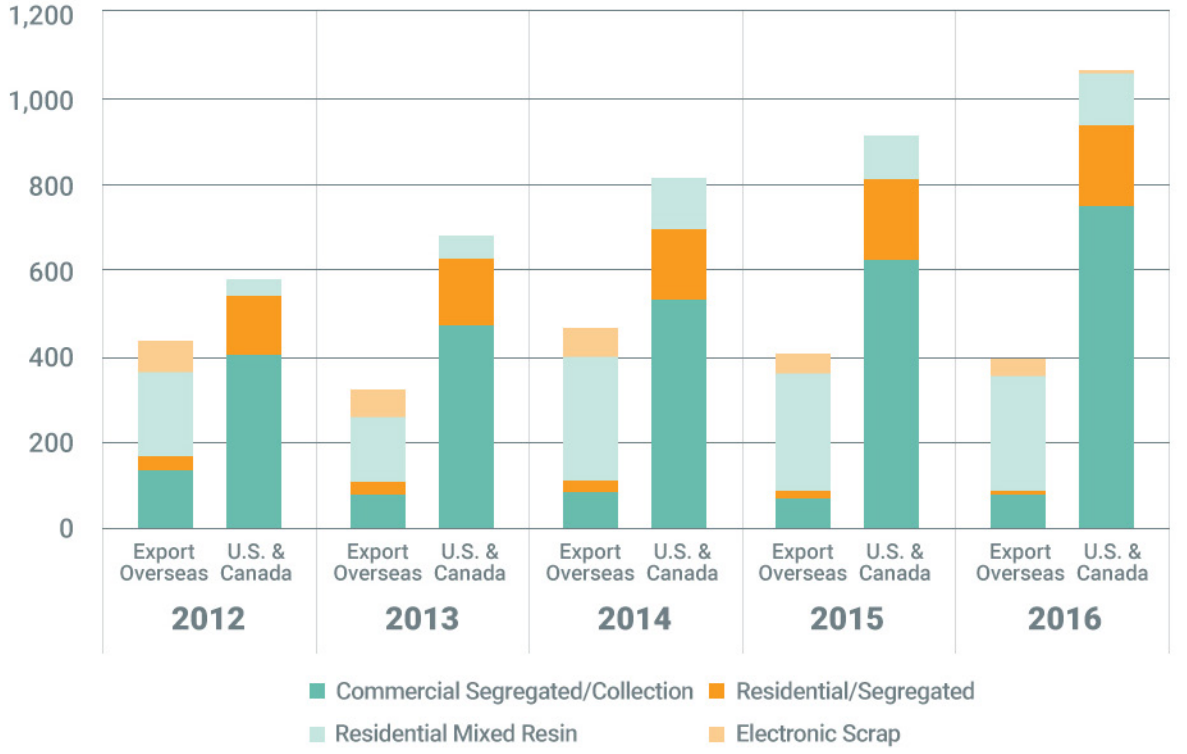
INTRODUCTION

The 2016 National Post-Consumer Non-Bottle Rigid Plastic Recycling Report is the tenth annual report on pounds of post-consumer non-bottle rigid plastics—packaging and non-packaging—recovered for recycling in the United States (U.S.).[1] Research for this report was conducted by More Recycling (MORE) for the Plastics Division of the American Chemistry Council.

1 The Environmental Protection Agency (EPA) defines "post-consumer" as a material or a finished product that has served its intended use that is then diverted or recovered before it is disposed. It is the material consumers and businesses recycle; it does not include manufacturers' waste, which is commonly reused in the original manufacturing process. The EPA defines "pre-consumer" 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, wherein "post-consumer" refers to plastics that have been previously used for their intended purpose by consumers and 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 post-industrial (pre-consumer) materials. An example of post-industrial material is scrap and trimmings that are generated in manufacturing and converting processes.

A minimum of 1.46 billion pounds of post-consumer non-bottle rigid plastic were reported as recovered for recycling in 2016, an increase of 136 million pounds, or 10.6 percent, compared to 2015. The 2016 total was nearly 4.5 times the volume collected for recycling in 2007 when the report was first compiled. As in previous years, most of the non-bottle rigid plastic was purchased by U.S. and Canadian reclaimers, with their combined purchases increasing by 16 percent between 2015 and 2016.[2] Total export volumes of non-bottle rigid plastics dropped by two percent in 2016 versus 2015, and 27 percent of the total non-bottle rigid plastic collected for recycling was sold to exporters, compared to 31 percent in 2015.

Figure 1: U.S. Non-Bottle Rigid Plastic Recovered (millions of pounds)



