

Supplemental Information: Selected Responses to DEQ's Recycling Acceptance Lists Request for Information

Materials Management Program

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DEQ is a leader in restoring,
maintaining and enhancing
the quality of Oregon's air,
land and water.



State of Oregon
Department of
Environmental
Quality

In February 2022, Oregon DEQ published a Request for Information regarding materials that might be considered for inclusion in Oregon's recycling acceptance lists. The RFI generated several dozen responses.

This document includes a sample of these responses relevant to materials that DEQ has recommended for inclusion in either the Local Government Recycling Acceptance List or the Producer Responsibility Organization Recycling Acceptance List.



Request for Information

February 3, 2022

Request for Information: Oregon statewide recycling collection list and producer-collected materials (for recycling)

The Oregon Department of Environmental Quality seeks technical information that can be used to evaluate materials against criteria set forth in statute. **Information should be submitted by March 20, 2022.** DEQ will use this information to assess materials and develop recommendations for inclusion (or exclusion) on statewide recycling lists, which are being developed in accordance with Section 22 of Oregon's Plastic Pollution and Recycling Modernization Act (Senate Bill 582).

Background and Context

In 2021, the Oregon Legislature adopted [Senate Bill 582](#), the Oregon Plastic Pollution and Recycling Modernization Act, and Governor Kate Brown signed it into law. The Act requires numerous changes that are intended to modernize and stabilize recycling services in Oregon and further reduce the environmental impacts of certain materials across their full life cycle.

Section 22 of the Act requires the Environmental Quality Commission to identify two lists of materials by administrative rule. Both lists and the requirements to collect and recycle the materials on those lists will go into effect on July 1, 2025.

Statewide collection recycling list [per Section 22(1)(a)]

The first list outlines "materials collected to provide the opportunity to recycle". This refers to on-route and drop-off recycling collection opportunities provided by local governments in communities with populations over 4,000 and includes requirements for solid waste disposal sites to collect materials for recycling.

A subset of the first list will specify all materials to be collected together. These commingled recyclables will set the foundation for the "uniform statewide collection list". Producer responsibility organizations can propose new items for the uniform statewide collection list by submitting a program plan and receiving approval from DEQ. Local governments offering commingled collection will be required to collect all of the materials on the uniform statewide collection list and will not be allowed to promote acceptance of other materials in commingled collection. Administrative rules may require local governments to collect additional materials separately (not commingled).

Note: The Act defines covered products to include packaging, printing and writing paper, and food service ware. However, the list of materials to be collected under the opportunity to recycle may extend beyond covered products to include other materials appropriate for on-route or drop-off collection, such as motor oil and scrap metal. While the Act provides no producer obligations for the recycling of such materials, DEQ could still require collection and proper sortation and marketing of them by local governments, their service providers, and permitted processing facilities. Therefore, this Request for Information includes and extends beyond covered products under the Recycling Modernization Act.

Producer-collected materials list [per Section 22(1)(b)]

The second list to be identified by administrative rule includes “covered products of which a producer responsibility organization must provide for the collection through recycling depot or mobile collection events as provided in section 15” of the Act. For purposes of illustration, an example could be film plastics, which are recyclable but largely incompatible with commingled processing systems, thereby requiring separate collection and handling. Section 22 also requires the Commission to establish collection targets, performance standards, and convenience standards for materials on this list via administrative rule.

DEQ plans to propose draft rules to the Commission for consideration and potential adoption around September 2023. Draft rules for implementation of Section 22 will be bundled with several other rules relating to the Recycling Modernization Act as part of a single, larger rulemaking. For further information about Section 22 and DEQ’s plans to evaluate materials, please refer to that [project’s web page](#). For information about the larger Recycling Modernization Act, please refer to the [Act’s main web page](#).

Statutory Criteria

Section 22 of the Recycling Modernization Act requires the Commission to consider multiple criteria when determining whether a material should be included in one of the state’s lists of materials to be recycled. These criteria are as follows:

- (a) The stability, maturity, accessibility, and viability of responsible end markets;
- (b) Environmental health and safety considerations;
- (c) The anticipated yield loss for the material during the recycling process;
- (d) The material’s compatibility with existing (Oregon) recycling infrastructure;
- (e) The amount of the material available;
- (f) The practicalities of sorting and storing the material;
- (g) Contamination;
- (h) The ability for waste generators to easily identify and properly prepare the material;
- (i) Economic factors;
- (j) Environmental factors from a life cycle perspective; and
- (k) The policy expressed in Oregon Revised Statutes 459.015 (2)(a) to (c), as amended by Section 46 of the Recycling Modernization Act.

Request for Information

DEQ requests information that can support evaluation of materials considered for recycling against the criteria listed above. Information should relate to the specific criteria and should be supported with citations, technical reports, and/or other documentary evidence where available.

Respondents are invited to provide information for one or multiple materials and for one or multiple criteria; respondents do not need to provide information for all criteria. Respondents may also submit more than one response (for example, a different response for each of three different materials). If a single response document addresses more than one material, please organize the response by material.

Responses should clearly identify and define each material for which information is being provided. Information in the form of supplemental reports or evidence can be provided via separate attachments or hyperlinks to documents that can be viewed or downloaded from a webpage.

All responses should clearly identify the contact name, phone number, and email address of the submitter so that DEQ can follow-up in the event that additional information is requested.

Please submit all responses via email to rethinkrecycling@deq.oregon.gov. Responses should be submitted by midnight (Pacific Time) on March 20, 2022. DEQ may be able to consider information submitted after that deadline, but strongly encourages potential respondents to submit as much information as available by that date.

Materials of Interest

DEQ has begun an internal review of materials against the above-referenced statutory criteria. This has resulted in some initial sorting of materials into two categories:

- **Materials easily justified for inclusion in commingled recycling collection programs.** These include uncoated corrugated containers, newsprint, printing and writing paper, steel and aluminum cans, PET bottles and HDPE bottles. While DEQ is required to evaluate all materials against statutory criteria prior to recommending them to the Commission for inclusion in the uniform statewide collection list, less new evidence is needed to justify the inclusion of these materials. Potential respondents to this Request for Information would be justified in making these materials a low (or lower) priority for purposes their response.
- **All other materials not mentioned above.** This includes some materials that are collected for recycling in some but not all collection programs at present (e.g., gable top cartons), and some that are not collected for recycling in Oregon but are collected elsewhere (e.g., PET thermoforms). DEQ will focus its research on these types of materials and encourages submission of information that will aid in such evaluation.

Please note that “recycling” in the context of this request does **not** include composting, anaerobic digestion, or the recovery of energy through combustion of the material; yard and food wastes, nor the composting of technical nutrients such as paper or bioplastics are not the subject of this assessment. In addition, DEQ is only evaluating under Section 22 materials that are present in the municipal solid waste stream and which could be considered available and appropriate for recycling through on-route or drop-off collection. The scope of this

evaluation further excludes materials that primarily originate through construction or demolition activities (e.g., lumber, drywall) as well as most hazardous materials (paint, mercury thermostats, etc.), except for used motor oil. Further, as part of this project, DEQ does not intend to evaluate the recycling of furniture, electronic devices (other than appliances), textiles, fats/oils/greases, or animal mortalities.

How Information May Be Used

DEQ will review submitted materials and may request clarification or additional information.

All information transmitted to DEQ through this process will become a public record and will be subject to Oregon's public records laws. DEQ may share all or a portion of any submittal with a technical workgroup, a rulemaking advisory committee, the Environmental Quality Commission, or other parties, including the media. Submittals may be re-posted by the Department. Respondents should not share information that is considered proprietary or confidential in nature.

DEQ will use information submitted through this process as part of a larger assessment to evaluate materials against the criteria listed in Section 22(3) of the Recycling Modernization Act. That assessment will inform DEQ's recommendations for material to include on the uniform statewide collection list, other materials that local governments are obligated to collect for recycling as part of providing the opportunity to recycle, and the list of materials that producer responsibility organizations are required to provide recycling services for. Ultimately, the decisions about which materials to collect for recycling may have regulatory, economic, and environmental impacts.

Potential respondents should provide evidence and documentation and submit responses that are accurate. Speculation, if any, should be clearly noted. If respondents believe that submitted information is likely to change in the near future (for example, due to emerging technologies or new markets), please describe both the current state of affairs as well as the predicted change, including anticipated dates and reasons for it.

Next Steps and Additional Opportunities for Involvement

Following review of submitted materials, DEQ may request additional information from respondents. In some cases, DEQ may also invite a respondent to participate in a meeting with a technical workgroup in order to further discuss their submittal.

Meetings of the technical workgroup (and rule advisory committee) will be open to the public and DEQ will provide an opportunity for remote participation and public comment. Meeting materials for the technical workgroup will be posted on [this page](#). The webpage for the rules advisory committee has not yet been created but will be available later in 2022.

Questions

For questions regarding this Request for Information, please email DEQ's project manager for implementation of Section 22 of the Recycling Modernization Act, David Allaway: david.allaway@deq.oregon.gov.

Alternate formats

DEQ can provide documents in an alternate format or in a language other than English upon request. Call DEQ at 800-452-4011 or email deqinfo@deq.state.or.us.



American Forest & Paper Association

March 18, 2022

David Allaway
Senior Policy Analyst
Oregon Department of Environmental Quality
Materials Management Program
700 NE Multnomah Ave., Ste. 600
Portland, OR 97232

RE: Comments on Implementation of Section 22 of Oregon’s Plastic Pollution and Recycling Modernization Act

Dear Mr. Allaway,

The American Forest & Paper Association (AF&PA) is pleased to submit these comments in response to the Oregon Department of Environmental Quality request for comments on the implementation of Section 22 of Oregon’s Plastic Pollution and Recycling Modernization Act.

The American Forest & Paper Association (AF&PA) serves to advance U.S. paper and wood products manufacturers through fact-based public policy and marketplace advocacy. The forest products industry is circular by nature. AF&PA member companies make essential products from renewable and recycle resources, generate renewable bioenergy and are committed to continuous improvement through the industry’s sustainability initiative — [Better Practices, Better Planet 2030: Sustainable Products for a Sustainable Future](#). The forest products industry accounts for approximately four percent of the total U.S. manufacturing GDP, manufactures nearly \$300 billion in products annually and employs approximately 950,000 people. The industry meets a payroll of approximately \$60 billion annually and is among the top 10 manufacturing sector employers in 45 states.

AF&PA believes that all paper and paper-based packaging products can be easily collected and recycled into Oregon’s statewide collection recycling system.

- Foodservice packaging
- Food contact packaging
- Ice cream cartons
- Liquid packaging cartons
- Magazines
- Mail
- Molded fiber containers
- Newspaper
- Office paper
- Old Corrugated Containers (OCC)
- Paper bags
- Paper cups
- Paper-padded mailers
- Paperboard without poly
- Paperboard with poly
- Pizza boxes

Paper Recycling Works

U.S. EPA data confirms the superior record and environmental success story of paper recycling from municipal collection programs.¹ According to the U.S. EPA, in 2018 (the most recent EPA data available) paper and paper-based packaging had a far higher recycling rate from municipal solid waste (MSW) streams than other major recyclable commodities: Paper (68.2%); Steel (33.1%); Glass (25.0%); Aluminum (17.2%); and Plastics (8.5%).² Put another way, more paper by weight is recovered for recycling from municipal solid waste streams than plastic, glass, steel and aluminum combined.³ EPA statistics also show that in 2018, 46 million tons of paper and paperboard were recycled from municipal solid waste, compared to 3 million tons of plastics. By contrast, that year 27 million tons of plastics in municipal solid waste were sent to landfills. That is 76 percent of all plastic waste.⁴

Robust end markets for recovered paper are an essential pillar of the industry's success. Demand for recovered paper is strong and growing. In 2021, U.S. paper and paperboard mills consumed 32.9 million tons of recovered paper, an increase of 4.7% over 2020 consumption. And the U.S. exported another 18.0 million tons of recovered paper to mills around the world, an increase of 13.4% over 2020 levels.

The industry anticipates consuming more recovered paper to make paper and paper-based packaging in the years ahead. Between 2019 and the end of 2024, U.S. paper, packaging and pulp producers committed to investing more than \$5 billion in new manufacturing capacity specifically designed to use recovered paper. That increased manufacturing capacity will consume some 8 million additional tons of recovered paper per year.

Materials of Interest for Recycling

Section 22 of Oregon's The Plastic and Recycling Modernization Act requires the Environmental Quality Commission to identify two lists of materials under consideration: Statewide Collection Recycling and Producer-collected Materials lists. Oregon defines the Statewide Collection Recycling materials list as: "materials collected to provide the opportunity to recycle". This refers to on-route and drop-off recycling collection opportunities provided by all local governments in the state with populations over 4,000, and requirements for solid waste disposal sites to collect materials for recycling.

Since 1994, AF&PA has performed a series of national surveys to measure the extent and track the growth of access to community paper and paperboard recycling. In 2021, AF&PA conducted the 2021 AF&PA Access to Recycling Study ("2021 Study") as an update to the last study AF&PA conducted in 2014.

¹ [Advancing Sustainable Materials Management: 2018 Fact Sheet. EPA. November 2020.](#)

² <https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/plastics-material-specific-data>

³ [Advancing Sustainable Materials Management: 2018 Fact Sheet. EPA. November 2020.](#)

⁴ [Advancing Sustainable Materials Management: 2018 Fact Sheet. EPA. November 2020](#)

The 2021 Study measured curbside and drop-off community recycling programs provided through municipal or county governments, organized via contract or franchised through a private hauler, or available to residents via subscription services or privately operated drop-offs.

Materials Easily Justified for Inclusion in Commingled Recycling Collection Programs

In 2021, 85.7% of Oregonians had access to community curbside recycling programs and 35% of Oregonians had access to a drop-off recycling programs. The table below presents the survey results for categories in the 2021 Study for Oregonians who can recycle based on their access to curbside and drop-off recycling programs:

Percent of Oregonians Who Can Recycle Each Category Based on Availability of Curbside and Drop-Off Recycling Programs		
Material	Curbside Access Rate	Drop-Off Access Rate
Old Corrugated Containers (OCC)	83%	100%
Newspaper	82%	97%
Paperboard without poly	82%	81%
Paper bags	81%	93%
Magazines	80%	98%
Office paper	80%	97%
Mail	75%	97%
Paperboard with poly	49%	36%
Liquid packaging cartons	42%	15%
Pizza boxes	39%	66%
Foodservice packaging	2%	0%
Paper cups	0%	0%
Paper-padded mailers* <i>Not surveyed in 2021 Study</i>		

Curbside and Drop-off Recycling Access

Oregonians who have access to curbside recycling can overwhelmingly recycle seven of the categories shown in the chart above. For example, 81% of Oregonians who have access to curbside recycling can recycling paper bags. Similarly, to curbside recycling, Oregonians that have access to drop-off recycling programs have extremely high rates of recycling of paper and paper-based packaging. Seven of the categories in the have at least a 90% access rate for Oregonians who have access to a drop-off program.

The 2021 Study shows that local governments are already making residential curbside and drop-off recycling broadly accessible for the majority of paper and paper-based packaging categories.

