Wisconsin Rigid Plastics Recycling Study

December 2015

Prepared for the American Chemistry Council

MOORE
RECYCLING ASSOCIATES INC.

Introduction

The purpose of this study was to gather information about specific supplies of recyclable rigid plastics in the Industrial, Commercial, and Institutional (ICI) sectors in order to identify opportunities to facilitate greater recycling of rigid plastics. Increased recycling requires increased collection as well as growth in the recycling infrastructure. Attracting investment in reclamation and market development requires the documentation of a growing supply of good quality material. Opportunities to expand recycling within the ICI sector will likely lead to opportunities for expanded collection of many residential equivalents and ultimately an overall increase in Wisconsin plastic recycling.

The percentage of ICI plastic in the waste stream varies greatly by state and by resin. The ICI sector in Wisconsin generates 61 percent (63,000 tons) of the total rigid plastics landfilled each year based on the 2009 Wisconsin Waste Characterization Study conducted by Recycling Connections Corporation.

For the purpose of teasing out the broad category of rigid plastics in the 2009 Wisconsin Waste Characterization Study, Moore Recycling Associates reviewed currently available waste studies, virgin resin sales reports, the North American Industry Classification System (NAICS) and code data. In addition, we surveyed Wisconsin extension program managers, major manufacturers from all of the industrial regions in Wisconsin, transfer station managers within the industrial regions, commercial plastic recycling service providers, reclaimers, material recovery facilities (MRFs), and exporters. For reasons outlined below in the Barriers section, after extensive research, we are left with significant unknowns. We were able to account for roughly 60 percent of the 63,000 tons of rigid plastics in the ICI waste stream.

Finding specific data in the category was stymied by several barriers. The waste characterization methodology adopted by EPA and loosely mimicked by states is impractical in terms of definitively determining how much non-bottle rigid plastic is available for recycling. We used the EPA categories of information by resin and compared them to the eleven (11) state waste characterization studies and found significant variation between studies. For example, the EPA has 12 pounds per person in the total PET packaging category, yet the state average is 24 pounds with a range of 11 to 52.

Barriers

Waste analysis studies represent a tradeoff between available funding and comprehensiveness. Competing issues and interests impact the data that is produced. If the plastics industry makes the case that sufficient buyers and demand exists to buy non-bottle rigid plastic, then perhaps, in future studies, EPA and States will research more discrete categories based on scrap commodities rather than grouping readily recyclable materials with less recyclable materials.

As far as tracking the waste to its source, the process is again hindered by lack of information. In some cases it was necessary to make assumptions in order to connect the dots. For example, the WI waste characterization was only able to specify the percentage of any given material category in multifamily waste. When multifamily percentages are compared to single family there are disparities, but without specific tonnage data it is difficult to tell how impactful that is.

Arguably the largest blind spot in Wisconsin waste is the industrial sector. Because manufacturers in WI are not required to report their waste, may have apprehension sharing data because it's either proprietary or may be viewed as negative, phone calls to the manufacturers were generally fruitless. Many simply said they recycle the recyclable material and provide recycling to their employees.

Sources of Rigid Plastics

Industrial

Moore staff contacted 15 major manufacturers to ask about rigid plastic waste generated at manufacturing facilities. Nearly all participants reported that their company generated little to no rigid plastic waste and their employees had access to onsite recycling for bottles and containers. Interviews with several transfer station managers indicated that much of the rigid waste was coming from retailers in population centers; they said they believe manufacturers send very little rigid plastic waste through their transfer stations.

Commercial

Based on interviews and observations, most of the ICI rigid plastic in the waste stream likely comes from the commercial sector. Restaurants and supermarkets alone may contribute 25 percent of the 63,000 tons of rigid plastics each year. The commercial sector also includes multifamily waste based on the methodology of Wisconsin's waste characterization study. Multifamily waste accounts for nearly 25 percent of ICI rigid plastic in Wisconsin's waste stream.

Restaurants / Hotels / Malls:

According to the study *2006 CalRecycle Waste Disposal and Diversion Findings for Selected Industry Groups*[1], there are 99.3 pounds of rigid plastic per restaurant employee per year[2]. Assuming there are 267,600 hotel employees in Wisconsin[3], restaurants may contribute up to

[1] http://www.calrecycle.ca.gov/publications/Documents/Disposal%5C34106006.pdf

[2] We used the 2006 rather than 2014 Report because the 2006 study provides per employee data and is closer to the last WI Waste Characterization Study which was conducted in 2009.