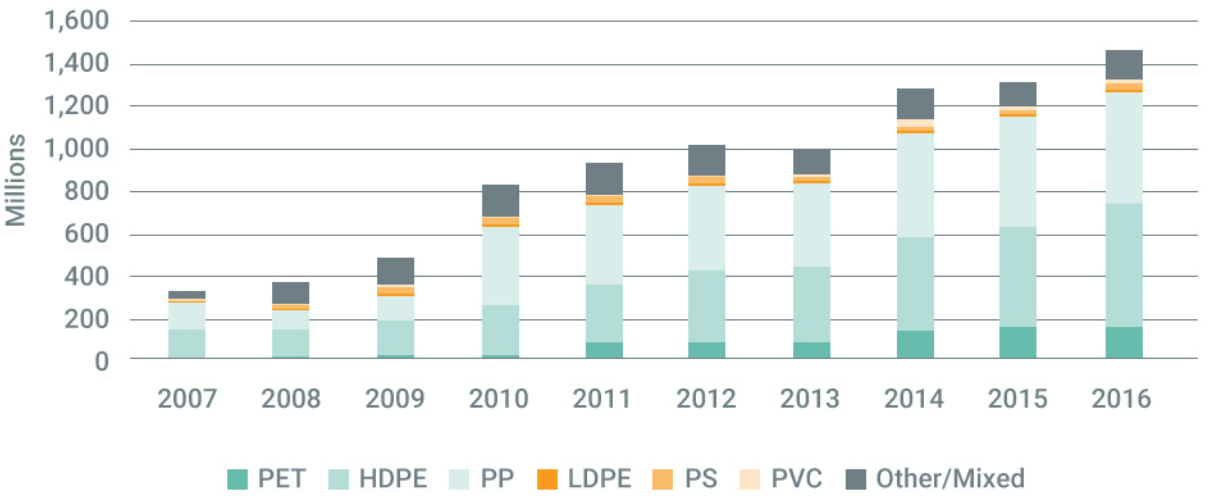
In 2016, 70 percent of non-bottle rigid plastic recovered for recycling was segregated by resin, and 81 percent of that segregated material was generated in the commercial sector. The remaining 30 percent recovered is mixed plastics; 27 percent mixed resin rigid bales and three percent electronic scrap. Although export purchases of mixed rigid bales were down in 2016, as compared to 2015, export purchases still made up sixty-six percent of the mixed resin rigid bales generated from the residential sector. Export purchases of residential material further segregated by resin was also down, but export reported an increase in commercial sourced/collected material. The United States' and Canada's total combined purchases of mixed resin rigid bales also decreased in 2016, but increased for segregated material, both commercially sourced/collected

2 United States' and Canadian purchases of non-bottle rigid plastics are combined throughout this report and may be referred to collectively as "domestic" purchases so as to distinguish them from material that is exported overseas.

as well as residential recycled plastic that was further segregated by resin.[3] The make-up of the mixed resin rigid bale categories purchased continued to shift in 2016, with U.S. and export markets preferring bales containing only bulkier material versus those containing a mixture of small and bulkier material. While the pounds of Mixed Bulky Rigid Plastic purchased for recycling increased, there was a decrease in the purchasing of less segregated bales with the largest decreases in the 3-7 Bottle and All Other Rigid Plastic (containing bulky) and the 3-7 Bottle and Small Rigid Plastic categories following close behind. (See Methodology: Survey Categories for all non-bottle rigid plastic category definitions.)

Non-bottle rigid plastic from the residential and commercial sector is primarily comprised of high density polyethylene (HDPE) and polypropylene (PP); together HDPE and PP make up 76 percent of the non-bottle rigid plastic acquired for recycling.

Figure 2: U.S. Non-Bottle Rigid Plastic Recovered Year to Year by Resin (million of pounds)



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

3 More Recycling surveys and counts material from reclaimers, which are defined as companies that wash post-consumer material or otherwise process unwashed material into a clean feedstock or end product.

Data on recovered post-consumer non-bottle rigid plastic are collected through a voluntary, annual plastic recycling survey that also gathers data on bottles, film and other plastics. For this report, the survey gathers data on residential and commercially generated recycled plastic. Residentially generated commodities are both mixed resin rigid plastic and non-bottle rigid material further segregated by resin. Commercial material includes products that have met their intended use, such as packaging for transport—pallets, crates, and totes—and material collected through special programs by the commercial sector, such as battery casings.

THE FOLLOWING STEPS ARE TAKEN TO PREPARE THE REPORT

- MORE continually updates its markets database to include current exporters, reclaimers, and other handlers of plastic scrap;
- MORE conducts an electronic survey of market participants in plastic recycling to collect data; and
- MORE undertakes a follow-up step for survey-collected data, to help check the accuracy of the data through follow-up calls, conversations with industry contacts, and reviews of other public sources of recycling indus try information.

DATA COLLECTION AND ANALYSIS

MORE continually updates a proprietary database of plastic exporters, processors, reclaimers, and key brokers to help ensure that the survey reaches the key plastic scrap buyers of material sourced for recycling in North America.[4]

MORE uses a custom-designed web-based survey system to gather data. Although the overall methodology has not changed since the first report, MORE continually seeks ways to improve the completeness and timeliness of the survey responses. For example, in 2016, MORE improved the organization of the survey category layout to more clearly ask for all residential material in a separate section from commercially sourced and collected material, whereas previous year's surveys had separated the categories by mixed material versus segregated by resin. MORE is involved in the plastic recycling industry's work to harmonize commodity categories and the terminology used by the industry. Updates to categories are reflected in MORE's survey, this report, and in the other tools and resources that MORE manages. This is critical in order to report on the key materials, to avoid misunderstanding, and to further support harmonization of terminology used in the industry.[5] The **model bale specifications**, maintained by the Association of Plastic Recyclers (APR), are a key resource in this process.[6]

4 Through its project work in the industry and on the websites it manages—PlasticsMarkets.org, RecycleMorePlastic.org, and PlasticFilmRecycling.org— MORE regularly engages with companies and new contacts in this sector. MORE also identifies potential buyers through published market databases and conversations with suppliers, such as material recovery facilities (MRFs) and key reclaimers.