Responsible End Markets

Oregon’s Plastic Pollution and Recycling Modernization Act defines *responsible end market* as “materials market in which the recycling or recovery of materials or the disposal of contaminants is conducted in a way that benefits the environment and minimizes risks to public health and worker health and safety.”

For those categories that are not currently accepted at as high a rate, like paper cups, foodservice packaging, poly-coated paperboard packaging, ice cream cartons, molded fiber containers and liquid packaging cartons, end markets also exist. For example, an AF&PA member mill in nearby Washington State sources Mixed Paper from Oregon to use in its mill. The mill successfully repulps and recycles the cups, foodservice packaging, poly-coated paper and liquid packaging cartons found in Mixed Paper into new products every day. Those categories provide high-quality fiber and recycling them from Mixed Paper extends the life of fiber that can be recycled into new products.

In addition to domestic consumption of recovered paper, recovered paper generated in the Pacific Northwest finds homes in export end markets. In 2021 the tonnage of recovered fiber exported from Oregon increased 166% over the prior year amount.

US Exports from Ports in Oregon in tonnage	2020	2021	% Change
Recovered Fiber Exports	4,419	11,766	166%

AF&PA believes that the DEQ should include all these categories in the proposed Statewide collection recycling list.

Foodservice, Food Contact Packaging and Contamination

AF&PA is aware there are some concerns about contamination of paper-based packaging like pizza boxes, cups and foodservice packaging. In 2020, WestRock, an AF&PA member company, conducted a mill study on how cheese and grease associated with pizza boxes impacted their repulpability and recyclability. The study was a continuation on an initial survey on pizza box recyclability done by AF&PA in 2019.

The WestRock study found neither cheese or grease negatively impacted repulpability, performance on the paper machine or finished product quality at typical levels of presence expected to be received in the recovery stream at MFRs and when included in the recovered fiber at expected levels of concentration in furnish at mills.

In addition, in 2013 and 2014, The Foodservice Packaging Institute conducted studies in Boston, MA and Delaware to determine whether food service packaging (e.g., pizza boxes, coffee cups, paper clamshells) and food contact packaging (e.g., cereal boxes, noodle boxes, ice cream packages) set out for recycling was more contaminated with food residue than food contact packaging that has traditionally been accepted at single stream MRFs. The studies found that “there is no appreciable difference in the amount of contamination between foodservice packaging and broader types of food packaging typically accepted in residential curbside programs....an initial indication that food contamination is a perceived rather than real barrier to residential recycling of foodservice packaging.”

Paper Padded Mailers

In addition, in 2021 AF&PA surveyed its members on the recyclability of paper-padded mailers. AF&PA members overwhelmingly agreed that the mailers can be recycled. Based on the results of the mill survey, the industry crafted the following recyclability statement:

“Paper padded mailers are widely accepted by AF&PA member company mills in an amount normally found in Old Corrugated Containers (OCC) and/or Mixed Paper bales generated in residential curbside recycling programs. We encourage communities to include paper padded mailers among the paper-based packaging items accepted in their residential recycling programs.”

Statutory Criteria

Section 22 of the Recycling Modernization Act specifies 11 criteria when determining whether a material should be included in one of the state’s lists of materials to be recycled. Based on the data above and current recycling practices in Oregon, AF&PA believes that paper and paper-based packaging have stable and responsible end markets, a continual stream of material going into the system, is compatible with Oregon’s existing recycling infrastructure, and contamination in foodservice packaging does not affect the yield loss for the material during the recycling process.

Because of this, AF&PA believes that the DEQ should include all of these categories in the proposed Statewide collection recycling list.

Producer-collected materials list [per Section 22(1)(b)]

Section 22 of Oregon’s The Plastic and Recycling Modernization Act requires the Environmental Quality Commission to identify two lists of materials under consideration: Statewide Collection Recycling and Producer-collected Materials lists.

Oregon defines producer-collected materials as materials that are largely incompatible with commingled processing systems, thereby requiring separate collection and handling in “which a producer responsibility organization must provide for the collection through recycling depot or mobile collection events as provided in section 15 of the Act.

The producer-collected materials list can be an effective policy tool for products that are difficult to process, have low recycling rates, or where healthy end markets do not exist; but none of these issues apply to paper and paper-based packaging.

AF&PA believes that paper and paper-based packaging should not be added to the producer-collected materials list.

The paper recycling rate has grown over decades, and remained consistently high, meeting or exceeding 63 percent since 2009. In 2019, the recovery rate for all paper was 66.2 percent and in 2020 – an unprecedented year of shutdowns, business changes, and temporary recycling halts – the recovery rate only decreased half a point to 65.7 percent. This speaks to the strength and resilience of the paper and paper-based packaging recovery.

As part of industry efforts to continue improving recyclability and recovery rates, on March 2, 2021, AF&PA released a new tool, the Design Guidance for Recyclability, which is a data-driven resource to aid packaging designers and brands in the design and manufacture of packaging to meet recyclability goals. The report contains research-based findings on the recyclability of corrugated packaging; bleached paperboard cartons; recycled/unbleached boxboard cartons; carrier board cartons; Kraft paper bags; multiwall paper shipping sacks; and molded fiber containers.

Being a “Challenge” to Recyclability Does Not Mean “Not Recyclable”

Something becomes a “challenge” in a mill when it impedes mill operations. For example, something may slow down a mill’s pulping process, plug screening systems or leave residue on finished paper or paperboard.

Being a “challenge” does not make something not recyclable. The ease of recyclability depends on a mill’s capability. It is important to note that each non-fiber element applied to each kind of packaging covered in the Design Guidance for Recyclability report was rated by some mills as not a “challenge”/able to be recycled.

Much of that determination is dependent on the type of fiber to which the element is attached. In addition, the impact varies based on each mill’s repulping capability. Some mills are extremely sophisticated and as investments continue to be made to improve paper recycling, we can expect to see changes in the impact of non-fiber elements on different types of packaging.

Conclusion

AF&PA appreciates the opportunity to submit these comments in response to the Oregon Department of Environmental Quality request for comments on the implementation of Section 22 of Oregon's Plastic Pollution and Recycling Modernization Act.

We believe that all paper and paper-based packaging products can be easily recycled in Oregon's statewide collection recycling system.

We would appreciate any opportunity to discuss further and would be more than happy to share additional information on the recyclability of paper and paper-based packaging products.

Please contact me at Terry_Webber@afandpa.org or 971-235-8816 if you have any questions.

Sincerely,

A handwritten signature in cursive script that reads "Terry J. Webber".

Terry Webber
Vice President, Industry Affairs
AMERICAN FOREST & PAPER ASSOCIATION

March 21, 2022

Mr. David Allaway
Project Manager, Implementation Section 22 of Recycling Modernization Act
Oregon Department of Environmental Quality
700 NE Multnomah Street, Suite 600
Portland, OR 97232

RE: DEQ Request for Information: Oregon statewide recycling collection list and producer-collected materials.

Dear Mr. Allaway:

On behalf of the American Recyclable Plastic Bag Alliance, which represents the U.S. manufacturers and recyclers of plastic bags, I write to respond to the Oregon Department of Environmental Quality's (DEQ) Request for Information regarding the to-be-developed statewide recycling collection list and producer-collected materials.

Like Oregon, America's plastic bag manufacturers recognize the importance of sustainability and are united in the belief that a sustainable industry requires a sustainable product. ARPBA members voluntarily established an industry-wide sustainability commitment to promote increased recycling of plastic carryout bags and increased use of recycled content in these products to facilitate increased circularity.

We urge the DEQ to recognize the efficacy of the store takeback program for plastic carryout bags and other polyethylene (PE) films developed in partnership between the industry and their retail partners and ultimately include these products in its producer-collected materials list to ensure they remain recognized as recyclable. Further, we urge the DEQ to acknowledge the importance of plastic carryout bags as an end market for recycled plastic carryout bags and other film products, particularly as the industry works to meet its self-established goals to increase the amount of recycled content in these products.

Plastic Carryout Bags and Other PE Film Products Are Easily Recyclable Via the Industry- & Retailer-Pioneered Store Takeback Program, Which is Working.

As the DEQ may know, in 2019, the state legislature passed [HB 2509](#), limiting the types of carryout bags certain Oregon establishments can distribute to consumers. Retailers and restaurants may only offer plastic carryout bags if they are at least four (4) mils thick. Consumers can easily recycle these reusable plastic carryout bags through the store takeback program the industry pioneered with its retail partners.

In addition, the store takeback program provides an alternative end-of-life option for various PE products and film, including much of the plastic packaging and other bags exempted by HB 2509. Examples of other [PE products and film commonly accepted](#) through the store takeback program includes: pallet wrap and stretch film, bread bags, case, and product overwrap, dry cleaning bags, newspaper sleeves, resealable food storage bags, produce bags, and e-commerce packaging, including air pillows, bubble wrap, plastic shipping envelopes, and product wraps.

Across all plastic carryout bags, the U.S. Environmental Protection Agency estimates that over 12 percent of bags are recycled. While the industry believes that this number can and should be much higher across all bags, research on bag and film recycling reveals [positive momentum](#).

In 2019, the last year for which data is available, just under 1 billion pounds of plastic film was recovered for recycling in the United States—a nearly 50 percent increase since 2005. Retail bag and film recycling represents the second largest category of product recovered for recycling, only trailing clear PE film. According to STINA, more than 275 million pounds of retail bags and film were recovered, a more than 13 percent increase over the previous year's data. Critically, more than 77 percent of this material was acquired by U.S. and Canadian reclaimers for processing. In short, the store takeback program is working and growing across America.

To make recycling easier for consumers and support further growth in recycling, the industry has partnered with STINA as a sponsor of its new bag and film recycling directory: www.bagandfilmrecycling.org. This important resource provides an easy and convenient mechanism for environmentally conscious consumers to identify store takeback program locations in their community. In addition, the database relies on crowd-sourced verification of the availability and location of takeback bins at local retailers to ensure it is accurate and up to date.

Including the store takeback program and plastic carryout bags and PE film products in the DEQ list will help create opportunities to expand this program, collect more PE bags and film, support end markets for these materials, and advance circularity in Oregon.

While Plastic Carryout Bags and Other PE Film Products Generally Must Be Separated from Curbside, Residential Recycling, Technology to Separate Different Materials Does Exist.

Plastic carryout bags and other PE film products are generally not accepted in curbside residential recycling, whether separated or comingled. While the technology to identify and separate recycled polyethylene products from other materials does exist, most material recovery facilities (MRFs) do not currently have the necessary machinery. However, this is changing in some areas. Recently, Boulder Colorado invested in [new sorting technology](#), which allows it to separate our polyethylene films from its comingled products, avoiding contamination and other operational issues.

When consumers mistakenly put PE products, whether bags, film, or wraps, into their recycling, these products can cause challenges for the equipment at most MRFs. However, labeling plastic carryout bags and films as unrecyclable, even as many of these products are ubiquitous in consumers' lives, is likely to result in increased contamination at MRFs or more recyclable materials being landfilled. To recycle correctly, consumers need more education and information, not less.

For example, despite a ban on all PE carryout bags in New York, state law still requires retailers to maintain store takeback locations for other PE products and films. [Research from the University at Buffalo](#) found that once the prohibition on film bags took effect and retailers no longer had reason to communicate how to recycle these materials, contamination in the store takeback stream increased.

On the other hand, anecdotal evidence from across the country shows that there are tremendous opportunities for producers of PE packaging, bags, and film to work together with municipalities on

separating, collecting, and ultimately recycling this material into new products and supporting innovation in new applications. These emerging efforts include programs like the Hefty Energy Bag Program, which works with localities to provide convenient ways for consumers to recycle films that are then processed into other products. Pilot programs in [Boise, Idaho](#) and [Gwinnett County in Georgia](#) are proving successful in ensuring these recyclable products find new life.

The store takeback program provides a convenient and easily accessible alternative for recycling plastic carryout bags and PE films. Considering that consumers likely acquire the majority of the recyclable plastic carryout bags and other recyclable PE products and film during their trips to the grocery store, ensuring that these products can be recycled through a separate, standardized stream collected where they originate helps protect both curbside residential recycling and store takeback streams from contamination.

Plastic Carryout Bags Have Environmental Advantages Over Alternative Products

While lifecycle assessment after lifecycle assessment of carryout bags have consistently found that traditional, thin-gauge plastic bags are the option with the fewest environmental impacts when properly disposed of, the reusable plastic carryout bags allowed under Oregon law also have substantial environmental advantages over alternative products for many of the same reasons.

These lifecycle assessments reveal that carryout bags made from other materials, whether plastics like woven or nonwoven polypropylene, polyethylene terephthalate, nylon, or natural fibers like cotton, require substantially more reuses to offset their larger environmental footprints. Research finds that the number of reuses these alternative bags require ranges from several dozen to several thousand, depending on the material and the breadth of the environmental considerations included in these assessments.

Research from the University of Clemson exploring these disparate impacts on the environment also analyzed consumer behavior, finding that only 25-41% of consumers actually reuse these bags enough times to offset their environmental impact. When consumers cannot meet these “breakeven” points, reusable bags that are generally viewed as “more sustainable” prove the opposite.

In August, the New York Times reported on one of these lifecycle assessments, noting that according to the Danish Environmental Protection Agency, consumers would need to reuse an organic cotton tote as many as 20,000 times to offset its overall impact. This reuse rate, equivalent to using one tote daily for 55 years, reveals some challenges with alternative bags. On the other hand, the reusable plastic carryout bags allowed by Oregon law can be recycled through the store takeback program at any point in their life, whether used once, twice, or the entirety of the 125 reuses they are specifically designed and manufactured to withstand.

Consumers’ shopping needs and habits vary wildly, even from trip to trip. Reusable plastic carryout bags play a critical role in helping retailers offer products that meet their needs in the given moment. To ensure that retailers and consumers can continue to rely on these recyclable products and access the store takeback program where they can be recycled, DEQ should include these products, as well as similar PE products and films in the producer-collected materials list.

Beyond the comments included here, I am also including several other resources related to the DEQ’s request for information that should prove helpful as this process unfolds. Attached you will

find lifecycle assessments on carryout bags referenced in this letter and the latest research from STINA on the state of PE film recycling in the United States can be [accessed here](#).

The industry stands ready to work with the DEQ as it undergoes the rulemaking process for Section 22, which provides Oregon an excellent opportunity to collaborate with America's plastic bag manufacturers as well as the Oregon retailers and consumers who rely on these products to promote increased recycling of these products through the store takeback program.

Ultimately, we believe supporting the store takeback program provides an opportunity to establish a robust and sustainable end market for recycled plastic carryout bags and numerous other PE films consumers use every day. We hope that the store takeback program and these products will be included in the Department of Environmental Quality's initial producer-collected material lists.

Thank you for your time and attention to this issue. Should you have any questions about the information included in this letter or wish to further discuss the industry and its sustainability interests, please contact me at ztaylor@plasticsindustry.org or (202) 974-5245.

Sincerely,

A handwritten signature in black ink, appearing to read 'Zachary Taylor', with a long horizontal flourish extending to the right.