[3] http://www.restaurant.org/Downloads/PDFs/State-Statistics/2015/WI_Restaurants2015

13,280 tons per year of rigid plastic to the ICI rigid plastic stream. Just under half of the restaurant rigid plastic (43.5%) is PET and HDPE bottles; the next largest (32.6%) category is durable plastic.[4]

The same CalRecycle study shows that hotels generate 121 pounds of rigid plastic per employee per year. Multiplying this by the number of hotel employees in Wisconsin[5] (30,377), shows that approximately 1,840 tons of ICI rigid plastic comes from hotels. The composition consists of PET/ HDPE bottles at 38.7 percent; HDPE buckets and containers are 12.9 percent, and durable plastic makes up 32.3 percent. The remaining material is other plastics (#3-#7).

The CalRecycle study calculates 65 pounds of rigid plastic per 1000 square feet of mall space per year. Multiplying this by the number of mall square feet in Wisconsin[6] (12,651), shows that malls generate approximately 410 tons per year of rigid plastic. Most of the rigid plastic found in malls is durable plastic.

Retail Grocery Stores:

A 2010 report[7] on rigid plastics in groceries by the Association of Plastic Recyclers (APR) shows that supermarkets can generate 4 to 5 tons of rigid plastic waste per store per year. We used population and a national total for supermarkets reported by the Progressive Grocer Magazine to extrapolate a total of 685 supermarkets in Wisconsin. This equates to an estimated 2,719 to 3,399 tons of rigid supermarket scrap plastic generated each year.

	Tons	Percent of Total ICI Rigid
Total ICI Rigid Plastic	**63,000**	**100%**
Grocery Rigid Pkg. Estimate (High)	**3,399**	**5.4%**
Grocery Rigid Pkg. Estimate (Low)	**2,719**	**4.3%**

Table 1. Estimate of grocery plastic in WI using Association of Post-Consumer Plastic Recyclers Study: Recyclable Rigid Plastics Recovery in Supermarkets June 2010 and Progressive Grocer Magazine's total number of supermarkets nationwide found on the Food Marketing Institutes website. [8]

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[4] Durable Plastic Items are defined as all other plastic objects other than containers, or film plastic. Examples include mop buckets, plastic outdoor furniture, plastic toys, large paint/food buckets, CD's, plastic stay straps, sporting goods, and plastic house wares such as dishes, cups, and cutlery. It also includes building materials such as house siding, window sashes and frames, housings for electronics, fan blades, impact-resistance cases (e.g., tool boxes, first aid boxes, tackle boxes, sewing kits, etc.), and plastic pipes and fittings.

[5] http://www.ahla.com/uploadedFiles/ahlaStateFactSheet_Wisconsin%281%29.pdf

[6] http://www.mallseeker.com/wisconsinmalls.aspx

[7] http://www.recyclegroceryplastics.org/images/pdf/vd_Phase-1-Final%20Report.pdf

[8] http://www.fmi.org/research-resources/supermarket-facts

Using the CalRecycle study methodology, “food stores” generate 2,650 tons per year, which corroborates the APR study.

According to the APR study, material found in grocery rigid waste includes: PP and PE buckets, PP floral bins, sanitizer bottles, and corrugated containers. This material profile is very close to the profile of much of the waste stream category called “Other Rigid Plastic Packaging” in the WI study, which includes tubs, lids, pails, and jars. This category makes up 68.9 percent of the rigid plastic waste in Wisconsin. It is possible that this large chunk of the rigid plastic could be readily recyclable material, but without more or better data, we have no real way of knowing.

Multifamily Units:

The 2009 Waste Characterization Study (WCS) shows a large disparity between multifamily and single-family waste profiles. PET beverage and non-beverage bottles and HDPE natural bottles make up a much larger percentage of the waste stream at multifamily units than single-family homes. Since multifamily units fall under the umbrella of ICI rather than residential, these readily recycled bottles and jars likely make up a large proportion of the 19,460 tons of bottles and containers found in the ICI waste stream.

While the WCS broke up waste into three categories (Single Family, Multifamily and ICI), they included multifamily waste in the ICI sector. This is due to the fact that large apartment complexes are often included in commercial recycling routes instead of residential routes, which means it is difficult to separate the ICI and multifamily data.