5 The Plastic Recycling Terms and Tools resource is intended to help harmonize terminology across the plastic recycling value chain. This resource can be found at https://www.recycleyourplastics.org/terms-tools.

6 Bale specifications maintaining by the Association of Plastic Recyclers (APR) are in alignment with the Plastic Recycling Terms and Tools, https://www.plasticsrecycling.org/resources/model-bale-specs

The survey is distributed by sending an email with a unique link to each survey contact, including both U.S. and Canadian reclaimers, export buyers for all post-consumer plastic, as well as some key players within the value chain, such as MRFs, brokers, and end users. After an appropriate amount of response time has passed, MORE employees send follow-up emails and make telephone calls to retrieve data. Data are entered into the online survey tool, either directly by the company surveyed, or by MORE staff in conjunction with the relevant company. Incoming data are reviewed for accuracy, and follow-up calls are made as needed. After data collection is complete, MORE compiles the data and categorizes them based on the detail reported.[7]

The residential commodity categories may be a mixture of resins, or some combination of bottles, containers, bulky items, and other non-bottle rigid plastic. Some are further segregated by resin and others are intentionally a combination of both resin and product type.

Where the commodities are a mix of bottle and non-bottle or resin, the non-bottle rigid plastic portion of the mixed rigid bales reported by respondents is calculated for this report by applying the content percentages of resin and product type from the 2014/15 mixed rigid bale composition study.[8] The 2015 report also used the 2014/2015 study data whereas previous reports dating back to 2011 used the 2011 composition study.[9]

The final data totals are reviewed and analyzed; then, they are reported in as much detail as possible without compromising the participating companies' confidentiality. In order to determine trends and identify anomalies that may require further vetting, the analysis includes year-to-year comparisons of the totals, material categories, and trends among export and U.S. and Canadian buyers. This quality control, which often requires follow-up with survey responders, is essential to determining if there has been an actual shift or just an entry error. Clarification may also be needed to determine whether reported material can be counted as post-consumer commercial or if it is, in fact, industrial scrap. 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.

7 MORE conducts the survey and takes steps to maintain the confidentiality of individual responses; no individual company data are released, nor are any specific data that do not include at least three companies reporting.

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

SURVEY CATEGORIES

The 2016 survey included the following rigid plastic categories:[10]

Mixed Resin Rigid Plastic from Residential Collection

- **3-7 Bottles and Small Rigid Plastics** (formerly Pre-picked Rigid Plastic: No Bulky) - Non-bottle rigid containers (includes cups, trays, boxes, clamshells, tubs, pots, deli containers, cartons, and blister). PET and HPDE bottles removed, leaving 3-7 bottles.
- **3-7 Bottles and All Other Rigid Plastics** (formerly Pre-picked Rigid Plastic: With Bulky) - Non-bottle rigid containers (includes cups, trays, boxes, clamshells, tubs, pots, deli containers, cartons, and blister). Bulky rigid plastic (includes carts, crates, buckets, baskets, toys, and lawn furniture). PET and HPDE bottles removed, leaving 3-7 bottles.
- **1-7 Bottles and Small Rigid Plastics (formerly All Rigid Plastic: No Bulky)** - 1-7 bottles and caps, small non-bottle rigid containers (includes cups, trays, boxes, clamshells, tubs, pots, deli containers, cartons, and blister).
- **1-7 All Rigid Plastics (formerly All Rigid Plastic: With Bulky)** - 1-7 bottles and caps. All non-bottle rigid containers (includes cups, trays, boxes, clamshells, tubs, pots, deli containers, carton, and blister), and all bulky rigid plastic (includes carts, crates, buckets, baskets, toys, and lawn furniture).
- **Mixed Bulky Rigid Plastics (formerly Bulky Rigid Plastic)** - Bulky rigid plastic (includes carts, crates, buckets, baskets, toys, and lawn furniture) predominantly PE and PP.
- **Mixed Clamshell** - A mixture of PET, PP, PS, and PVC clamshell-type containers.
- **Other Mixed Bottle and Non-bottle Rigid Plastic** - A "catch-all" category, defined on a case-by-case basis.

Plastic Further Segregated by Resin from Residential Collection

- **PET Thermoforms** – PET containers and lids, clamshells and other thermoformed packaging.
- **HDPE Colored Bottles with Containers** - Primarily HDPE bottles, with some HDPE or PP household containers, no bulky items.
- **PP Small Rigid Plastics (formerly PP Bottles and Containers)** - Primarily PP bottles, non-bottle containers and other small rigid items, no bulky items.
- **PP All Rigid Plastics (formerly PP Bottles/Containers and Bulky)** - Primarily PP bottles, non-bottle containers and bulky items (bulky is described below).
- **Tubs and Lids** - Non-bottle household containers, including buckets, predominantly PP and PE, with no bulky items.
- **Tubs and Lids: With Bulky (formerly PE/PP Bottles, Containers, and Bulky (Olefin)** - Primarily PE and PP bottles, non-bottle containers and bulky items (includes carts, crates, buckets, and lawn furniture).
- **HDPE Injection Bulky Rigid Plastics** – HDPE bulky rigid plastics (includes buckets, totes, creates, lawn furniture, carts, storage bins), may include some bulky PP and LDPE.