Zachary Taylor
Director
American Recyclable Plastic Bag Alliance



The power of packaging in balance:

March 22, 2022

David Allaway
Senior Policy Analyst
Oregon Department of Environmental Quality
Materials Management Program
700 NE Multnomah Avenue, Suite 600
Portland, Oregon 97232

RE: Oregon Statewide Recycling Collection List and Producer-Collected Materials (For Recycling)

Dear Mr. Allaway,

AMERIPEN – the American Institute for Packaging and the Environment – is pleased to submit these comments in response to the Oregon Department of Environmental Quality Request for Information on the implementation of Section 22 of Oregon’s Plastic Pollution and Recycling Modernization Act.

AMERIPEN is a coalition of stakeholders dedicated to improving packaging and the environment. We are the only material neutral packaging association in the United States. Our membership represents the entire packaging supply chain, including materials suppliers, packaging producers, consumer packaged goods companies and end-of-life materials managers. We focus on science and data to define and support our public policy positions and our comments are based on this rigorous research rooted in our commitment to achieve sustainable packaging, and effective and efficient recycling policies. We have several member companies with a significant presence in Oregon, and many more who import packaging materials and products into the state. The packaging industry supports more than 18,000 jobs and accounts for \$5.45 billion in total economic output in Oregon.

Section 22 of Oregon’s Plastic Pollution and Recycling Modernization Act requires the Oregon Environmental Quality Commission to identify two lists of materials by administrative rule – the Statewide Collection Recycling List and the and Producer-Collected Materials List. Our comments will be broken down into recommendations for both.

Additional materials to be considered for the Statewide Collection Recycling List

Oregon defines the Statewide Collection Recycling List as “materials collected to provide the opportunity to recycle”. This refers to on-route and drop-off recycling collection opportunities provided by all local governments in the state with populations over 4,000, and requirements for solid waste disposal sites to collect materials for recycling. Using this definition, and access data from the 2020-21 Sustainable Packaging Coalition (SPC) Centralized Study on Availability of Recycling, AMERIPEN

believes that all the following materials (products) can be easily collected and recycled into Oregon’s statewide collection recycling system.¹

Package Type	Access Rate
Aluminum Beverages	89%
Corrugated Boxes	88%
PET Beverage Bottles, Jugs and Jars	87%
HDPE Bottles, Jugs and Jars	87%
Steel Food Cans	87%
Paperboard Boxes	84%
Glass Beverage Bottles and Containers	76%
Aluminum Food Cans	75%
PP Bottles, Jugs and Jars	72%
LDPE Bottles, Jugs and Jars	70%

We note that U.S. Federal Trade Commission (FTC) Green Guides defines recyclable, in part, as material where 60% of the public has access to recycling. As the only quantitative metric defined in the Green Guides, access is believed to be indicative of the recycling systems ability to collect, sort and reprocess materials. While these numbers are related to federal access and not specific to Oregon, all the materials we have listed here exceed the 60% access rate thereby permitting for some flexibility to state specific differences.

While the FTC declares access as the primary means through which companies can make recyclable claims, AMERIPEN recognizes that there is increasing interest in other parameters to ensure that materials that are collected are actually used in end markets. We recognize Section 22 of Oregon’s Plastic Pollution and Recycling Modernization Act requests information on additional parameters such as stable and mature end markets, compatibility with existing infrastructure, and practicalities of sorting and storing. Oregon’s interest aligns with industry desires to better define recycling as a system of independent but interconnected actions. For that reason, we have identified and offer materials (products) below the 70% national access rate as materials for additional consideration and we provide data on additional parameters to help outline the systemic nature of recyclability and the promise of these materials.

Additional materials not yet widely recycled that we believe should be considered include:

- Aseptic cartons
- Aerosol containers (aluminum and steel)
- Paper-padded mailers
- Pizza boxes and other food contaminated paperboard packaging

¹ Sustainable Packaging Coalition. [2020-21 Centralized Study on Availability of Recycling](#) (2022)

- Polyethylene terephthalate (PET) cups and thermoforms
- Polycoated paperboard
 - o Ice cream containers
 - o Cups
 - o Foodservice containers
 - o Other
- Polypropylene (PP) tubs and other containers

Aseptic Cartons

Curbside and Drop-off Recycling Access

Data from the Carton Council indicates the following access rates for cartons within Oregon.²

Package Type	Access Rate
Aseptic Cartons	37% (curbside) 10% (drop off)

Responsible End Markets

Cartons have three different end markets for their products. Cartons can be sold as part of a mixed bale of paperboard, part of polycoated paperboard only bale or sold as Grade #52—a carton-only bale. There are currently five North American mills that accept Grade #52 bales and all still have excess capacity to absorb more. Additionally, West Coast markets are successfully selling grade #52 bales to three international locations in India, South Korea and Thailand. Almost all domestic mills purchase either mixed paper or polycoated paperboard grades.

Collection, Sortation and/or Anticipated Yield Data

With slightly less than half of Oregon consumers having access to carton recycling, we are confident that the process to collect and sort cartons is viable within the state. As the Carton Council continues to work with communities to help invest in technologies and education to help improve the sortation of cartons, we believe volume can continue to increase.

Material yields are dependent upon the final end market, but data from the Carton Council indicates that Grade #52 bales used for building materials can achieve 100% usage. A Grade 52 bale for tissue and toweling captures an estimated 67-70% of the total package with 80-95% of the fiber used. Similar numbers are reflected in Grade 52 bales used for de-inked pulp. Mixed bales sold to tissue and toweling have the smallest yield outcome with 50-60% of the total package used in reprocessing.

If Grade #52 bales can be processed by Oregon material recovery facilities (MRFs), Carton Council data indicates there is still room to increase capacity of these end markets by 50% or more.

² Per email from Carton Council 03-19-2022

Ongoing Activity to Support Recycling of these Materials by Industry

The Carton Council offers education and grants to help increase aseptic recycling across the U.S. Aseptic cartons can either be hand sorted or through automatic by utilizing either optical or robotic sortation. Material recovery facilities (MRFs) that are interested in recycling these materials are offered support both in identifying the best approach for sortation but then also with grants and training to help purchase and implement these new processes with success. Additionally, the Carton Council works with MRFs who have low carton volumes and cannot make an LTL (less than truckload).

Polycoated Paperboard

Curbside and Drop-off Recycling Access

Data from the American Forest and Paper Association (AF&PA) indicate the following access rates for polycoated paper materials within the State or Oregon.³

Package Type	Access Rate
Polycoated paperboard	49% (curbside) 36% (drop off)

Responsible End Markets

End markets for paper-based products are expected to continue to grow. Paper-based materials that have not historically been part of the bulk of fiber yields are advancing as mills seek new sources of inputs. AF&PA reports that between 2019 and 2021 U.S. paper, packaging and pulp producers have committed more than \$5 billion in new manufacturing capacity specifically designed to use recovered paper. This increased manufacturing capacity is expected to consume an additional 8 million tons of recovered paper per year.

The Food Service Packaging Institute (FPI) notes that currently 33 different mills between the U.S. and Canada accept post-consumer polycoated board. Mills will purchase it either as a unique polycoated board grade or as part of a mixed paper bales. There is a mill in nearby Washington State that sources mixed paper from Oregon. The mill successfully repulps and recycles cups, foodservice packaging, polycoated paper, and liquid packaging cartons found in mixed paper into new products every day. Its proximity to Oregon indicates less environmental impact in terms of transit

Collection, Sortation and/or Anticipated Yield Data

Polycoated paperboard can be flat or shaped into a 3-dimensional container format such as cups or ice-cream cartons. MRF flow studies undertaken by FPI indicate that on average one quarter of cups will flow to the fiber line as they are crushed during collection and sortation with the reminder three quarters flowing towards container lines where they can either be hand sorted or redirected as a result

³ AF&PA. [2021 AF&PA Access to Recycling Study](#) (2022)

of optical or robotic sortation.⁴ Since there are two different bale specs for this paperboard (polycoated only) or mixed, direction to either line does not tend to create challenges. Yield varies widely amongst mills based upon their processes and technologies. Based upon information reported by FPI's mill task force yield from polycoated containers is within 70% to 90%.⁵

Ongoing Activity to Support Recycling of these Materials by Industry

Both AF&PA and FPI perform regular studies with mills and communities to assess the recyclability of their paper-based products. Most commonly what they have found is that recyclability relies more on the technical equipment and skills of the specific mills rather than as a material specific issue. As the industry continues to support research and best practices, we expect access and recyclability to continue to advance.

Several FPI members have supported curbside recovery efforts by offering MRF equipment grants and market development support. Some of their efforts overlap and further support initiatives with the Carton Council to help ensure increased polycoated carton recovery.

Paper-Padded Mailers

Curbside and Drop-off Recycling Access

Paper-padded mailers are a relatively new innovation within the packaging space. As a result, data on access and inclusion into curbside programs has not yet aligned with the adoption of this new packaging format. 2020 and 2021 studies on access rate did not measure paper-based mailers.

Responsible End Markets

To assess the potential for paperboard mailers to be included in curbside programs, in 2021, AF&PA surveyed its members on the recyclability of paper-padded mailers⁶. Mills overwhelmingly agreed that the mailers can be recycled. Per the Institute of Scrap Recycling Industries (ISRI), paper-based mailers are considered acceptable input for either old corrugated cardboard (OCC) or mixed paper bales. These are two widely purchased bales in mills across the US. The AF&PA study concludes: "*We encourage communities to include paper padded mailers among the paper-based packaging items accepted in their residential recycling programs.*"⁷

As more curbside programs begin to recognize the benefits and pulpability of this format, we believe access will quickly grow.

⁴ RRS, [MRF Material Flow Study](#) (2015)

⁵ Email from FPI 3-21-2022

⁶ [AF&PA On Padded Paper Mailers](#) (2022)

⁷ Ibid

Collection, Sortation and/or Anticipated Yield Data

Although, to the best of our knowledge, no yield study has been undertaken on paper-based mailers per se, interpreting from the AF&PA Mill study, we assume mailers can flow through the system and be directed accordingly to OCC or mixed paper bales, and therefore yield rates for these materials are likely to be high.

Ongoing Activity to Support Recycling of these Materials by Industry

AF&PA performs regular studies with mills and communities to assess the recyclability of their paper-based products. Most commonly what they have found is that recyclability relies more on the technical equipment and skills of the specific mills rather than as a material specific issue. As the industry continues to support research and best practices, we expect access and recyclability to continue to advance.

Pizza Boxes and Other Food Contaminated Paperboard Packaging

Curbside and Drop-off Recycling Access

Data from the American Forest and Paper Association (AF&PA) indicate the following access rates for pizza boxes within the state.⁸

Package Type	Access Rate
Pizza Boxes	29% (curbside) 66% (drop off)

Responsible End Markets

Pizza boxes can be sold in either OCC or mixed paper bales.

A 2020 study by WestRock found neither cheese or grease negatively impacted repulpability, performance on the paper machine or finished product quality at their mills.⁹ In 2013 and 2014, FPI conducted studies to determine whether food service packaging (e.g., pizza boxes, coffee cups, paper clamshells) and food contact packaging (e.g., cereal boxes, noodle boxes, ice cream packages) set out for recycling was more contaminated with food residue than food contact packaging that has traditionally been accepted at single stream MRFs.¹⁰ The studies identified that: *“there is no appreciable difference in the amount of contamination between foodservice packaging and broader types of food packaging typically accepted in residential curbside programs...an initial indication that food contamination is a perceived rather than real barrier to residential recycling of foodservice packaging.”*

⁸ AF&PA [2021 AF&PA Access to Recycling Study](#) (2022)

⁹ WestRock, [Incorporation of Post-Consumer Pizza Boxes in the Recovered Fiber Stream](#) (2020)

¹⁰ Per email from AF&PA 03-18-22

Collection, Sortation and/or Anticipated Yield Data

To the best of our knowledge, no yield study has been undertaken on pizza boxes per se, but if we interpret the WestRock and FPI studies to indicate no appreciable challenge in recycling this material, we assume that food contaminated boxes can flow through the recycling system and be directed accordingly to OCC or mixed paper bales, the yield rates for these materials must be relatively high.

Ongoing Activity to Support Recycling of these Materials by Industry

Both AF&PA and FPI perform regular studies with mills and communities to assess the recyclability of their paper-based products. Most commonly what they have found is that recyclability relies more on the technical equipment and skills of the specific mills rather than as a material specific issue. As the industry continues to support research and best practices, we expect access and recyclability to continue to advance.

Aerosol Containers – Aluminum and Steel

Curbside and Drop-off Recycling Access

Data from the 2020-21 SPC Centralized Study on Availability of Recycling, indicate the following access rates for the aerosol containers.¹¹ Aerosol containers meet the FTC Green Guides threshold for recyclable claims.

Package Type	Access Rate
Aerosol Containers	61% (Steel); 62% (Aluminum)

Responsible End Markets

i. Aerosol Containers--Aluminum

Demand exceeds supply for mixed aluminum. Research for the aerosol container industry by RRS indicates “most secondary end-markets are eager for material and willing to work with potential suppliers to unlock new sources.”¹²

Although there is not an ISRI bale specification, mixed aluminum is often collected in open-top containers and then sold to either directly to one of two end markets: 1) Deox – a critical additive to steel making which helps to replace virgin material) or 2) RSI – melted into an ingot and then mixed with other materials to make a new product. Both end markets are stable and well-established.

¹¹ Ibid

¹² Resource Recycling Systems. [Surveying State of MRFs and End Market Barriers to Recycling Steel and Aluminum Aerosols and Pet Food Cans and Identification of Solutions](#). 2021

ii. Aerosol Containers – Steel

Steel aerosol containers also have stable and established end-markets. They can be readily added to steel bales at MRFs without any sortation concerns. Steel end-markets have national reach since 40 of 50 states (including Oregon) have electric arc furnaces capable of melting down steel cans, including aerosols. RRS research states, “There is ample capacity for steel mills to absorb higher volumes of steel from scrap managers across the country.”¹³

Collection, Sortation and/or Anticipated Yield Data

Aerosol containers are widely collected and sorted within the majority of U.S. based MRF’s based upon widely adopted and long-established technology. Eddy stream currents and magnets, in addition to their solid 3-dimensional shape result in an estimated 95% effective sortation rate for both aluminum and steel aerosol containers.

Ongoing Activity to Support Recycling of these Materials by Industry

In response to some concern that unemptied aerosol containers may pose safety concerns, the industry studied the potential risks that aerosol containers may pose in the recycling stream.¹⁴ The study found that the likelihood of an accident was very low. This study led to development of additional guidelines and educational resources to capitalize on the opportunity to recycle these containers safely.

The aerosol industry has invested heavily in developing and promoting resources to educate the public that they can recycle empty aerosol containers and to increase overall recycling rates.

Polyethylene Terephthalate (PET) Cups and Thermoforms

Curbside and Drop-off Recycling Access

Data from the 2020-21 SPC Centralized Study on Availability of Recycling, indicate polyethylene terephthalate (PET) cups and thermoforms (clamshells, trays etc.) have a national access rate around 54% – just slightly below the 60% FTC threshold rate.¹⁵

Package Type	Access Rate
PET Clamshells, Tubs, Trays, and Cups	54%

¹³ Resource Recycling Systems. [Surveying State of MRFs and End Market Barriers to Recycling Steel and Aluminum Aerosols and Pet Food Cans and Identification of Solutions.](#) (2021).