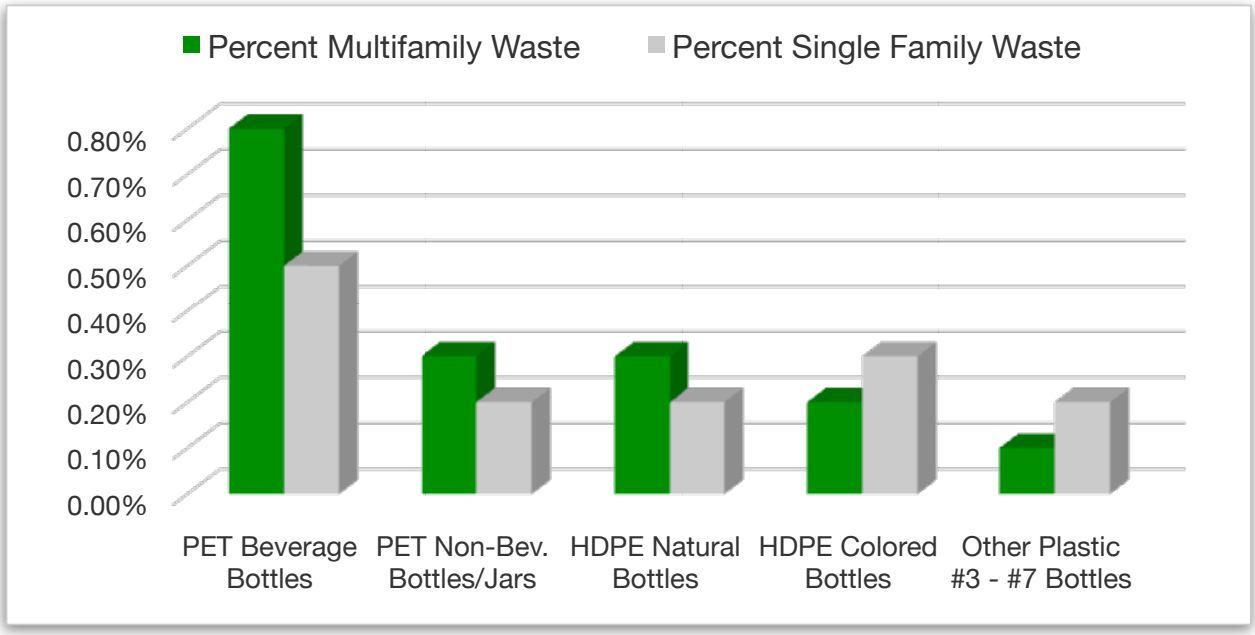

Figure 1. Comparison of percent of bottle waste in single-family versus multifamily residential.

The WCS researchers did conduct a smaller study of multifamily waste, which showed a much higher composition of bottles and jars than either ICI or single family housing. Since the multifamily audit was not done on the same scale as the ICI or single family, the researchers were not able to estimate a total tonnage per year. Instead they reported the amount of each component as a percentage of the total waste stream. As shown in Figure 1, this percentage was 60 percent higher than single family for PET Beverage Bottles, and 50 percent higher than PET Non-beverage Bottles and HDPE Natural Bottles.

Based on this information, it is expected that a large portion of these bottles in the ICI stream are generated at multifamily housing units. These readily recyclable PET and HDPE bottles account for approximately 17,800 tons, or 28 percent of the 63,000 tons. Although Wisconsin State law requires all multifamily housing units provide their residents with access to recycling, as with most communities, there appears to be a significant amount in the multifamily sector that is not captured for recycling.

Institutional

Moore staff used data from a number of generation-specific waste audits to estimate that universities and hospitals generate around 6 percent (3,500 tons) of the 63,000 tons of rigid plastics in Wisconsin waste stream.

Universities:

Very few colleges and universities have done extensive waste characterization studies, but there are five that represent various school sizes across the country. We calculated the amount of rigid plastics per student enrolled at each school and then used the average of the 5 schools to extrapolate the total number in Wisconsin based on the number of students enrolled in the state.

Based on these studies, there are approximately 18 pounds (0.009 tons) of rigid waste produced per student each year. Being that there are roughly 359,000 students enrolled at colleges and universities in