10 Recycled plastic commodity names reflect the current revised commodity names agreed upon by APR and ISRI (Institute of Scrap Recycling Industries) in 2016.

Other Categories

- **Mixed Electronic Scrap** - Primarily high impact polystyrene (HIPS), acrylonitrile butadiene styrene (ABS), polycarbonate (PC).
- **Categories for Commercial Generated/Collected Non-Bottle Rigid Plastic Segregated by Resin** - A list of major categories of non-bottle rigid plastic from commercial sources generating these commodities through their course of business or through special collection programs (e.g., PP battery casings). The list is based on categories that respondents have offered in previous surveys (e.g., HDPE injection (drums-buckets-crates), PP hangers, PVC Flooring, and PC CDs). MORE also provides an "other" category for PET, HDPE, PP, PS, PVC, ABS, and PC.
- **Other Non-Bottle Rigid Plastic** - A "catch-all" category for non-bottle rigid plastic segregated by resin that is different from the specific resin categories listed above.
- **Other 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.

The APR and the National Association for PET Container Resources (NAPCOR) conduct a separate, but similar, survey of U.S. and Canadian PET reclaimers. MORE does not survey these PET reclaimers and receives the aggregate data for non-bottle rigid plastic (e.g.. thermo-forms, cap and label material obtained through the PET bottle reclamation process and some post-commercial data) from APR/NAPCOR.

Reclay Steward Edge (RSE) also assisted MORE in obtaining non-bottle rigid plastic recycling data, with a focus on closed loop recyclers, to further capture the quantities recycled in this area. The data acquired by RSE contributed to the revised 2015 data and the 2016 totals included in this report.

DATA GAPS AND ASSUMPTIONS

Participation in the survey is voluntary and the reported data 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 percent participation, the presented totals represent the minimum amount of non-bottle rigid plastic recovered for recycling and sold on the marketplace. Only data provided by North American reclaimers and exporters selling directly overseas, are included in the reported totals, unless we determine that data are missing in areas where substantive information from other reliable resources is available. Only U.S. and Canadian reclaimers currently respond to the survey. Data provided by brokers and MRFs are primarily used as a reference to better understand the flow of material, but MORE may include their data if enough information is provided that would enable us to attribute material sold to a non-responder.

Again, since participation in the survey is voluntary, MORE sometimes receives responses from existing companies that did not previously respond. Increases in year-to-year recovery rates are often a combination of increased collection along with material that was recycled in previous years but not reported. When MORE can conclude the nature of an increase (or decrease), the reasoning is indicated; however, it can be difficult to make a solid determination in any given year, depending on the depth of information MORE receives from plastic handling companies for previous years and while taking into account the need to protect confidentiality. A good example of this is the additional responses for closed loop recyclers that contributed both to the 2015 data, and to the 2016 data reflected in this report. The 2015 data reflected in this report is updated from that of the 2015 report version as released in March 2016. These companies are not captured in 2014 data, although many of them were likely in operation, so part of the increase from 2014 to 2015 is due to these new responses. The 2016 data also includes a few new responders that were likely in operation in 2015, but did not report, so part of the increase in 2016 is also due to new responses.

MORE tracks exporters' purchasing of plastic through a number of industry resources. Except for the largest exporters, players in the export market come and go, and may change the type or mix of materials that they purchase. When final efforts to track down survey non-responders was underway in mid- to late 2017, there were growing concerns about when China's policy restricting the import of scrap materials would take effect. As a result, exporters were, in some cases, less responsive to calls about their buying history or follow-up survey inquiries.

In addition to the potential impact of non-responders, changes in how responders report pounds in the survey categories has an impact on the totals reported year over year. 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.

Post-commercial material, which is material from the commercial sector that has met its intended use, can be difficult to track because it is often purchased by companies that are also handling industrial scrap. The survey now specifically includes a detailed section on post-industrial plastic recycling to encourage responses from industrial/commercial scrap recyclers. Having an additional focus on post-industrial recycling enables us to engage these recyclers about post-commercial material that they handle, and that they may not realize is considered post-consumer.

As previously mentioned, MORE applied the bale composition results from the 2014/15 study commissioned by the APR to the mixed rigid plastic bale quantities reported by responders to arrive at the non-bottle portion of these bales, separated by resin.[11] Only the plastic portions of the mixed rigid bales are included in the quantity totals; the waste is removed, unlike gross quantities that are used for most other recycled commodities.

Based on separately available industry statistics for lead-acid battery and e-scrap recycling, it is likely that MORE 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.