¹⁴ Kumar R. Bhimavarapu and Dimitrios M. Karydas. Recycling Aerosol Cans: A Risk Assessment. Factory Mutual Research Corporation. (April 1996).

¹⁵ Sustainable Packaging Coalition. [2020-21 Centralized Study on Availability of Recycling](#) (2022)

Responsible End Markets

As demand for post-consumer PET grows¹⁶, there is increased interest in capturing thermoforms and cups to help supplement volume. Currently PET thermoforms and cups can be sold as part of mixed PET bottle and thermoform bale or as a thermoform only bale. Over 14 different reprocessors across Canada and the U.S. will accept PET thermoforms in one or both formats. Additionally, Republic Service’s recent announcement of a new plastics recycling facility in Las Vegas will further increase demand for this material as they offer the capacity of 65 million lbs. per year of PET.¹⁷

Chemical recycling is also an emerging market, with Eastman’s facility in Kingsport, Tennessee expressing interest in taking all formats and colors of PET for their 2023 launch.

PET has one of the more diverse end markets of the plastics resins, with demand for this material existing in the textiles, packaging and building material sectors.

Collection, Sortation and/or Anticipated Yield Data

According to a 2015 MRF study commissioned by FPI, 61% of PET clamshells and 77% of PET cups made it to a target PET bale. Losses tend to occur when these three-dimensional shapes are flattened during the collection and sortation process and then redirected to paper lines. As an increasing number of MRFs have upgraded equipment since 2015 and additional; funding for increase optical or robotic sortation becomes available, this yield is expected to increase.

Ongoing Activity to Support Recycling of these Materials by Industry

FPI’s Community Partnership Program and industry specific research works directly with residential recycling programs to evaluate and increase access to recycling for many foodservice items.

Additionally, The Recycling Partnership (TRP) launches a PET recovery working group in March 2022 to help identify best practices to increase PET recovery of all formats.

Polypropylene (PP) Tubs and Other Containers

Curbside and Drop-off Recycling Access

Data from the 2020-21 SPC Centralized Study on Availability of Recycling indicate the following access rates for polypropylene (PP) tubs, cups and containers.

Package Type	Access Rate
Polypropylene Tubs and other containers	59%

¹⁶ Both from voluntary goals but also increasing state recycled content mandates

¹⁷ Resource Recycling [Republic Services Move to Vertically Integrate in Plastics](#) (March 2022)

We note that national access is just slightly below the FTC 60% threshold and given the increase demand for this material by end markets, it is likely to exceed 60% in the very near future.

Responsible End Markets

With the rise of voluntary goals, state recycled content mandates and growing chemical recycling capacity, demand for recycled polypropylene markets is poised to grow. PP tends to be sold in one of two different bales type – either as a polypropylene only bale or as a mixed plastics bale. There is no distinction within these markets between tubs or cups and containers. At the current time there are 17 different re-processors who will put polypropylene in either bale format.

While the majority of these PP reprocessors are based in the East Coast, it should be noted that there are two emerging reprocessors in Oregon looking to source PP Bales: Denton Plastics and Green Rhino.

Polypropylene is also an emerging feedstock for chemical recycling and agreements between companies like Berry Plastics, Wendy's and Lyondell Basel who are establishing upfront commitments to use and process specific volumes of post-consumer polypropylene plastics.

Collection, Sortation and/or Anticipated Yield Data

FPI's 2015 MRF Flow study indicates that PP cups and containers have a high rate of capture. PP products appear to hold their 3-dimensional shape rather well, increasing their direction to the correct container lines. Depending on technology, MRFs were losing between 3-10% of PP containers to paper lines. As noted with PET, any investments in improving paper lines to better captured crushed plastics that are misdirected will further increase yield.

Ongoing Activity to Support Recycling of these Materials by Industry

FPI's Community Partnership Program and industry specific research works directly with residential recycling programs to evaluate and increase access to recycling for many foodservice items, including polypropylene.

Additionally, the Recycling Partnership has launched an established PP recovery working group to help identify best practices to increase PP recovery of all formats.

Additional Materials to be Considered for Producer-Collected Materials lists

Oregon defines materials to be considered for the producer-collected materials list as materials that are largely incompatible with commingled processing systems, thereby requiring separate collection and handling in *“which a producer responsibility organization must provide for the collection through recycling depot or mobile collection events as provided in section 15 of the Act.”*

We believe the following should be considered for the producer collected materials list

- Polystyrene

Curbside and Drop-off Recycling Access

Data from the 2020-21 SPC Centralized Study on Availability of Recycling¹⁸ indicates rigid polystyrene materials (EPS) are generally collected 45% rate curbside.

Package Type	Access Rate
Rigid Polystyrene ¹⁹	45%

The EPS Industry Alliance (EPSIA) notes that 55 communities in the U.S. offer curbside recycling access for expanded polystyrene (EPS), with an additional 214 drop off locations. In Oregon alone there are five drop off locations in Tigard, Salem, and Eugene.

Given the high demand for EPS in commercial sales, measuring recycling based on consumer curbside access may be misleading in this case.

Responsible End Markets

Tigard, Oregon is home to Agilyx, the first U.S. chemical recycling facility for EPS. As of July 2021, Agilyx has converted more than 4,400 tons of mixed waste plastic and polystyrene waste and plans to continue growth. Demand is there if we can gather EPS.

Collection, Sortation and/or Anticipated Yield Data

The low weight, high bulk of EPS tends to discourage many residential communities from collecting this materials. But where drop off programs exist, or commercial collection is possible, the use of densifiers has significantly improved the economics and interest in collecting and recycling this material.

By collecting via drop-off or through commercial partners, EPS does not face challenges other materials have in running through a MRF sortation line.

We are not aware of any data on yield.

Industry Support for Recycling of these Materials

There are several industry-supported efforts to increase EPS recycling. There are six MRFs in the U.S. that have recently adopted a turnkey EPS recycling system that minimizes sortation problems and

¹⁸ Ibid

¹⁹ Please note that Carton Council data on aseptic cartons access is specific to Oregon access. Federal access is slightly higher.

significantly reduces storage space. The system consistent of a refurbished freight container that houses a low volume densifier and handling materials.

To help maintain feedstock, Agylix has developed the Cyclyx consortium to build off their insights from drop off and collection programs to help gather increased feedstock for both their facilities as well as other emerging chemical recyclers. They also host several collection programs with communities and corporations

EPSIA as well as DART Container also offer grant programs to help place densifiers within community spaces, or corporations.

End markets and access to EPS recycling continues to grow. We believe Oregon DEQ should recognize this material as a promising market with a state-based recycler within.

Conclusion

AMERIPEN appreciates the opportunity to submit this letter. In trying to address all the various materials our members produce, we refer you as well to our peer trade associations who we understand have also submitted information and are able provide much greater detail the recyclability parameters associated with their specific material.

AMERIPEN welcomes any inquiries regarding this submission, and we would be happy to help facilitate further dialogues with our material specific peers.

With appreciation,



Dan Felton
Executive Director



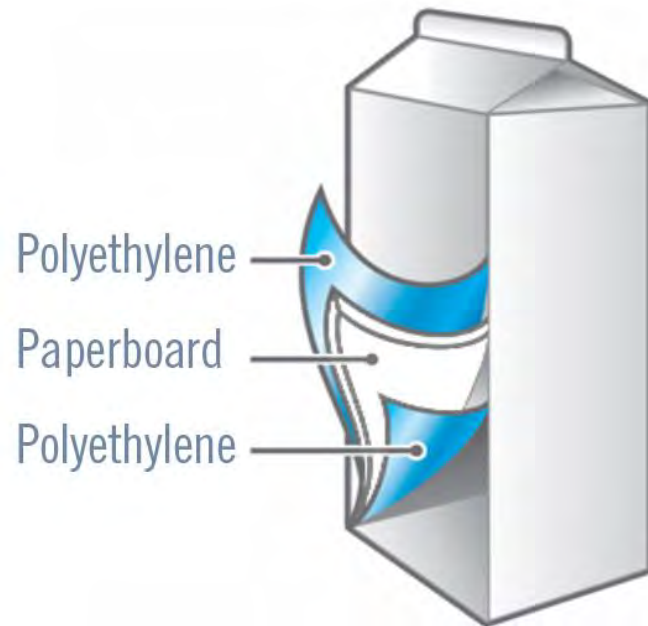
Oregon RFI Response

March 20, 2022

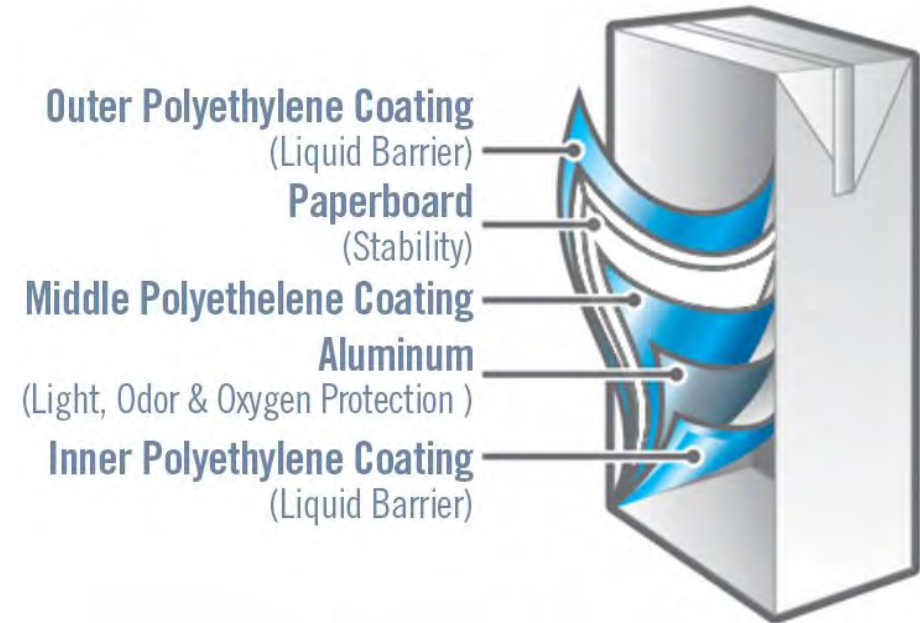


Carton design provides protection against light, air and harmful bacteria

Refrigerated “gable top”



Shelf stable “aseptic”



Who is the Carton Council

- Composed of four leading carton manufacturers, Elopak, Pactiv Evergreen, SIG Combibloc, and Tetra Pak, the Carton Council formed in 2009 to deliver long-term **collaborative solutions** to divert valuable cartons from the landfill.
- Through a united effort, the Carton Council is committed to expanding carton recycling nationwide.



Carton Council Strategy

OUR ULTIMATE GOAL: Increase the carton recycling rate and decrease the amount of cartons going to landfills or becoming litter

OUR OBJECTIVES: Expand Access Increase Participation



STRATEGIES FOR ACHIEVING:

Provide counsel and resources to MRFs to encourage sorting of Grade #52 cartons

Engage with recycling facilities/officials

Support implementation of school recycling programs

Partner with stakeholders/advocates

Foster the development of solid end markets

Educate consumers

Encourage company/brand involvement

Participate in legislative discussions

Cartons are increasingly used in markets that are diverse, stable and expanding

Cartons are a feedstock in end markets totaling \$335B

- Building Products
 - Roofing board \$20B US Market
 - Wall board \$14B US Market
 - Exterior sheathing \$7B Global Market
 - Ceiling tiles \$2B US Market
- Tissue and Toweling
 - Tissue and toweling \$250B US Market
- Deinked Pulp
 - Market pulp \$7B Global Market
- Board, Packaging and Toweling Market– as mixed paper furnish
 - Paper mills \$35B US Market

Carton end markets: yield and size

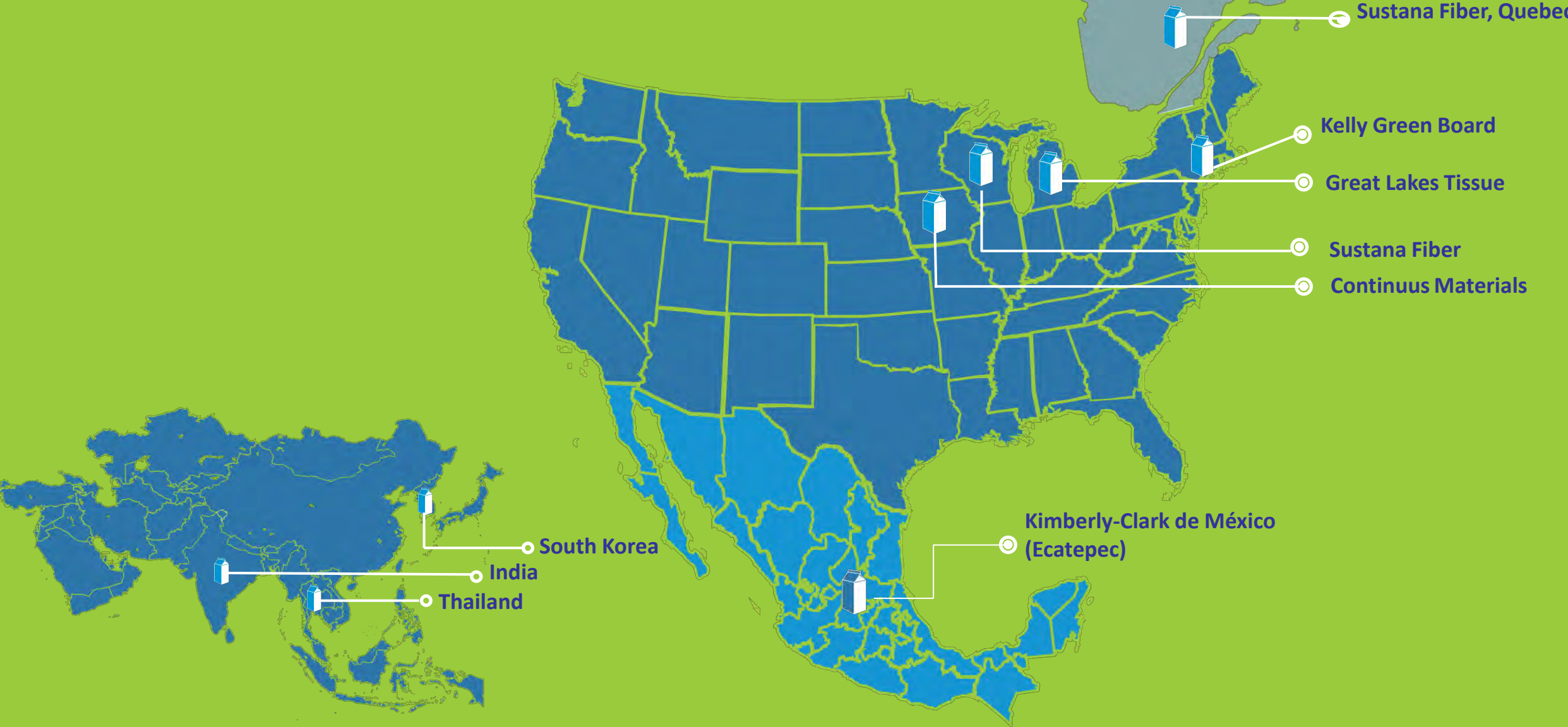
Recycling end market:	Building materials	Tissue and Toweling	De-ink pulp	Tissue Toweling/Packaging
Grade consumed as:	Grade 52	Grade 52	Grade 52	Mixed
% yield for entire package	100%	67-70%	67-70%	50-60%
% yield for fiber content	100%	85-90%	85-90%	65-80%
% yield for poly & polyAl content	100%	0%	0%	0%
What happens to poly & polyAl residual	Poly and PolyAl residual becomes part of end product.	Poly & PolyAl residual is either landfilled or captured and used as waste to energy.	Poly & PolyAl residual is either landfilled or captured and used as waste to energy.	Poly & PolyAl residual is either landfilled or captured and used as waste to energy.
Existing end market viability:	11,000 tpy capacity	15,000 tpy capacity	20,000 tpy capacity	est. 75,000 tpy capacity
Long term end market viability:	Potential growth capacity estimated at 200,000 tpy	Potential growth capacity estimated at 20,000 tpy	Potential growth capacity estimated at 50,000 tpy	Significant growth potential

These numbers are based on information received from mills in various parts of the US and Canada and Mexico as well as some mills overseas.