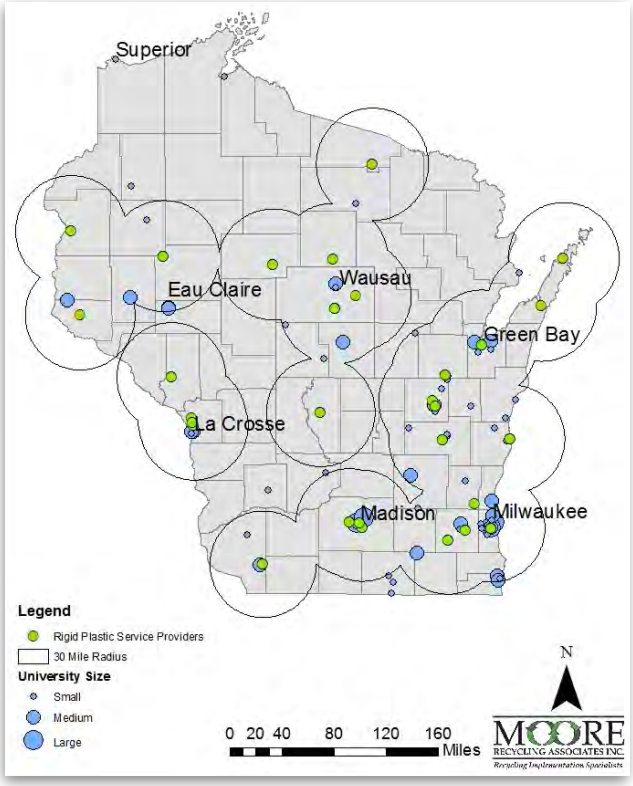

Figure 2. Universities and Rigid Plastic Service Providers according to Wisconsin Recycling Marketplace[9]

[9] http://www4.uwm.edu/shwec/wrmd/search.cfm

Wisconsin, the rigid waste for these students accounts for 3,178 tons, or 5 percent of ICI rigid. According to the studies, plastic generated in the residence areas of universities are very similar to that generated in multi-family dwellings.

Hospitals:

The Healthcare Plastics Recycling Council (HPRC) and Stanford Hospital conducted an extensive waste characterization study in 2012. This study estimated that the hospital, which had 613 active beds, produces 18.7 tons of recyclable rigid plastic waste a year. According to the American Hospital Directory there are 11,564 active hospital beds in Wisconsin, which translates to roughly 354 tons per year.

The HPRC study only broke out bottles versus other rigid plastic; a large majority (roughly 90%) of the material was other rigid plastic. According to HPRC's Common Recyclable Healthcare Plastics guide[10], most of the rigid plastics are PET and HDPE bottles or rigid PP.

Total: Sources of Rigid Plastics

Sector	Estimated Amount (tons)
Industrial	Unknown
Commercial	
Restaurant	13,280
Supermarket	2,720
Multifamily Residential	15,500
Hotels	1,840
Malls	410
Other	Unknown
Institutional	
Hospitals	350
Universities	3,180
Other	Unknown
TOTAL	**37,280 of 63,000**

Table 2. Roughly 40 percent of the source of rigid plastic in the ICI waste stream is still unknown.

[10] https://www.dropbox.com/sh/n0omcekvgsx54w6/AABCSgYf_8CJNHQTZX4IJELKa/Common%20Recyclable%20Healthcare%20Plastics.pdf?dl=0

State of the Market for Rigid Plastics

Like many commodities, prices for rigid plastic scrap are depressed. That said, the underlying economics are sound and the infrastructure—while not complete—is robust. Prospects for expansion are encouraging.