11 National Mixed Rigid Plastic Bale Composition Study, Association of Plastic Recyclers (APR), July 2015

NON-BOTTLE RIGID PLASTIC RECYCLED

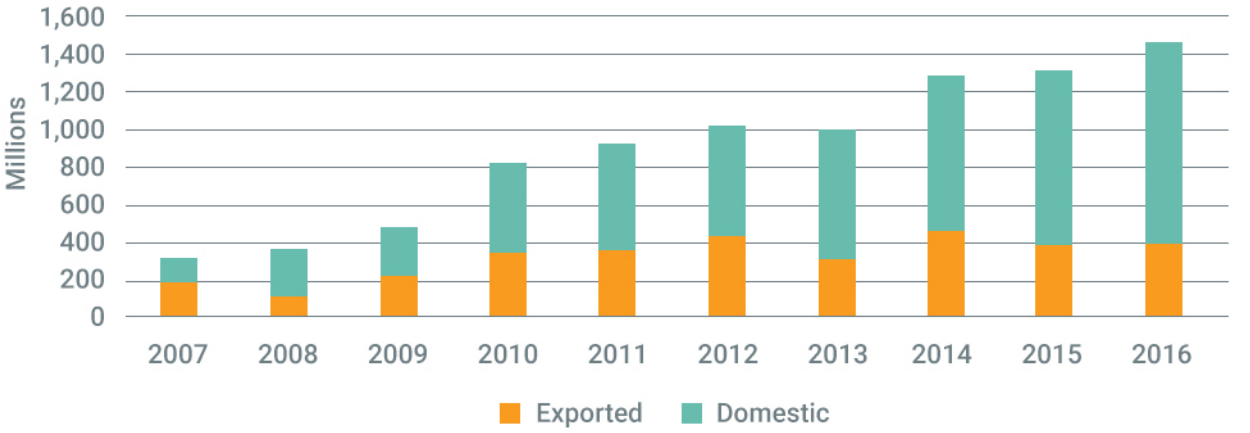
In 2016, the amount of non-bottle rigid plastic reported as recovered in the U.S. for recycling increased to 1.46 billion pounds, an increase of just under 11 percent from 2015 and an increase of over 1.1 billion pounds since 2007. Approximately 73 percent of the 1.46 billion pounds was reclaimed in the U.S. or Canada in 2016, with the remainder exported overseas. As previously noted, because participation in the survey is voluntary, the data in the report does not reflect 100 percent of the non-bottle rigid plastic that was acquired for recycling.

Table 1: U.S. Post-Consumer Non-Bottle Rigid Plastic Recovered (millions of pounds)

Year	Exported	Purchase for Use in U.S. or Canada		Total
		(Volume)	(Percent)	
2007	204.0	121.4	37%	325.4
2008	137.1	223.6	62%	360.8
2009	236.1	243.1	51%	479.2
2010	350.9	475.8	58%	826.7
2011	361.5	572.4	61%	933.9
2012	437.2	579.5	57%	1,016.7
2013	329.0	678.7	67%	1,007.7
2014	467.8	816.5	64%	1,284.3
2015	407.1	912.2	69%	1,319.2
2016	398.1	1,057.0	73%	1,455.1

Due to an additional effort to collect data from closed loop commercial reclaimers, the 2015 data has been updated since the 2015 report was released and that update is reflected in this report. The 2015 report documented 1.24 billion pounds and this report is updated to 1.32 billion pounds, a 3% increase over 2014.

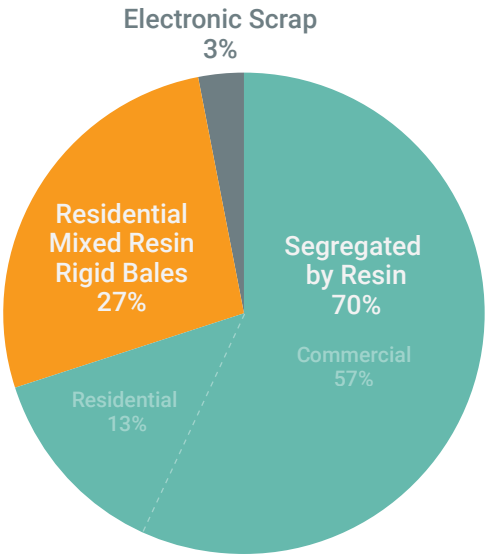
Figure 3: Purchases of U.S. Recovered Non-Bottle Rigid Plastic (millions of pounds)



From 2015 to 2016, the recovery of non-bottle rigid plastic increased by 136 million pounds. This reflected an increase of 145 million pounds for combined U.S./Canadian purchases offset by an export purchase decline of nine million pounds. U.S. and Canadian buyers reported a marginal increase in non-bottle rigid plastic acquired from purchasing of mixed-resin rigid bales, with most of their overall increase coming from the purchasing of non-bottle rigid plastic segregated by resin from both residential and commercial sources.[12] Exporters reported an increase in commercially sourced/collected non-bottle plastic from 2015 to 2016, but reported a larger drop in non-bottle rigid plastic from residential sourced plastic, both from mixed resin rigid bales, as well as residential material further segregated by resin.