Due to the proprietary nature of this information, we are unable to provide further specifics as many recyclers were not willing to share more detailed information.

Some expressed an openness to connecting directly with DEQ.

Grade 52/Mill Spec Poly Markets



Mixed Paper & Grade 52/Poly Markets



End Markets: validation

- Attached to this submission are letters from Kimberly Clark of Mexico, one of the end-markets for cartons, and Omnisphere, a broker that moves bales of materials including cartons.

Environmental health and safety considerations

- Please refer to [Elopak's](#), [Pactiv Evergreen's](#), [SIG Combibloc's](#), and [Tetra Pak's](#) comprehensive sustainability reporting for information on environmental health and safety.
- Additionally, please refer to Tetra Pak's [alignment with the Global Reporting Initiative](#).

Compatibility with existing Oregon recycling infrastructure

- Slightly less than half the households* in Oregon have access to carton recycling:
 - 37% have access through curbside recycling
 - 10% have access through drop off recycling
- Once collected, cartons are either sorted into Grade 52 or into Mixed Paper to be sent on for recycling.
- Carton Council's grant program for MRFs can help to offset the capital costs of equipment needed to sort cartons.
 - Carton Council has been engaged with and continues to look for other opportunities to increase access to carton recycling in more parts of the state of Oregon.



*Household access data is from CCNA database managed by a third-party organization.

Cartons available for recycling per EPA

- The estimated quantity of gable-top and aseptic cartons generated in the US is 10.5 lbs/household/year¹. At this generation rate, Oregon households would generate roughly 8,000 tons of cartons per year.
- Carton Council estimates that cartons should make up 0.5% - 1% of the inbound material stream of a typical MRF that accepts cartons for recycling. Based on this MRF composition, the quantity of cartons available to be recovered in Oregon would be between 4,000-8,000 tons annually².

¹ US EPA, [*Advancing Sustainable Materials Management: Facts and Figures 2018*](#)

² Oregon DEQ, [*2019 Material Recovery and Waste Generation Rates Report*](#).

Other calculations by RRS.

The practicalities of sorting and storing the material

- Cartons can be sorted into either PSI Grades spec 52 (Post Consumer Aseptic and Gable Top Cartons), or into a mixed paper grade along with other paper and packaging.
 - While Carton Council promotes the sortation of cartons into Grade 52, it is ultimately the decision of the MRF and their end markets as to which stream they chose to direct cartons for recycling.
- When sorting cartons into grade 52 at the MRF; cartons can be sorted by hand or using automation such as optical sortation and robotic sortation. Carton Council has a well-established grant program for MRFs to help procure the necessary equipment to accept and sort cartons. Carton Council also provides technical expertise to help MRFs find the best sorting solution.
- Carton Council has experience in working with MRFs on LTL (less than truckload) solutions where baled carton volumes might be lower. Carton Council would be willing to investigate similar solutions where appropriate in Oregon.

Contamination

- Contamination can be present in all material used for food and beverage packaging, including metal cans, plastic bottles, jugs, tubs and jars, and glass bottles and jars, as well as cartons.
- Contamination present in carton packages could include food material, liquids, and straws (specific to juice boxes).
- Carton Council provides [simple recycling education](#) to improve consumer preparation, emphasizing the steps of emptying, placing in the recycling bin without flattening, and attaching caps. These steps align with the consumer directions for recycling packages such as PET bottles, HDPE jugs, etc.
- Carton Council provides [comprehensive materials](#) to be used in school recycling programs, featuring the “[Drink, Empty, Recycle](#)” message, as well as educational materials that students can take home to reinforce the lessons around recycling preparation with their families.
- Plastic components (caps and straws) are intended to be reattached or pushed into the carton package. This prevents them from potentially being lost as litter or residue. At the end market, the plastic components become part of the polyAl fraction as described on page 6, and may become part of an end product, used for energy production, or landfilled.



The ability for waste generators to easily identify and properly prepare the material

- Carton Council provides extensive educational material on carton recycling, including visual and video content. All materials are available for recycling program use via www.cartonopportunities.org
- Carton Council has been an industry leader in conducting research with consumers on how they make the decision to recycle, what steps go into making behavior changes, and their perceptions of recycling. Findings from this research have been published in numerous trade articles, including those linked below.



- [Study: Decision to recycle is only the first step](#)
- [Consumers Aren't Making Connection Between Recycling and Creating New Products](#)
- [Show don't tell when it comes to reminding consumers to recycle](#)
- Additional publications and media coverage can be found at <https://cartonopportunities.org/carton-news>

Economic factors

- Carton Council's grant program for MRFs helps to support the capital costs of equipment used to sort cartons.
 - Carton Council can also provide technical expertise to help MRFs find the best sorting solution.
- Carton Council has provided grant funding to almost 100 MRFs nationwide since it was established.
- While the economic factors vary from MRF to MRF, cartons can be a valuable product for MRFs to accept and sort into Grade 52 or as part of mixed paper.

Environmental factors from a life cycle perspective

- From a life cycle perspective, cartons represent a lightweight and efficient packaging choice with a high product-to-package weight ratio. When analyzed, cartons have been found to only produce between 17%-40% CO2E emissions on a normalized basis, e.g., per 1,000 liters of product versus traditional comparable packaging formats, such as PET bottles, glass bottles, and steel cans.
- Please refer to the following LCA references:
 - US-based study for Tetra Recart: [LCA: Soup in Tetra Recart carton packages \(tetrapak.com\)](https://www.tetrapak.com/en/press-releases/2021/01/lca-soup-in-tetra-recart-carton-packages)
 - Wine container systems: [Life cycle inventory of container systems for wine \(tetrapak.com\)](https://www.tetrapak.com/en/press-releases/2021/01/life-cycle-inventory-of-container-systems-for-wine)
 - Milk container systems: ELOPAK NORTH AMERICA: TOWARDS A SUSTAINABLE FUTURE LCA, NOVEMBER 2021 (attached)

Thank you

- The CCNA organization appreciates your time reviewing the submitted information and we welcome the opportunity to further discuss carton recycling in Oregon.

Date: March 9, 2022

**Mr. David Allaway
Oregon Department of Environmental Quality**

Dear Sirs,

Kimberly-Clark de Mexico (KCM), at our recycled tissue mill in Ecatepec, has been a consumer of fiber from aseptic cartons for several years. In 2017, after doing equipment modifications, we began to use ISRI Grade 52 (Post-Consumer Aseptic and Gable Top Cartons) from the US and Canada as part of our raw material. This grade is a good source of fiber for our recycled tissue products being produced at our Ecatepec mill.



**Lic. Marco Antonio Jiménez Ríos
Purchasing Manager (Recycled Fibers)
Kimberly Clark de México S.A. de C.V.**

Oficinas Administrativas

**Jaime Balmes No. 8, Piso 9
Polanco, 11510 México, D.F.
Tel: (55) 5282-7273**

OMNISPHERE CORPORATION

March 11, 2022

Mr. David Allaway
Oregon Department of Environmental Quality

Dear Mr. Allaway,

My name is Alexander F Valdes, and I am the president of Omnisphere Corporation. We are a trading company with 48 years of experience marketing waste paper from all 50 states to Paper Mills that manufacture recycled tissue and toweling. One of our primary customers is the Kimberly-Clark de Mexico (KCM) paper mill in Ecatepec, Mexico. This paper mill uses waste paper, including ISRI Grade 52 (Post-Consumer Aseptic and Gable Top Cartons), as part of its paper-making raw material.

In 2017, after equipment modifications, the Ecatepec mill began using ISRI Grade 52 from the US and Canada, and they have been a consistent monthly buyer of this grade. We believe that this interest will continue in the foreseeable future, as KCM sees value in the fiber contained in Grade #52.

We would welcome the opportunity to source ISRI Grade 52 from Oregon.



Alexander F. Valdes
President

ELOPAK NORTH AMERICA

TOWARDS A
SUSTAINABLE FUTURE
LCA NOVEMBER, 2021

PRESENTATION TO THE NACC
(NORTH AMERICAN CARTON COUNCIL)
MARCH 3RD, 2022



LCA MAIN OBJECTIVES

- Compare the environmental profiles of primary packaging for fresh milk and juice in USA and Canada
- Identify significant contributions to the environmental impacts across the product lifecycle (Cradle to grave)
- Identify possible improvement areas of the studied systems

ELOPAK AMERICAS LCA – MAY 2021

Comparative LCA of different primary packaging solutions of fresh milk and juice sold in North America (Canada and USA).



Pure-Pak®
White board



Pure-Pak®
Natural brown
board



HDPE
bottle



PET
bottle

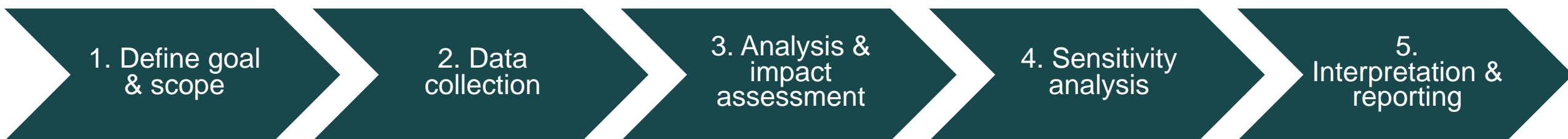
Cradle-to-grave (multiple impact categories, ISO 14044 compliant)

LCA CONDUCTED BY ANTHESIS

- Anthesis is a specialist global sustainability services and solutions provider founded on the belief that sustainable business practices are at the heart of long-term commercial success
- Launched in March 2013 to meet market demand for an international firm whose core business is providing commercially relevant sustainability services
- Around 500 staff globally, through organic and acquisitive growth
- Global team of LCA specialists with experience across many sectors
- Strong presence in North America (Boulder, San Francisco Bay, Boston, Ottawa, New Brunswick)



STEPS OF LCA



PEER REVIEW

Lise Laurin



CEO at EarthShift Global,
New insights for Life Cycle
Assessment, Sustainability and
S-ROI

Bill Flanagan



Co-Founder & Director at Aspire
Sustainability

Chair, Board of Directors, of the
American Center for Life Cycle
Assessment (ACLCA)

Rafael Auras



Professor at the Michigan State
University School of Packaging

Packaging Sustainability,
Polymeric Packaging Materials,
LCA

COMPETITOR ANALYSIS (HDPE) – 15 SAMPLES

Milk

Juice

Canada
(1 L, 2 L)



USA
(quart, ½ gallon)



COMPETITOR ANALYSIS (PET) – 14 SAMPLES

Milk

Canada
(1 L, 2 L)



Juice



USA
(quart, 1/2 gallon)



LCA DESCRIPTION

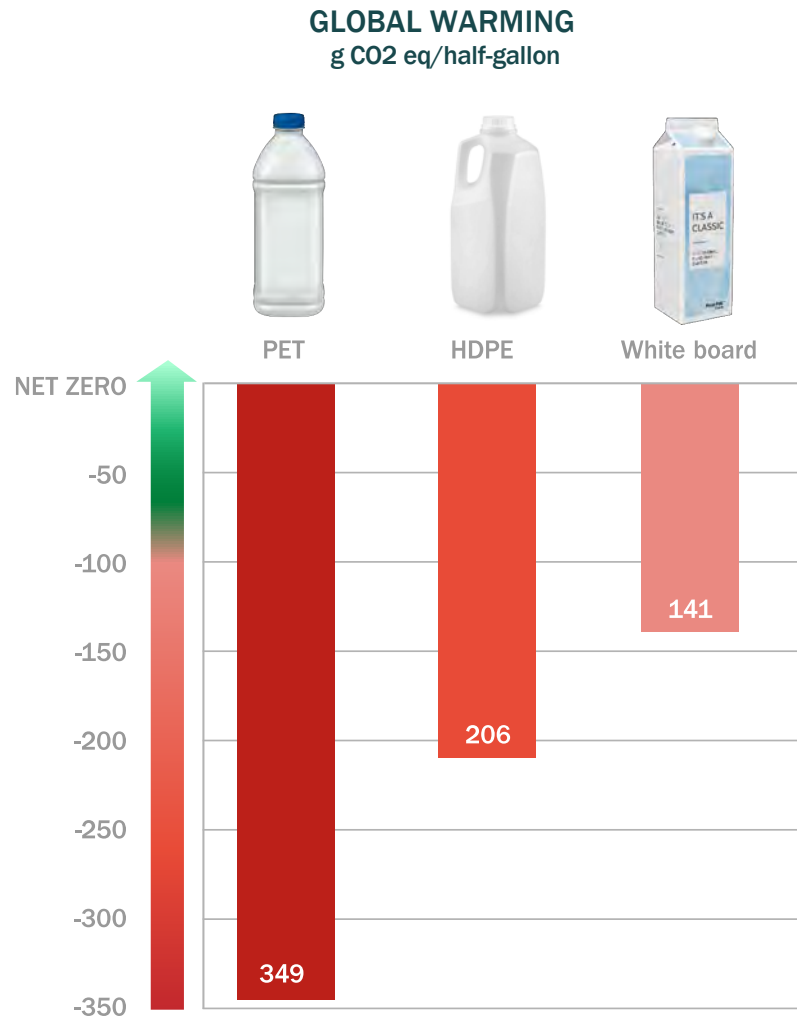
A Life Cycle Assessment (LCA) is a tool to quantify the environmental impacts associated with a product, throughout its life cycle. The system boundary for each product system in this LCA was “cradle-to-grave”, which comprises: the extraction/cultivation and processing of raw materials, manufacturing, forming and filling processes, end-of-life, and all transportation and waste stages.

An independent panel of experts carried out a critical review of the study to ensure compliance with the ISO standards for LCA (ISO 14040 and 14044).