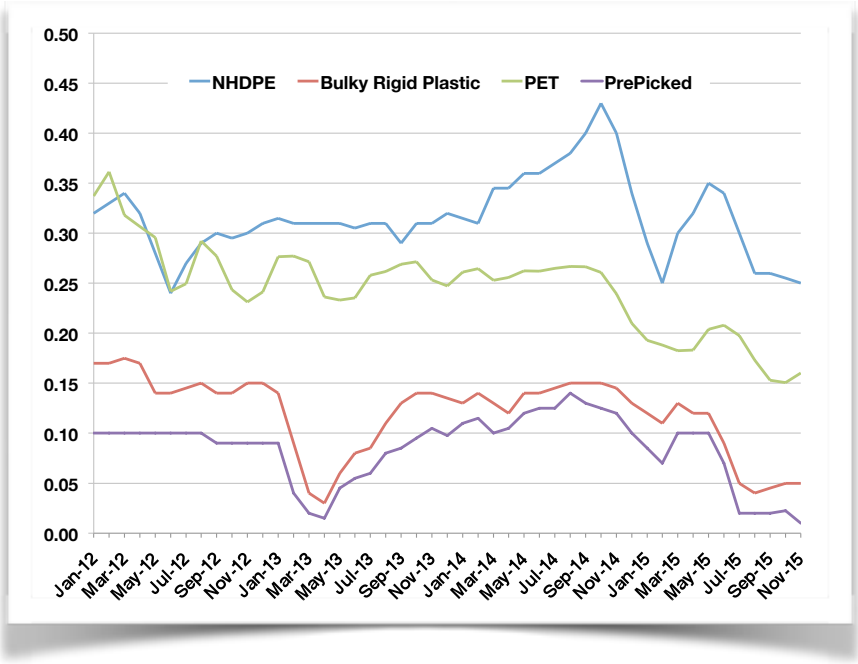

Figure 3. Historical Scrap Prices for Various bale grades

Markets exist in and around Wisconsin for most grades of rigid plastic including mixed rigid plastic purchased by plastic recovery facilities referred to as PRFs. PRFs accept mixed rigid plastic and separate and—in most cases—reclaim one or more resin type.

There is demand for all the common grades of plastic including PET bottle and thermoforms, HDPE bottles, and non-bottle rigid plastic.

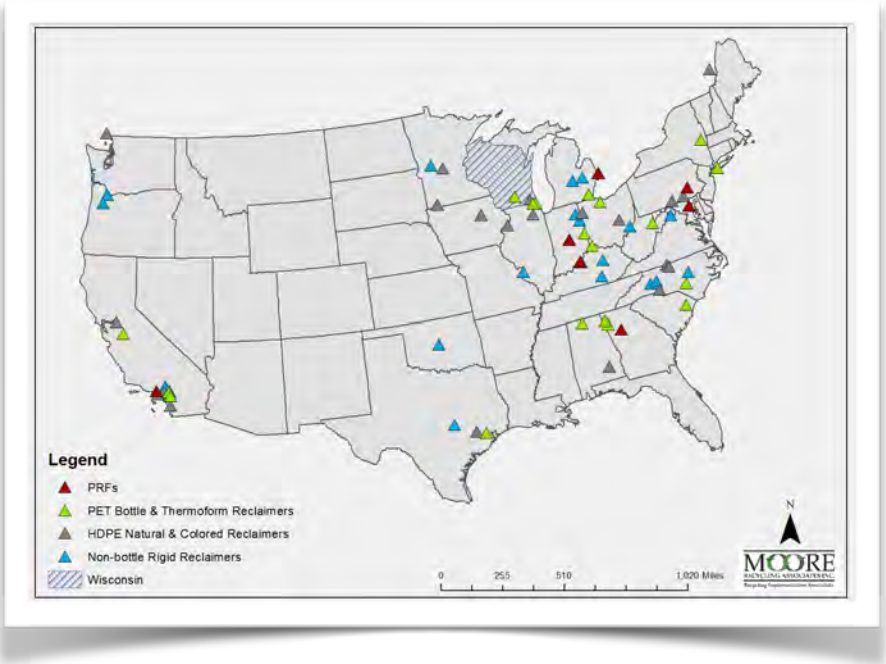

Figure 4. Buyers for Rigid Plastic Material: for specific information on each market see <http://www.zeemaps.com/view?group=1774998&x=-95.651340&y=41.676707&z=14>

In addition to the infrastructure for separation and reclamation, there is a strong regional infrastructure of rigid plastic recycling service providers shown on Figure 2.

MRFs also accept most rigid plastics and generate rigid plastic bales. Most conduct four (or five) rigid plastic bale sorts[11]: Bulky Rigid, PET Bottles, HDPE Bottles (or Colored HDPE Bottles, Natural HDPE Bottles), and Pre-picked No Bulky. Yet, there are other sorting options including All Rigid Plastic No Bulky, PET Thermoforms, and Polypropylene. The APR's Rigid Plastic Recycling Program worked with Moore Recycling Associates in 2014 to develop an online calculator <recyclemoreplastic.org/sortforvalue> that illustrates the economic value of various sorts of recyclable rigid plastics.

This screen shot shows an example using current pricing estimates:

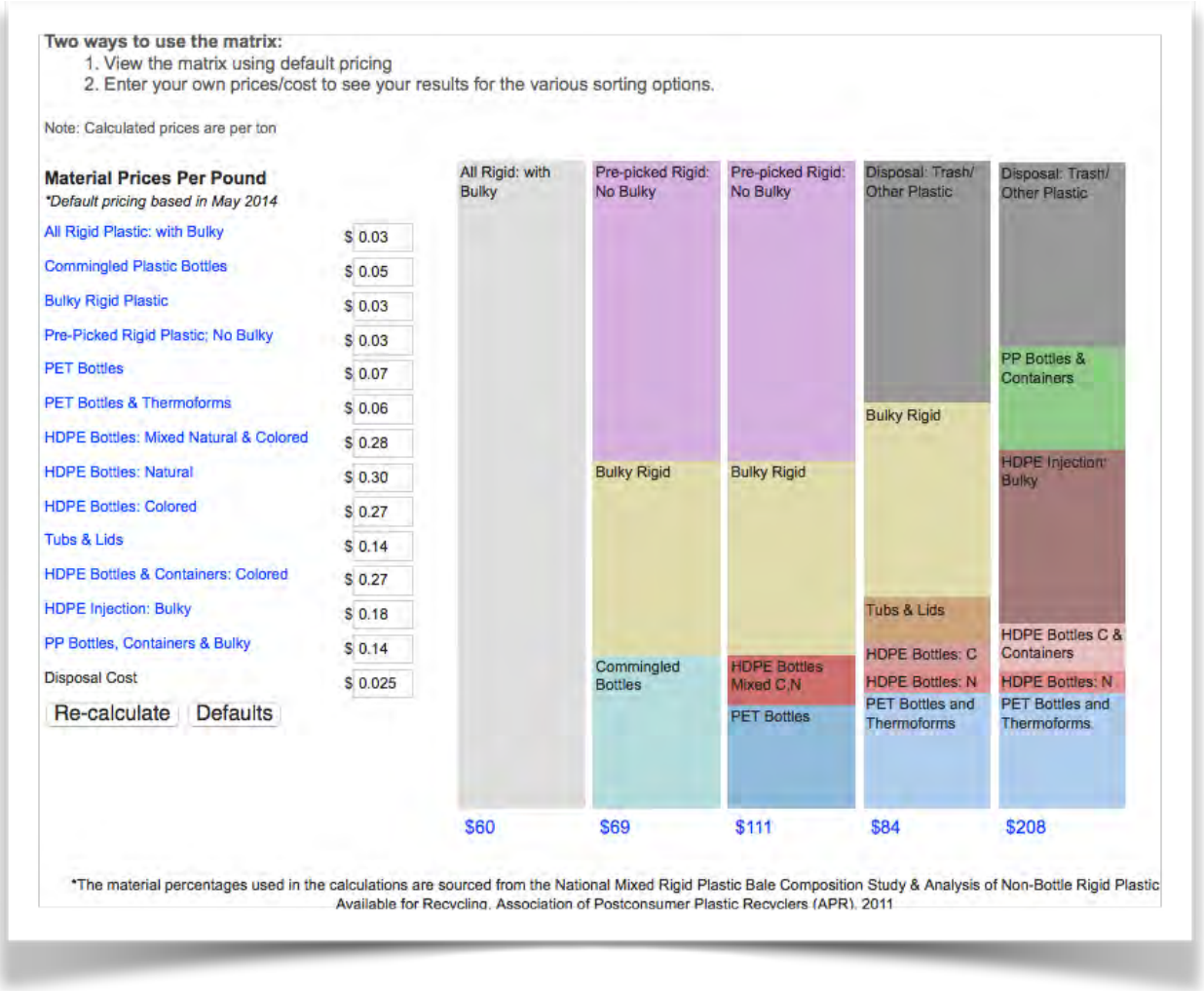

Figure 5. Sort for Value Calculator

[11] All bale grades have hyperlinks to APR Model Bale Specification

Interpreting the graphic

The first column on the left represents the value of one ton of All Rigid Plastic. Using the data from All Rigid Plastic bales (as determined in the 2011/12 National Mixed Rigid Plastic Bale Composition Study) each successive bar to the right represents the same material broken out into discrete product types. The second bar comprises three sorts, the third bar has four sorts and the last two bars have five sorts each. Please note: the last bar is over estimating the value of the bale because the percentage of high value HDPE Injection Bulky found in a typical program has seen significant market changes—a narrowing of allowable material—thus the volume of HDPE Injection will likely be lower and the volume of remaining "Trash/Other," higher.

Other/Trash

The National Mixed Rigid Plastic Bale Composition Study found a fairly high percentage of contamination (an average of 13%) in All Rigid Plastic bales. In addition, a percentage of the bales (16% to 25%) do not currently have North American buyers if separated as indicated. Thus, with more sorting comes more trash and non-salable material, but also cleaner products worth more per ton. In the first three bars, the Other/Trash is mixed with the commodities (one of the reasons it has a lower value).