Across all categories, 70 percent of the non-bottle plastic material recycled is purchased as already segregated, e.g., commercial material, or further segregated, e.g., residential material that is collected and then further sorted by resin. Fifty-seven percent of the non-bottle rigid plastic reported as recycled is from commercial sources, 40 percent is from residential collection, and three percent is from electronic recycling, which is likely a combination of residential and commercial. The non-bottle rigid plastic portion of mixed resin rigid bales comprised 27 percent of the total quantity reported, down two percentage points compared to 2015. Commercially sourced/collected non-bottle plastic increased by 20 percent, but non-bottle rigid plastic from segregated residential material decreased by three percent. U.S./Canadian markets continue to dominate the purchase of

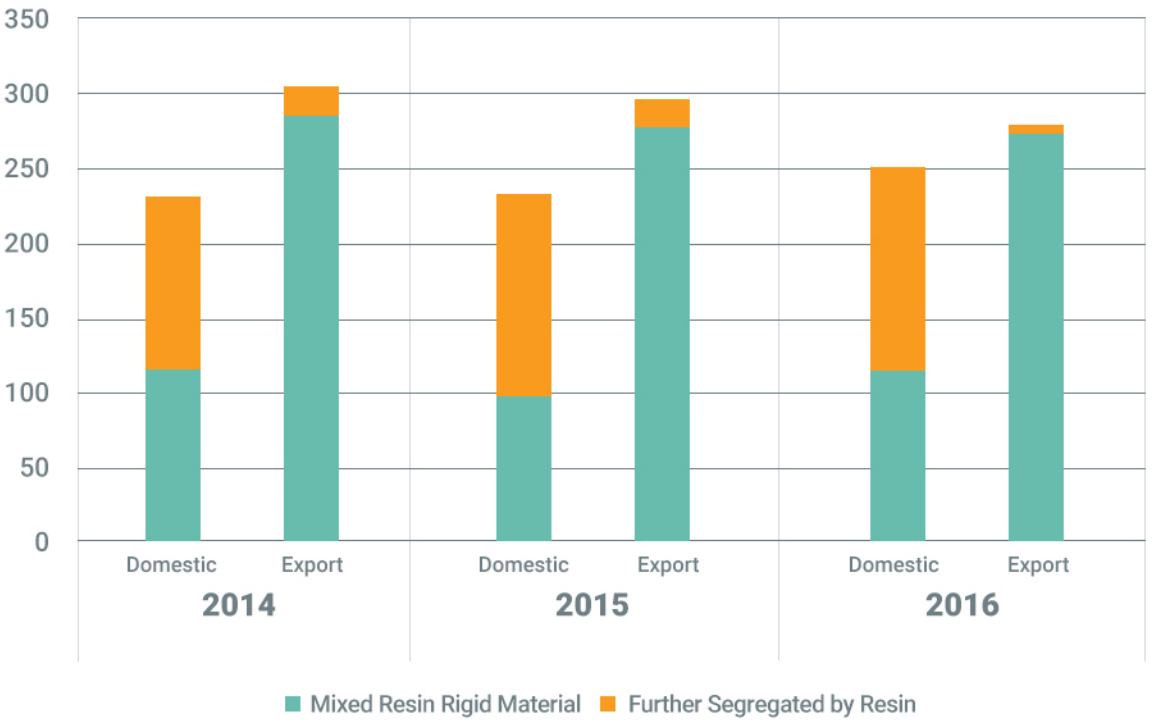
Figure 4: Sources of U.S. Recycled Non-Bottle Rigid Plastic, 2016



12 Non-Bottle Rigid Plastic Segregated by Resin includes commercial sourced/collected plastic and residential sourced plastic. Residential sourced material is further segregated, but may not be entirely one resin.

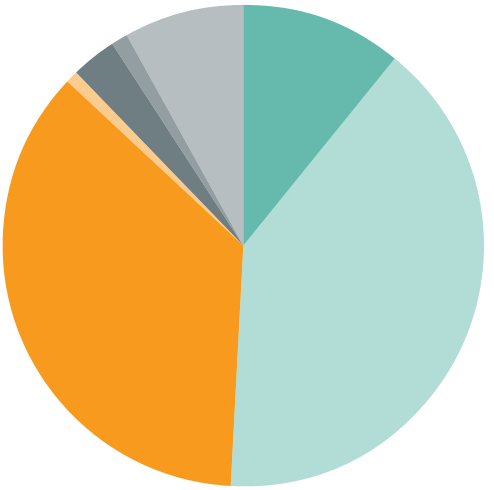
residential sourced non-bottle plastic, further segregated by resin, reporting 93 percent of purchases in this category with a slight increase in purchases overall; the decrease in this category for 2016 was due to a drop in export purchases. The non-bottle rigid plastic from mixed resin rigid bales increased by four percent even though mixed resin rigid bales reported as purchased decreased by three percent. This is due to the significant increase in purchases of mixed bulky rigid plastic and the decrease in purchases of mixed bales (1-7 and 3-7 bottle and rigid plastic bale categories), which contain less non-bottle rigid plastic by comparison; this occurred in both U.S./Canadian and export markets.

Figure 5: Non-Bottle Rigid Plastic from Residential Sourced Material



Export markets continued to purchase a larger percentage of non-bottle rigid plastics generated by residential collection in the United States at 52 percent in 2016; this is down from 56 percent in 2015 and 57 percent in 2014. Seventy-three percent of the residential non-bottle rigid plastic was purchased as part of mixed resin rigid bales, representing combined U.S./ Canada and export market purchases. Export markets purchased 69 percent of the residential non-bottle rigid plastic as part of mixed resin rigid plastic bales, down by two percent from 2015, following a one percent drop from 2014 to 2015. U.S./Canadian purchases of residential non-bottle rigid plastic from mixed resin rigid bales increased in 2016 by 21 percent after a decline of 17 percent from 2014 to 2015. This increase was mostly due to Mixed Bulky Rigid purchases, as most other mixed resin rigid bale purchases by U.S./Canadian buyers continued to decline.