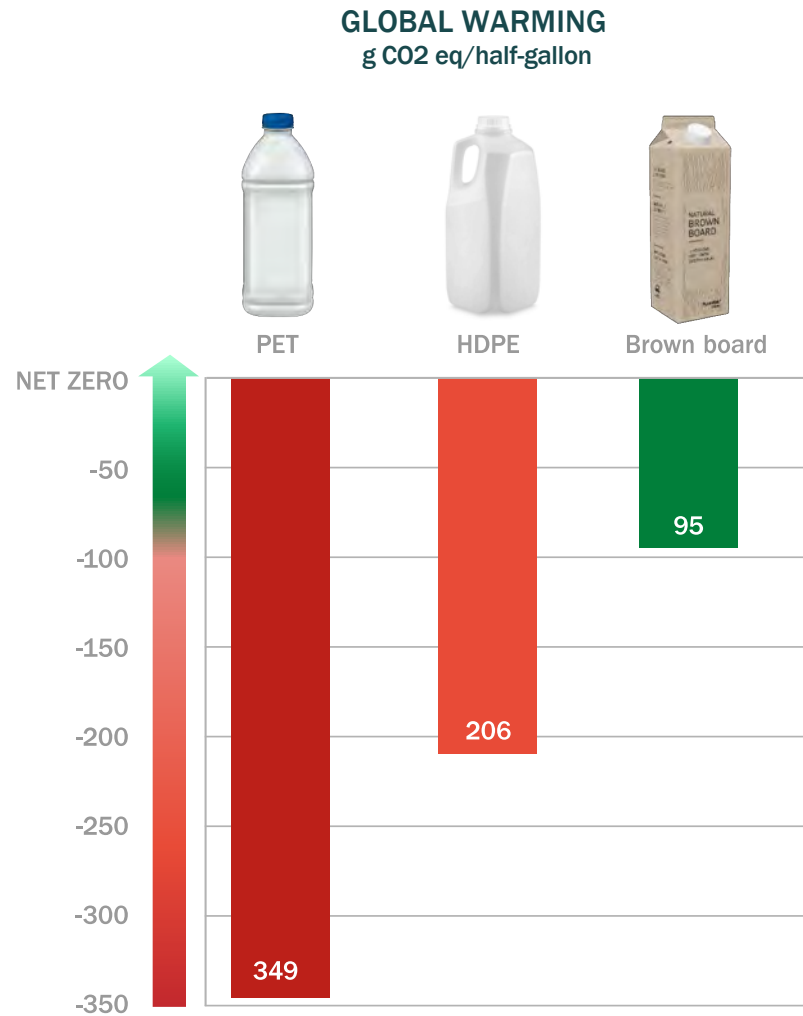
In this LCA, it was assumed that plastic bottles contained post-consumer recycled content, 15% for HDPE bottles and 7,5% for PET bottles which was seen as a conservative assumption in respect of cartons (i.e. favoring competitor bottles to Elopak).

A key focus for this study was the Global Warming impact category, measured in carbon dioxide equivalent.

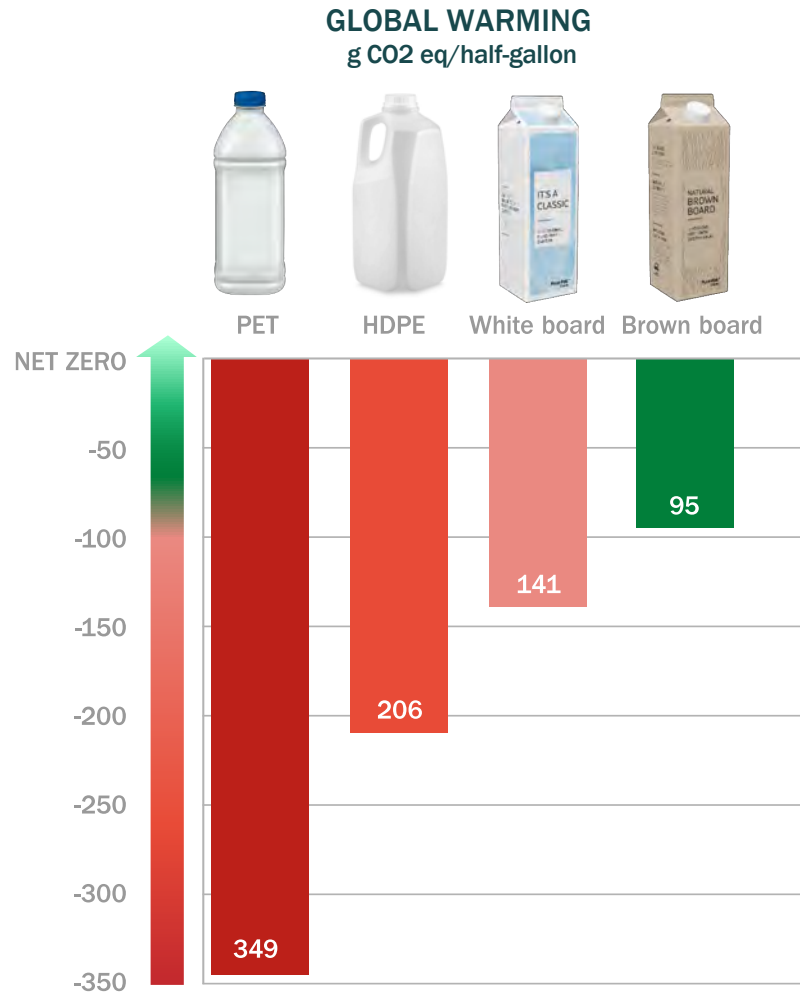
BASIC PURE-PAK: MUCH LOWER CO2 IMPACT VS PLASTIC BOTTLES



PURE-PAK NATURAL BROWN BOARD: MUCH LOWER IMPACT VS PLASTIC BOTTLES



ELOPAK'S CARTONS HAVE A MUCH LOWER CARBON FOOTPRINT THAN A TYPICAL HDPE BOTTLE OR PET BOTTLE



Overview of all impact categories assessed in the LCA, indicating where cartons perform better than plastic bottles

Key Criteria	White carton	Natural brown carton	Key Comments
1 Global Warming	✓	✓✓	Significant CO ₂ e reduction versus PET and HDPE
2 Fine Particulate Matter Formation	✓	✓✓	Significant reduction versus PET and HDPE
3 Fossil Resource Scarcity	✓	✓✓	Significant reduction versus PET and HDPE
4 Fresh Water Eutrophication	✓	✓✓	Significant reduction versus PET and HDPE
5 Marine Eutrophication	✓	✓✓	Significant reduction versus PET and HDPE
6 Mineral Resource Scarcity	✓	✓✓	Significant reduction versus PET and HDPE
7 Terrestrial Acidification	✓	✓✓	Significant reduction versus PET and HDPE;
8 Stratospheric Ozone Depletion	✓	✓✓	Impact mostly from the paperboard production and the coating material production. Nylon production is one of the main contributors.
9 Ozone Formation Human Health	✗	✓✓	Impact mostly from fossil fuels-derived energy and direct emissions at paper mills during paperboard production in North America (white carton)
10 Ozone Formation Terrestrial Ecosystems	✗	✓✓	Impact mostly from fossil fuels-derived energy and direct emissions at papermills during paperboard production in North America (white carton)
11 Land Use	✗	✓✓	Forest-based products require some use of land, however, Elopak source only from responsibly managed forests, secured through third party verified certified or controlled sources.
12 Ionizing Radiation	✓	✗	Nuclear power in the grid electricity mix in Sweden (40% nuclear) where the brown paperboard is produced
13 Water Consumption	✗	✗	Cooling water for nuclear power plants in Sweden (brown paperboard) and paperboard production in North America (white carton)

LCA

- 1.Key learning of our LCA: the level of CO₂ of one pack versus another is related to the source of the raw material and the converting process
- 2.Recycling plays a minor role in CO₂; recycling is about reducing litering

CO2eq/Half-Gallon	Total	End of life	%
White board	140.62	4.27	3%
NBB	95.21	3.84	4%
HDPE	206.2	8.7	4.2%
PET	348.96	10.37	3%



Background

In 2019, recycling market shifts led to the decision by City of Eugene to exclude specific materials from its recycling program due to the economics of recycling certain materials at that time. Materials removed from the program included plastic tubs, plastic jugs, and shredded paper. The items that remain on Eugene's list of accepted materials include paper, cardboard, tin and aluminum cans, transparent soda bottles, water bottles, milk jugs, and juice bottles.

Resident response to the removal of plastic tubs and jugs from curbside commingled collection has been robust. Program staff receive calls once monthly or more from residents that are frustrated with the lack of local recycling options for these items and/or who are storing them in anticipation of an opportunity to recycle them in the future. In many cases, these conversations also reveal that other items (plastic clamshell and takeout containers and other rigid plastic items like flowerpots) that have never been accepted into the City's commingled recycling program are still commonly thought to be recyclable among residents.

Eugene Residents and Recycling

To improve awareness and understanding of Eugene's existing recycling program within the community, a public education campaign is currently underway to determine the most effective way to reduce confusion around Eugene's recycling program while simultaneously anticipating how best to communicate future changes to recycling programs related to Oregon's Plastic Pollution and Recycling Modernization Act (Senate Bill 582).

Focus Groups

The City has contracted recent qualitative research designed to explore the knowledge and motivations of Eugene residents related to recycling locally. Three focus groups were conducted in February of 2022 including single-family homeowners, renters of both multifamily and single-family residences, and Spanish speaking residents.

Residents in all groups expressed a high level of awareness about recycling in general and an understanding of the importance of recycling correctly, and also understood that there were impacts associated with putting the wrong items in their recycling.

Focus group members reported being motivated to recycle by environmental concerns, the safety of workers processing recycled material, and the idea that recycling service could potentially be limited or made less accessible by service providers due to contamination issues, leading many to report that they would throw an item away if they were unsure it could be recycled.

Participants reported they were most confused when recycling different kinds of plastics, and nearly all participants were unclear which items made from plastics could be recycled. In some cases, focus group members were aware of the resin identification numbers on plastic

containers and routinely looked for them when recycling despite Eugene's recycling program accepting plastics based on shape and visual characteristics and not resin type.

Residents reported not being aware that guidelines vary from locality to locality and that they rely on recycling information that they acquired a while ago, sometimes even in different cities or states. Many interviewees also expressed frustration about how rules may vary from place to place and indicated that they would not spend significant amounts of time researching information when unsure about what to do with a specific item.

Public Outreach

While performing public education and outreach around recycling at community events, City of Eugene Waste Prevention staff routinely encounter a lack of clarity about what can be recycled even among residents that describe themselves as environmentally minded and up to date on recycling information.

One of the methods of educational outreach employed by the Waste Prevention team is a recycling 'game' where participants use trash pickers to select materials from a mixed pile of common household trash and recycling materials and then place them into staged trash, recycling, and yard + food waste 'bins'. In addition to being educational and very popular with families, the staff delivering the game have reported the most common items that residents consistently misidentify as recycling as:

- Plastic clamshell containers
- Plastic to-go containers
- Plastic tubs and jugs not accepted into the current recycling program
- Rigid plastic items such as flowerpots
- Frozen food boxes

Resident Communications

When responding to resident inquiries related to recycling, the majority of resident calls (6 out of an average of 7 calls weekly) are requests for information about where to recycle items that are too large to fit in their curbside commingled bin (large volumes of cardboard), or that are not accepted into the recycling program (tubs and jugs).

Contamination

Data on the level of contamination in Eugene's commingled recycling stream isn't readily available but during observation by Waste prevention staff of local commercial and residential recycling route loads being aggregated at a local materials recovery facility, contamination is obvious and significant. Plastic film, rigid plastics including clamshell and takeout containers, and single use items such as coffee/hot cups are prevalent.

Recycling Contamination Measured at Public City Facilities

The City's Internal Zero Waste Program staff works with assigned recycling coordinators at City operated facilities to ensure that recycling signage is posted and up to date in both public and

restricted areas, monitors internal and external trash and recycling for volume and recycling contamination, and works with an external third-party contractor to perform waste assessments at these facilities.

In 2017, a waste assessment performed on a City operated pool/community center with publicly accessible trash and recycling collection points reported a 40% contamination rate in the exterior recycling container. After the 2019 changes to Eugene's recycling program, contamination observed during a waste assessment at a different but similarly sized pool/community center was 37% of the total material in the exterior recycling containers. In both assessments, the contamination was comprised of rigid plastic, compostable food, and items suitable for donation.

Recommendation

Although the removal of several items from Eugene's recycling program simplified the program's list of accepted materials, no direct evidence that the exclusion of shredded paper and several categories of plastics has significantly reduced commingled contamination of the local recycling stream overall has been observed.

Eugene made alterations to the list of accepted materials in the City's recycling program due to market forces that may no longer be as relevant as we anticipate the contribution of resources from producers potentially increasing the feasibility of recycling a broader range of materials. A final list of commonly recycled items that included more categories of material (clamshell containers, tubs, jugs, flower pots and other rigid plastic products) than are currently included in Eugene's commingled curbside recycling program would align better with existing resident recycling habits while possibly allowing for more targeted public outreach and education focusing on eliminating the most problematic items (plastic film, etc.) from commingled recycling streams.



MARCH 17, 2022

OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY

Re: Request for Information on Oregon Statewide Recycling Collection List

Dear DEQ Technical Workgroup and Rules Advisory Committee,

Denton Plastics, Inc. would like to register support for the inclusion of certain foodservice packaging items on the "Uniform Statewide Collection List". Denton Plastics, Inc. is located in Portland, Oregon and we are an end market for post-consumer materials sourced from Material Recovery Facilities (MRFs). We currently source post-consumer olefins to produce PCR Resin with a capacity of 2 million pounds post-consumer material annually.

We will begin procuring the following MRF grades

- -0- lbs of Mixed Plastic Bales [add detail as needed – e.g. 1-7, 3-7, other...]
- -0- lbs of PET Thermoform Bales
- 600,000 pounds of Polypropylene Bales
- 1,400,000 pounds of Polyethylene Bales

The following foodservice packaging items are acceptable in these incoming bales:

- **Polypropylene (PP) cups and containers**, including drink cups, deli tubs, clamshells, takeout dishes and lids and other PP thermoformed or injection molded containers
- **Rigid Polystyrene (PS) cups and containers**, including drink cups, clamshells, sandwich boxes and other thermoformed containers
- **Expanded Polystyrene (EPS or Styrofoam) cups and containers**, including drink cups and clamshells

As an end market for these materials with expanding demand from our customers Denton Plastics, Inc. wants to encourage the inclusion of these items in the statewide list to ensure an adequate supply to feed our growing operation.

Thanks very much for your consideration. We are happy to provide follow-up information upon request.

Best Regards,

A handwritten signature in black ink that reads "Nicole Janssen".

Nicole Janssen,

President,

Denton Plastics, Inc.

Martin Vogt
President & CEO
EFS-plastics Inc.
5788 Line 84, Listowel, ON, Canada N4W 3G9
519-418-3377 ext. 3101
Martin.vogt@efs-plastics.ca

March 18, 2022

OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY

Re: Request for Information on Oregon Statewide Recycling Collection List

Dear DEQ Technical Workgroup and Rules Advisory Committee,

EFS-plastics Inc. would like to register support for the inclusion of certain foodservice packaging items on the "Uniform Statewide Collection List". EFS-plastics Inc. has three facilities in North America, including a new facility in Lethbridge, Alberta, and we are an end market for post-consumer materials sourced from Material Recovery Facilities (MRFs). We have been purchasing #3-7 mixed plastic from Oregon MRFs since 2019 to process at our facility in Listowel, Ontario, as our throughput capacity has grown rapidly in recent years. At our new Lethbridge facility, we are sourcing post-consumer olefins (mostly in the form of #3-7 or #1-7 commodity bales) to produce various grades of 100% PCR PP and PE pellets. We currently have a total capacity to process 55,000 metric tonnes post-consumer material annually.