Other considerations

The following figure is a screenshot of an Excel tool that can assist a MRF operator or other stakeholder with the decision to:

Separate PP and market it as a source separated Polypropylene bale, or

Include the PP with the non-bottle plastics and market it as a Pre-picked bale

PP Sorted and Pre-picked as Residual		Daily Tons	Weekly Tons	Monthly Tons	Price Per Lb.	Bottom Line Per Month
Residual Generation		16	80	346	$ (0.025)	$ (17,320.00)
PP Generation		0.75	4	16	$ 0.140	$ 4,546.50
Net Revenue						$ (12,773.50)

PP Included with Pre-picked						
Recovery of Pre-picked from Residual	30%	Daily Tons	Weekly Tons	Monthly Tons	Price Per Lb.	Bottom Line Per Month
Pre-picked Recovery		5	24	104	0.03	$ 6,235.20
Residual Generation		11	56	242	$ (0.025)	$ (12,124.00)
PP Generation		0.75	4	16	$ 0.03	$ 974.25
Net Revenue						$ (4,914.55)
Monthly Bottom Line Impact	$ 7,858.95					
Annual Bottom Line Impact	$ 94,307.40					

Figure 6. Decision to Sort: PP sorted vs. PP with Pre-Picked Bales

The table assumes that if the PP is removed from the non-bottle stream, then the remaining non-bottle material will be residual to be disposed of at a cost (because there are no—or very limited—markets for mixed resin bales with the HDPE, PET and PP removed).

The figure also assumes the same bale values and disposal cost as the calculator above plus:

Amount of daily residual that the sort line is producing: 16 tons per day
Estimation of daily PP pounds, if separated: 0.75 tons per day
Estimated percentage of Pre-Picked bale material in residual: 30%

To obtain a copy of this table as an Excel spreadsheet, please go to RecycleMorePlastic.org.

Recommendations

More detailed waste studies could certainly shed light on the exact make up and source of rigid plastics ending up in the Wisconsin waste stream, but there is enough information available to inform future strategies and near-term actions aimed at capturing rigid plastic in the waste stream. Clearly efforts should be focused on multi-family and restaurants. University and grocery store recycling efforts are also worthwhile. Resources for each of these are listed in Appendix A.

Rigid Plastic Collection Efforts

There are several specific areas that could see strong results. Strengthening the work with APR on rigid plastic collection at supermarkets is a relatively simple and proven strategy. In addition, consider utilizing the resources of the Healthcare Plastic Recycling Council and the existing plastic service providers network to increase rigid plastic recovery from hospitals. The WI Department of Natural Resources has an excellent restaurant recycling guide[12]that, along with additional resources found in Appendix A, could help increase rigid plastic collection.

Under Wisconsin law, landlords are required to provide recycling services on their properties and to educate residents on each building's recycling programs at move-in and twice per year thereafter. With enforcement, this legislated tool should provide significant results. One additional consideration for multi-family recycling, is the synergy between the potential to recover scrap plastic at universities and multi-family locations. Most universities have a large and transient multi-family population that requires targeted educational efforts.

Lastly, as noted in Additional Considerations, most of the ICI locations that generate rigid plastic also generate film, so a coordinated effort for recycling commercial and institutional rigid and film plastic is recommended.

[12] http://dnr.wi.gov/files/PDF/pubs/wa/WA1536.pdf

Data Collection and Tracking

Categorize Plastics in Waste Audits by Commodity:

Certain plastic categories in the Wisconsin Waste Characterization Study were too broad to determine recyclability or value while others were very clear and useful. From the point of view of a recycler, plastic lawn furniture and drinking straws are very different commodities. However, in the WI study they both fell in the category “Other Plastic”. Plastic lawn furniture is part of the commodity, “Bulky Rigid Plastic” with markets and value, but drinking straws are not readily recyclable at this time. If the goal of the study is to highlight opportunities for waste reduction through recycling, it is best to group materials according to recycling commodity category.

Track Waste to Source:

According to the 2009 Wisconsin Waste Characterization Study, the ICI sector generates 373 thousand tons of plastic a year—almost twice as much as the residential sector. A more in-depth waste characterization specifically focusing on ICI plastic waste to its source would illuminate areas of focus overlooked by the current data. These studies could take place at transfer stations, rather than the landfill, where it would be easier to determine the generators. Working with the commercial sector to tackle both non bottle rigid and film from both residents and the commercial sector are likely the most cost affective areas of focus. Material may be concentrated and there is a benefit to retailers in reducing their disposal costs.