Figure 6: U.S. Post-consumer Non-Bottle Rigid Plastic Recovered in 2016 By Resin (million of pounds)



	Millions of Pounds	Percent
PET	153	11%
HDPE	585	40%
PP	531	36%
LDPE	9	1%
PS	39	3%
PVC	18	1%
Other	121	8%

In 2016, HDPE comprised the largest proportion of the total quantity of non-bottle rigid plastic recycled, followed by PP. This is a shift since PP has historically comprised the largest portion. PP and HDPE together comprise the majority of the non-bottle rigid plastic in mixed resin rigid bales, and the majority of reported segregated resin material. HDPE contributed to 80% of the increase reported in 2016 with notable increases also reported for PP and PS in 2016, as compared to 2015. The increases for HDPE and PS are likely due in large part to new survey responders contributing data in 2016, whereas previous responders reported increases in PP purchasing in 2016 compared to 2015. PET showed a decrease overall in 2016 as compared to 2015.

Both shifts in mixed resin rigid bales and non-bottle segregated by resin contributed to the changes in the resin breakdown. The continued increase in Mixed Bulky Rigid Plastics bales in 2016 contributed to the increase in HDPE and PP. An overall increase in PP residential commodities (Tubs and Lids/ PP Small Rigid) also contributed to the increase in PP, along with an increase in commercial material. The largest decrease in mixed rigid resin bales was the 3-7 Bottle and All Rigid, followed by 3-7 Bottle and Small Rigid, and 1-7 and All Rigid. Decreases in the 3-7 Bottles and Small Rigid Plastic contributed to the decrease in PET along with decreases in segregated PET Thermoform quantities and commercial material. The increase in PS was due to material reported as segregated resin. Recovered volumes of LDPE, PVC and Other remained fairly flat.

UNITED STATES & CANADIAN CAPACITY AND END MARKETS

Based on survey responses, the estimate for non-bottle rigid plastic reclamation capacity in the U.S. for 2016 was approximately 1.2 billion pounds, a measure of total annual “pounds in” capacity to wash or process unwashed material directly into regrind, pellets, or end products. The non-bottle capacity was estimated based on information from 57 companies. At least 100 million pounds of additional non-bottle reclamation capacity was estimated in Canada in 2016, drawing on both U.S. and Canadian material. It is important to acknowledge that there was likely additional grind

capacity, in both the U.S. and Canada, for plastic scrap that was clean enough to be used unwashed that 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. reclamation capacity is for relatively clean—and often larger—PE and PP items, because it can be handled more cost effectively than small items and often does not require washing. Many buyers are seeking clean PE and PP-based bulky rigid materials, such as buckets, crates, battery casings, storage bins, and hangers.

Very few reclaimers reported their end-market information in the 2016 survey, but based on previous year's reporting, the primary U.S. / Canadian end uses for non-bottle rigid plastics are automotive products, crates, buckets, pipe, lawn and garden products, and other relatively thick-walled injection molded products. A small portion of the non-bottle rigid plastic recovered is used in composite products, such as lumber, and other extruded products.

THE REMAINING SECTIONS OF THIS REPORT PRESENT DISCUSSION AND RECOMMENDATIONS THAT REFLECT MORE RECYCLING'S EXPERTISE AND INDUSTRY KNOWLEDGE.

PERFECT STORM BREWING

MORE tracks the non-bottle rigid plastic recycling market throughout the calendar year. 2016 was another volatile year in terms of pricing for rigid plastics. Upward spikes in pricing occurred, but most scrap plastic commodities endured lower prices.

Significant investments have gone into making recycling easier with roll carts and single stream recycling—in more areas—leading to growth in collection of an evolving stream. The stream is ever changing with constant innovation in products. Packages are being made out of lighter material that pose greater challenges for recyclers. Making items lighter serves the goal of reducing greenhouse gas emissions, but exacerbates challenges within the recycling system, which is predominantly a weight-based, diversion-from-landfill oriented system. MRFs are weathering a perfect storm; MRFs must process a more complex stream and try to find revenue while facing demand challenges. So while we still have U.S. and/or Canadian markets for most segregated materials, the recycling system lacks the sorting capacity to extract value out of a commingled recycling stream.

With greater than 20 years of demand from China, overcoming the collective inertia fostered by ready export markets will be a challenge. China's 2013 Green Fence policy, restricting the import of scrap material, was a warning. At that time, the economic competitiveness of virgin resin helped make investment in Plastic Recovery Facilities (PRFs) attractive. PRFs were a saving grace during the first round of import restrictions from China, but by 2016, both MRFs and PRFs were experiencing a different economic environment for scrap. The challenge for MRFs continue with more restrictions on the import of scrap. The National Sword, China's 2017 policy restricting the import of scrap materials, may be the catalyst for the United States to fix the economic model for recycling and fill the gaps in the infrastructure.