We would like to take this opportunity to highlight how important it is to us to grow the supply of polyolefins (in particular PP) collected from households. As a recycler, we are seeing demand grow for PCR PP and PE over the next few years, and we are looking far and wide to get access to more material. We know there is a large volume of PP and PE that is not being appropriately collected or sorted in the Pacific Northwest and is unfortunately ending up in landfill. EFS-plastics is very eager to continue working with communities and MRFs in Oregon to incentivize them to keep these materials in circulation.

We procure the following MRF grades:

- 25,000 tonnes of #3-7 or #1-7 mixed rigid plastic
- 20,000 tones of Grade A-C and MRF-grade film
- 5,000 tonnes of PP/Tubs & Lids
- 5,000 tonnes of HDPE

The following foodservice packaging items are desirable in these incoming bales:

- Polyethylene Terephthalate (PET) Cups and Containers, including drink cups, clamshells, bowls, trays and other thermoformed containers
- Polypropylene (PP) cups and containers, including drink cups, deli tubs, clamshells, takeout dishes and lids and other PP thermoformed or injection molded containers

The following foodservice packaging items are acceptable in these incoming bales (i.e., we are happy to accept them because we can easily sort them from other materials, and it makes it easier for MRFs to recover more material that we do want.)

- Rigid Polystyrene (PS) cups and containers, including drink cups, clamshells, sandwich boxes and other thermoformed containers
- Expanded Polystyrene (EPS or Styrofoam) cups and containers, including drink cups and clamshells

As an end market for these materials with expanding demand from our customers, EFS-plastics wants to encourage the inclusion of these items in the statewide list to ensure an adequate supply to feed our growing operation.

Thanks very much for your consideration. We are happy to provide follow-up information upon request.

Best Regards,

A handwritten signature in blue ink, appearing to read 'Vogt', with a long, sweeping horizontal stroke extending to the right.

Martin Vogt
President & CEO

Flexible Packaging Association

Submission to Oregon State Department of Environmental Quality

Request for Information – Recyclable Materials

The Flexible Packaging Association (FPA) respectfully submits the following information in response to The Oregon Department of Environmental Quality's (DEQ) Request for Information: Oregon statewide recycling collection list and producer-collected materials (for recycling).

FPA is a national association that represents flexible packaging (such as rollstock, bags, pouches, labels, liners, wraps, and tamper-evident packaging for food and medicine) manufacturers and suppliers to the industry in the United States. Flexible packaging, a \$34.8 billion industry, is the second largest and fastest growing segment of the packaging industry and employs approximately 79,000 workers in the United States. FPA appreciates DEQ's consideration of the below information regarding the recycling capacities of flexible materials and urges DEQ to classify both Polyethylene and Multi-material flexible packaging as recyclable.

Polyethylene (PE)

FPA strongly believes that Polyethylene (PE) is a recyclable, highly versatile, valuable material with a wide range of applications and uses. PE is one of the most widely used polymers worldwide. The Recycling Partnership estimates that the average household generates 75 pounds of film and flexible materials per year. This suggests a residential supply stream upwards of 7.3 billion pounds per year of flexible materials, just in the U.S, and unfortunately, most of it ends up in a landfill. This is largely because our recycling infrastructure is outdated.. Not only is PE recyclable but recycling High Density Polyethylene (HDPE) and Low Density Polyethylene (LDPE) provides benefits to the economy and environment.

When PE is mechanically recycled, the process results in small resin pellets that can be used in other production processes, either with the pellets being used alone or mixed with virgin materials, depending on the product needs. Mechanical recycling, however, generally requires a homogenous material stream, thus plastics must be sorted before they can be mechanically recycled. Mechanical recycling is widely used to regrind plastic water bottles (PET), laundry bottle and milk jugs (HDPE), as well as some flexible materials such as plastic grocery bags (PE). These materials can then be re-incorporated into new packaging or turned into another product, such as plastic lumber, which is often the case with recycled PE bags. What's more, the majority of PE plastics are able to be recycled up to 10 times.

PE based products are also, generally, much lighter than other packaging alternatives, meaning that even with no recycling, they still result in less material sent to landfill vs. other formats. Products made from all PE, such as overwraps and grocery bags can be easily recycled at front of store recycling drop off locations. In classifying PE as a recyclable material, DEQ would further encourage other

recycling collection programs. One such program, the Wrap Recycling Action Program (WRAP) allows consumers to bring PE films such as grocery bags, bread bags, and overwraps for paper towels back to stores as part of the store drop-off program. These PE bags are then combined with other PE film collected at the back of stores and sent to a reprocessing center to be recycled. Following the initial success of the program, the group developed the website www.plasticfilmrecycling.org to provide information to consumers and community leaders on how to advance flexible PE film recycling in their community. The site lists over 18,000 drop-off locations in the U.S. that accept PE films. Furthermore, Research from Europe notes that approximately 80% of flexible packaging today is made from mono-material (mostly PE), showing that the bag drop-off program has a great opportunity to expand flexible packaging recycling.

In the U.S., approximately one-third of all food produced is disposed of before it is consumed, resulting in 1.3 billion tons of food thrown out annually. A cucumber wrapped in PE film can stay fresh for up to 14 days, while an unwrapped cucumber stays fresh for about five days. In the developed world, more than 50% of food waste takes place in households, and nearly 20% is wasted during processing. Plastic packaging helps to reduce this high level of waste in both areas. Food waste is a major contributor to global greenhouse gasses and is a large contributor of methane gas at landfills. Flexible packaging, in general, and PE in particular can help reduce food waste through methods such as portion control (to prevent overuse and waste) and extending food shelf life.

In 2019 the global polyethylene market size was \$107.43 billion and is projected to reach \$130.26 billion by 2027. Furthermore, states and nations are increasingly requiring higher levels of post-consumer recycled (PCR) content in products and the demand for recycled/recyclable materials like PE has already outpaced the supply. PE is lightweight, highly valuable, easily recyclable, and a crucial piece of the puzzle moving towards a circular economy.

Multi-Material Flexible Packaging

FPA believes that the classification of Multi-Material Flexible Packaging (MMFP) as a recyclable material is of critical importance to the reduction of the environmental impacts of packaging and to continued progress towards a circular economy. MMFP consists of several thin layers that are typically combined with an adhesive or wax. These thin layers each have a specific strength, printing, operation, moisture, and oxygen barrier, which together allow the packaging to meet performance needs while using much less material overall than would be required of any single material. Multi-material films are strong, cost effective, and generally lighter and thinner, which helps to reduce demand for resources required both to produce and to transport packaging—including a reduction in greenhouse gases. Because of these advantages, an estimated 40 billion packages are produced from multi-material films annually in the U.S., and MMFP is anticipated to be one of the fastest growing packaging formats over the coming years. Though the recovery of MMFPs is more complicated than that of some single material packaging, it is becoming increasingly feasible, and the advantages of MMFP make it worthwhile to take extra care during its recycling now while a better infrastructure for MMFP recycling is crafted and refined.

MMFPs can be challenging to mechanically recycle under current infrastructure because they do not have a standard composition, and consequently there can be a wide range of material and some

uncertainty regarding output products. However, these outputs are still viable materials for many end users. It is important to note that multi-material films are still relatively new to the market, and as with most new materials, options for recovery have not caught up. This should not discourage the use of MMFPs or exclude them from recyclability, as there is increasing support for innovation in the recycling of multi-materials through a number of initiatives. One such example is the Hefty EnergyBag program, which collects plastics that are typically thrown away, like candy wrappers and juice pouches, through curbside collection and sorting at a material recycling facility (MRF) and converts them into energy resources. EnergyBag is a great example of an initiative that is complimentary to mechanical recycling, and additionally it demonstrates the feasibility of curbside collection, sorting, and contamination control of MMFPs.

Another example initiative is Materials Recovery For the Future (MRFF), a pilot program in Birdsboro, Pennsylvania that successfully collects, separates and prepares flexible plastic packaging for recycling, including multi-material flexibles. The flexible materials that MRFF captures are processed into a commodity bale for reuse in a variety of markets. This program aimed to and succeeded in demonstrating that adequate optical sorting capacity and peripherals allow for the efficient capture of flexible packaging in a large single-stream MRF.

In closing, the Flexible Packaging Association would also like to stress that it is highly important to consider Advanced Recycling technologies as a complementary method to mechanical recycling in any serious dialogue. Advanced Recycling through pyrolysis and gasification, best demonstrated through the University of Florida's Advanced Recycling Program, can process plastics such as MMFPs that do not have strongly defined end markets and can produce new plastics and chemicals that are virgin equivalent, ultimately enabling a more circular economy for plastics. FPA strongly supports the classification of Advanced Recycling as a form of recycling, and its benefits are particularly valuable with respect to MMFPs.

FPA is grateful for the opportunity to provide comment and would thank you in advance for your consideration. If we can provide further information or answer any questions, please do not hesitate to contact FPA via phone at 410-694-0800 or via e-mail at SSchlaich@Flexpack.org or ATrumpy@Flexpack.org.

Respectfully,

Sam Schlaich

Sam H. Schlaich, J.D.

Government Affairs Counsel, FPA

Oregon Statewide Recycling Collection List and Producer-Collection Materials for Recycling

This information is submitted by the Foodservice Packaging Institute in response to the February 3, 2022 Request for Information: Oregon statewide recycling collection list and producer-collected materials (for recycling).

We welcome questions and can provide additional details upon request. Please contact:
Ashley Elzinga
571-407-1434
aelzinga@fpi.org

Background

The Oregon Department of Environmental Quality has requested technical information that can be used to evaluate materials against evaluation criteria set forth in statute. The Oregon Plastic Pollution and Recycling Modernization Act was passed into law in 2021 requiring numerous changes that are intended to modernize and stabilize recycling services in Oregon.

The Foodservice Packaging Institute (FPI) was founded in 1933 and is the leading authority for the North American foodservice packaging industry. FPI encourages the responsible use of all foodservice packaging through promotion of its benefits and members' products. FPI's core members are foodservice packaging manufacturers and their raw material and machinery suppliers. With over 75 members, FPI includes approximately 90% of converters and suppliers in the foodservice packaging industry in North America, and over 200 foodservice operators, distributors, and educational institutions.

FPI is committed to reducing the impact of its products on the environment and is dedicated to making sure these items recovered and diverted from the landfill. FPI has a separately funded recovery group with a focus on paper and plastic cups, containers, bags, and boxes. Since 2011, this group has been working with communities, recycling facilities, composters, and end markets to expand to find stable and sustainable recovery solutions for these valuable materials. This group receives technical support from Resource Recycling Systems (RRS).

Through the [Community Partnership program](#) that launched in 2017, FPI has partnered with 15 residential programs to add foodservice items to their accepted material lists. The specific items are determined through consultation with the individual program, the Material Recovery Facilities (MRF) and end markets that process the community's materials. Once FPI determines viability for inclusion of foodservice packaging materials into the prospective community recovery program, FPI works with the city and/or municipality to educate residents on best practices for recovery. Because these efforts are market-based, they have proven stable and sustainable without further assistance from FPI, and the partners report numerous benefits to their programs.

A number of years ago, in an effort to accelerate the adoption of paper cup recycling, a select group of FPI members decided to commit additional funds for paper cup recovery in the U.S. This group includes many key stakeholders of the value chain such as manufacturers, users, and recyclers of paper cups. The paper cup recovery efforts complement the Community Partnership program and include market development work and equipment grants for MRFs who require additional sorting to process paper cups.

This RFI submission provides information regarding recyclability factors related to paper cups, to support decisions around their inclusion in the uniform statewide collection list (USCL). The data has been compiled with the assistance of technical consultant, RRS, who has conducted ongoing research on recycling and recyclability of these materials for FPI and other clients.

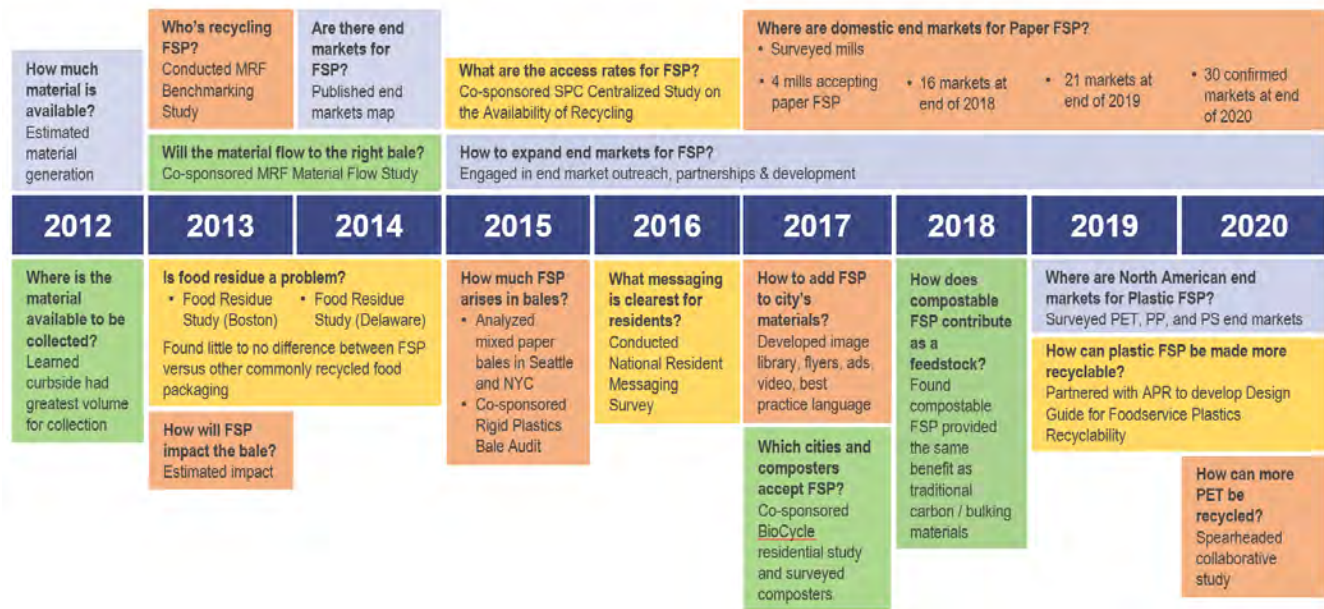
Fiber: Paper Cups and Paper Containers

This submission focuses on polycoated paper beverage cups. Most paper cups used in the US are made from solid bleached sulfate (SBS) white paperboard and are traditionally lined with polyethylene (PE). A very small percentage are lined with polylactic acid (PLA). Unless otherwise specified, the term “polycoat” cups refers to both PE and PLA-lined cups. Cups used for hot beverages have the polycoat layer only on the inside, whereas cups used for cold beverages have a second layer of coating on the outside to protect the integrity of the cup from condensation. Wax-coated cups no longer play a significant role in the paper cup market.