Additional Considerations

Commercial Film:

Plastic film is a commodity that is not compatible with traditional recycling and therefore overwhelmingly ends up in the landfill—even where mandatory recycling exists. The following graph highlights the potential for film recycling compared to rigid plastics. The Wrap Recycling Action Program has laid the groundwork for expansion in access, developed tools and resources but significant growth in recycling requires sustained education. Just focusing on the low-hanging fruit (Shopping bags and Industrial Film Pkg.), based on historical pricing, millions of dollars in scrap film are discarded annually in Wisconsin.

Agricultural film also has available markets in North America, but faces additional challenges. Quality and efficiency in collection are the elements necessary for recycling of scrap film.The “Other Plastic Film” category, which makes up the majority of all plastic waste, is made up of more difficult to recycle materials like multilayer/multi-resin film, shower curtains, garbage bags and plastic tarpaulins.

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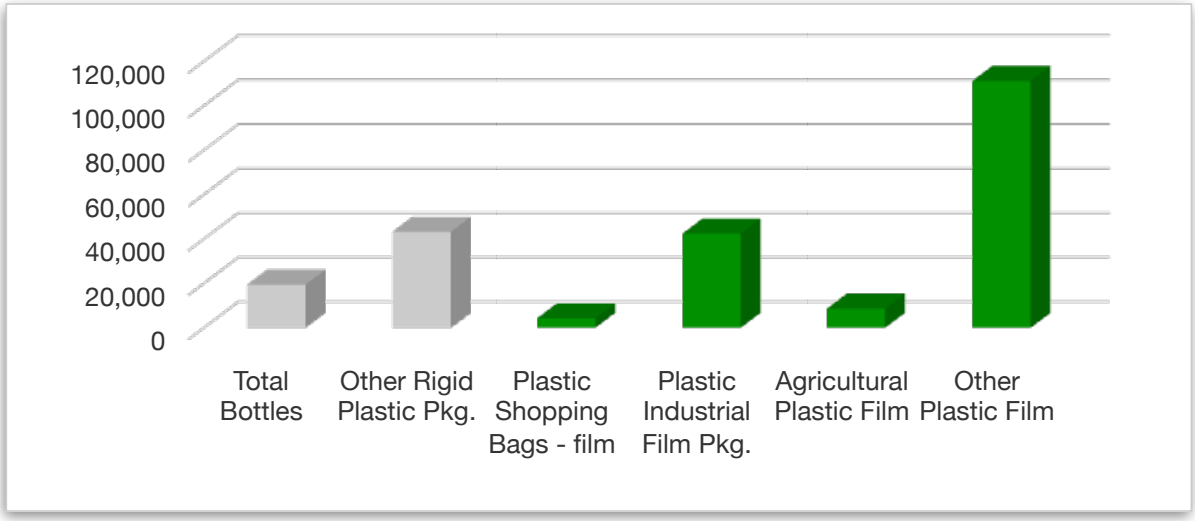

Figure 7. Comparison of film and rigid plastic waste generation in WI

About Moore Recycling Associates Inc

Moore Recycling Associates offers over 25 years of research, consulting and management experience in the recycling of postconsumer materials; we provide technical, management and short- and long-term strategic planning services. Packaging, especially plastic packaging, is our primary area of expertise, and we've developed a deep understanding of its complex and ever-changing lifecycle—from collection to recycling infrastructure to end-use markets.

That understanding is grounded in extensive hands-on research—conducted on the sorting-room floor, in visits to domestic and overseas markets, and through an annual National Plastics Recycling Survey. It's refined through rigorous analysis of the collected data, and shared in a series of influential reports and trade-publication articles (available on the Publications page of www.MooreRecycling.com).

Data Sources

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Appendix A: Resources

Plastic market information: PlasticMarkets.org

Grocery store plastic recycling resources: www.RecycleGroceryPlastics.org

Common plastic recycling terminology to help streamline communications: www.RecycleMorePlastic.org/TermsAndTools

College and University Recycling Coalition: http://curc3r.org/

Multi-family recycling toolkit: http://metrovancouverblog.org/2015/10/28/multi-family-recycling-toolkit-provides-support-to-landlords-and-residents-to-improve-recycling-efforts/

Multi-family recycling resources: http://www.calrecycle.ca.gov/LGCentral/Programs/MultiFamily/Default.htm

Plastic recycling guide for hospitals: www.hprc.org/#!hospicycle

Restaurant recycling information: www.restaurantsrecycle.org

Restaurant recycling article: http://nrn.com/sustainability/restaurants-weigh-costs-benefits-recycling

Restaurant recycling case studies: www.partnership4recycling.org/web/deao/recycling/abc/case-studies