The remaining contributor to this perfect storm is how the economic competitiveness of virgin resin deflates the case for investment in recycling, leaving the United States ill-prepared for global market changes. Some large MRFs have expanded sorting capabilities but, overall, instead of growth in secondary processing facilities (e.g., PRFs and secondary MRFs), there has been a decline in the number of facilities equipped to sort mixed rigid bales. This report documents a decline in mixed resin rigid bale purchases pre-National Sword impact. Given the insufficient infrastructure necessary to handle the growing recycling stream, there will likely be a much greater amount of plastic running off the MRF lines into the residue pile as MRFs focus on improving the quality of fiber (i.e., paper and cardboard) streams, given the high proportion of fiber compared to plastic.

As concluded in the **2015 National Post-Consumer Non-Bottle Rigid Plastic Recycling Report**, the recycling system needs more sorting capacity to handle residential non-bottle rigid plastic. Healthy end-use demand for both residential and commercial recycled plastic is also essential if we want to see continued growth of non-bottle rigid plastic recycling.

MARKET DEVELOPMENT & INFRASTRUCTURE EXPANSION

The deep question remains: how to fund the necessary expansion in sorting capacity, given weak demand? In late 2017, More Recycling, released the "**End Market Demand for Recycled Plastic**" study. The research, funded by the American Chemistry Council, the Association of Plastic Recyclers and the Sustainable Packaging Coalition, documented U.S./Canadian demand for polyethylene post-consumer resin (PCR): In 2015, converters had the capacity to process only 76 percent of the PE PCR acquired for recycling in the U.S. When PCR fails to offer an economic advantage over virgin, demand for PCR fades unless other benefits are realized (e.g., PCR use is tied to reduction in carbon dioxide emissions). Lifecycle studies and **EPA tools** indicate that PCR has a lower carbon footprint than virgin resin.[13] MORE recommends policies that recognize a product's overall impact on greenhouse gas savings which would help alleviate the economic barriers to using recycled content. If a product can be made with PCR without sacrificing performance, then it should have greater attractiveness in the market.

Once PCR is more highly sought, it is more likely that we'll see the necessary steps taken to build the infrastructure needed to sort recyclables to the point where they offer value to reclaimers and manufacturers. We need more sorting capacity within MRFs and other secondary processing facilities. Expanding the collection of the growing amount of PP rigid containers, PET thermoforms, and small format materials requires growth in end market demand and secondary processing. With new policy restrictions from China we, as a country, have an opportunity to capture more of our recyclables domestically, which in turn serves a greater objective: reducing marine debris and litter. While the United States is not one of the top five countries contributing to marine debris, according to the Ocean Conservancy's **Stemming the Tide** report, sending our mixed recyclables to countries that have been identified among the top five increases the odds of U.S. scrap becoming marine debris. Improving the quality of recyclables whether for U.S. and Canadian or overseas consumption is a step towards reducing marine debris. In order to create a more valuable, high quality domestic non-bottle rigid material stream, the public and private sectors need to invest in education, infrastructure and enforcement of policy that stimulates end market demand.[14]

13 https://www.epa.gov/warm/individual-waste-reduction-model-iwarm-tool

14 Stemming the Tide, https://oceanconservancy.org/wp-content/uploads/2017/04/full-report-stemming-the.pdf

HARMONIZATION OF RECYCLING EDUCATION & DESIGN FOR RECYCLING

We recommend that recycling education include more emphasis on buying recycled and improving the quality of the recycling stream. Quality is the result of the original design of the product or package, as well as the handling and sorting practices for that package once the product has been used. With key tools like the APR Design Guide® for Plastics Recyclability and the How2Recycle label working in partnership, there has been positive movement in designing for recycling.[15] However, with demand challenges for PCR, we recommend that future design goals strive for recyclability plus recycled content.

On the handling and sorting side of the system, we recommend clear, harmonized messaging. Many communities need support determining what should go in the bin and resources to help them educate their residents. We recommend continued alignment on messaging and terminology across recycling organizations. Efforts from The Recycling Partnership along with the Plastic Recycling Terms & Tools initiative provide market based, research driven terms, images and messages.[16]

15 The APR Design Guide for Plastics Recyclability, http://www.plasticsrecycling.org/apr-design-guide/apr-design-guide-home; How2Recycle label - www.how2recycle.info

16 http://www.recycleyourplastics.org/termsandtools

ADDITONAL INFORMATION

The Plastics Division of the American Chemistry Council, which provided funding to More Recycling (MORE) to prepare this report, provides resources to assist communities, businesses and others in increasing awareness and education about the recycling of plastic bottles, containers, plastic bags, and film. Formerly known as Moore Recycling Associates, MORE is a recognized expert in the field of plastics recycling and has been conducting recycling studies for over 27 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. For information about recycling non-bottle rigid plastics, visit **www.AmericanChemistry.com/Plastics**. Also, visit **www.PlasticsMarkets.org**, which is maintained by MORE, for information about additional markets and handling guidelines. This report and others on plastic recycling can be found at **www.MoreRecycling.com**.

DISCLAIMER

The *2016 National Post-Consumer Non-Bottle Rigid Plastics Recycling Report* was prepared to provide information to parties interested in the recycling of plastics, in particular non-bottle rigid plastic materials. While provided in good faith, 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. This work is protected by copyright. ACC which sponsored the report and is the owner of the copyright, hereby grants a nonexclusive royalty-free license to reproduce and distribute this work, subject to the following limitations: (1) the work must be reproduced in its entirety, without alterations; and (2) copies of the work may not be sold.