FPI Research

Since the inception of FPI’s recovery efforts over ten years ago, FPI has been conducting research on recyclability of foodservice packaging in order to understand and overcome potential barriers to its recovery. This research has provided the foundation for FPI’s successful Community Partnership program. Many of these studies have been collaborations with other industry stakeholders including the Association of Plastic Recyclers and the Sustainable Packaging Coalition, and since 2012, much of this research has been conducted with technical support from RRS and other technical experts including Cascadia Consulting, DSM, Stina (formerly More Recycling), and Moore and Associates. Below is an overview of these research efforts and the questions they were designed to address.

Overview of FPI's Foundational Research



Overviews of studies are available at www.recycleFSP.org

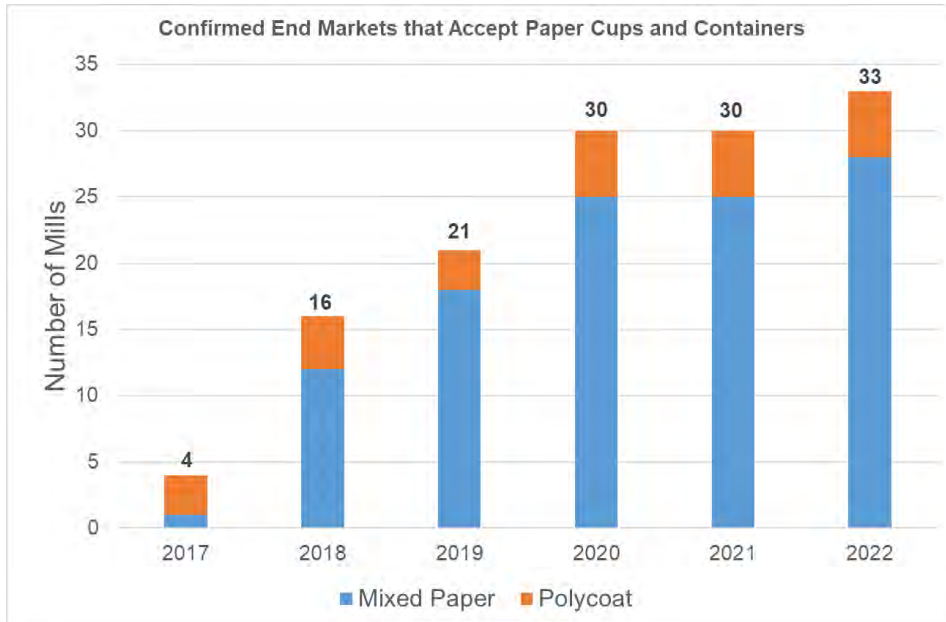
Studies of particular relevance for paper cups and containers are:

- [Food Residue Studies](#)
- [MRF Flow Studies](#)
- [Mixed Paper Bale Audits](#)

In addition, a recent [white paper by Moore & Associates](#) summarizes the landscape and developments related to recycling of paper cups.

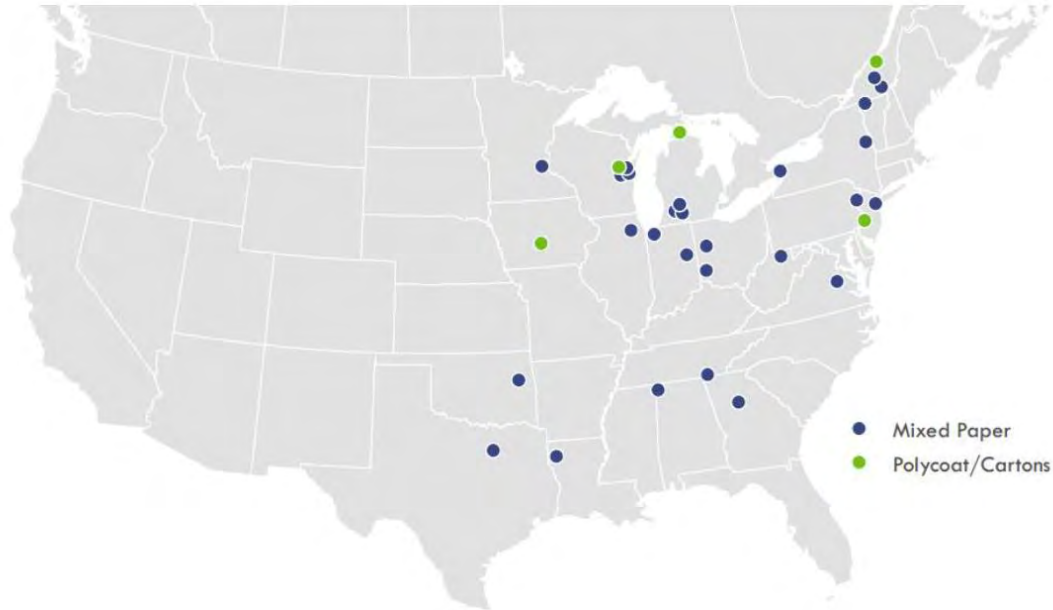
The Stability, Maturity, Accessibility and Viability of Responsible End Markets

The paperboard in paper cups contains long, strong fibers that are desired by mills. Traditionally, paper cups and other polycoated items have not been sought by recycled paper mills due to their coatings. However, fiber market trends such as the declining supply of recovered printing grades (e.g., sorted office paper) and the overall desire of the fiber industry to recover more fiber are driving growing interest in this material. Numerous companies have conducted trials of paper cups in their mills and begun to accept post-consumer paper cups as part of their furnish. The following table illustrates the change in end market acceptance over the last several years.



Growth in end markets for post-consumer paper cups, 2017-2022

As of March 2022, there are 33 confirmed end markets in the US and Canada that formally accept post-consumer polycoated (i.e. PE-coated or PLA-coated) paper cups. Of these, 28 accept cups in residential mixed paper. Another 5 end markets purchase polycoat bales consisting of cartons and cups. FPI maintains a [list of end markets for cups](#) (included as an appendix) and an [interactive end markets map](#) that are updated to reflect any changes.



End markets that accept paper cups. Source: <https://www.recyclefsp.org/s/End-Markets-for-Paper-Cups.pdf>

As of March 2022, this list includes the following end markets:

Mixed Paper Markets

The following mills purchase residential mixed paper bales containing paper cups. Some also accept other paper foodservice packaging.

Cascades, Ashland, VA (operational Q1 2023)

Cascades, Kingsey Falls, QC

Cascades, Niagara Falls, NY

Essity, Barton, AL

Essity, Menasha, WI

Essity, Middletown, OH

Essity, South Glens Falls, NY

Georgia-Pacific, Green Bay, WI

Georgia-Pacific, Muskogee, OK

Graphic Packaging International, Battle Creek, MI

Graphic Packaging International, East Angus, QC

Graphic Packaging International, Middletown, OH

Graphic Packaging International, Kalamazoo, MI

Green Bay Packaging, Green Bay, WI

ND Paper (sourcing via ACN), Fairmont, WV

Pratt, Conyers, GA

Pratt, Shreveport, LA

Pratt, Staten Island, NY

Pratt, Valparaiso, IN

Pratt, Wapakoneta, OH

WestRock, Aurora, IL

WestRock, Battle Creek, MI

WestRock, Chattanooga, TN

WestRock, Dallas, TX

WestRock, Eaton, IN

WestRock, Missisquoi, VT

WestRock, St. Paul, MN

WestRock, Stroudsburg, PA

Polycoat / Carton Markets

The following end markets purchase bales containing paper cups along with aseptic and gabletop cartons.

Continuus, Des Moines, IA

Continuus, Philadelphia, PA

Great Lakes Tissue, Cheboygan, MI
Sustana (Breakey Fiber), Levis, QC

Sustana (Fox River Fiber), DePere, WI

Notably, the 28 mixed paper mills that have formally confirmed their acceptance of paper cups represent over 75% of the US/Canadian mixed paper market by tonnage consumed. FPI facilitates a mill task force that is working to increase recovery of paper cups and paper foodservice packaging. The companies in that task force were joined by several other mill companies to release a joint mill statement of their cup acceptance and commitment to paper cup recycling. This statement is included as an appendix.

At this time, the landscape of mills that explicitly accept cups is concentrated on the eastern half of the US. This is in part a function of the overall distribution of paper mills in the US, which skews toward the east, and also a reflection of the global market dynamics which have long resulted in recovered materials from the western US flowing to overseas markets. While FPI's focus and priority has always been on strengthening North American end markets, some MRFs and brokers do send fiber bales with cups from the western states to Asian markets. Considerably less mixed paper is flowing offshore than it did a few years ago due to changes in China's policy, but a number of Asian markets do play a role in recovering mixed paper, and several South Korean mills consume polycoat/carton bales.

Today, there are mills that do not accept paper cups in their furnish. There is a need for more domestic/North American outlets for materials arising on the west coast and FPI continues to address this challenge and work on end market development. This work includes its mill task force, collaboration with AF&PA to develop information for mills, and direct engagement with mills to offer technical assistance and to facilitate mill trials for paper cups. FPI is particularly interested in increasing end markets in the western US and is in dialog with a paper mill in Washington regarding its acceptance of paper cups and other foodservice items.

The Anticipated Yield Loss for the Material During the Recycling Process

MRF Capture / Yield loss

In a 2015 MRF flow study co-sponsored by FPI (see appendix), approximately one-quarter of the paper cups flowed to the fiber line, and approximately three-quarters flowed to the container line. These numbers represent the average of results from five MRFs with very different configurations and represent a baseline, i.e., MRFs that were not optimized to capture paper cups.

Based on our work with MRFs, a common assumption is that paper cups that are flattened during collection will flow with fiber, while only round cups will flow to the container line.

FPI has conducted several more recent RFID tests, using both flattened and intact cups, to help MRFs understand where and how to best capture cups. These studies have shown that around 70% to 90% of 3-dimensional cups flow to the container line, and approximately 60% to 80% of flattened cups flow to the container line.

If the targeted bale is mixed paper, cups that enter the container line do not necessarily represent yield losses, as MRFs that accept paper cups will generally capture them from the container line using manual sortation or automated technology. If the targeted bale is a polycoat bale, the percentage of cups that flow to mixed paper do not necessarily represent yield losses, because they also can be recovered through that bale. The rate of successful capture to the target bale depends on a variety of factors including which bale is targeted, the MRF's 2D/3D screening system, the size and weight of the cup, and the use of manual or automated cup sortation. FPI does not yet have data on MRF capture/yield loss from MRFs that are actively targeting cups.

Mill Recovery / Yield Loss

Yield varies significantly according to a mill's technology and its furnish. Because this is proprietary, FPI does not have comprehensive data on cup yield. Based on information reported by several members of FPI's mill task force, yield from the cup is in the 70 to 90% range, depending on whether the cup has single- or double-sided coating and on the pulping system in use.

The Material's Compatibility with Existing (Oregon) Recycling Infrastructure

According to FPI research, most foodservice packaging is discarded at home or in the workplace. This means that residential curbside collection offers significant potential for capturing this material to achieve optimal diversion. Due to conditions spurred by the ongoing pandemic, takeout and delivery have likely prompted more opportunity for at home collection.

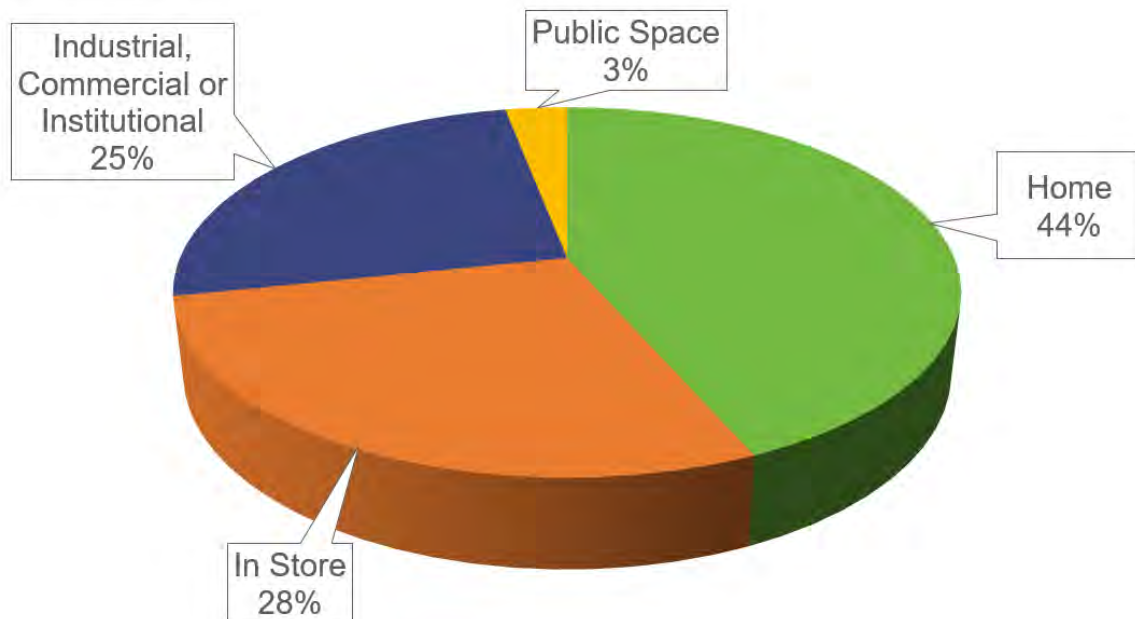


Chart showing breakdown of foodservice packaging by point of disposal

Paper cups are not yet generally accepted in Oregon's franchise agreements, but if they were accepted, residential education could be updated to reflect this. An FPI-sponsored study is currently underway which will provide more detailed insights into whether any Oregon communities accept paper cups in residential programs.

As FPI is aware of very few Oregon recycling programs accepting paper cups, we do not have information on how specific Oregon MRFs are handling cups they do receive but would expect that they are allowed to flow to mixed paper and/or residue.

The Amount of the Material Available

According to industry estimates, there are roughly 600,000 tons of paper cups produced annually in the US.

The US EPA does not track paper cups specifically but estimates that there are 2.84 billion pounds of paper cups and plates in the municipal waste stream (2018 EPA SMM Facts and Figures).

In the case of paper cups, sources suggest that as much as 70% leave the store/restaurant and at least half end up in the home, where they are available to be recycled in the residential stream.

The Practicalities of Sorting and Storing the Material

Recovering paper cups does not require sorting them to a new bale; they can be recovered through either of the two existing commodities, mixed paper or a polycoat bale consisting of cartons and cups.

MRFs who choose to include cups in mixed paper can allow the cups on the fiber line to flow to that bale and can redirect cups from the container line to the fiber line or to mixed paper. Based on bale audits conducted by FPI (see appendix), paper cups make up a very small percentage of the bale (less than 0.5% by weight). However, MRFs handle large volumes of mixed paper, so storage (and storage time) would not be a concern.

Similarly, MRFs who choose to sort cups into a polycoat bale can pick the cups from the container line and direct them to that bale. This positive sort can be a manual sort, however some MRFs are investing in automated solutions (i.e., optical or robotic sorters) that can recover cups along with cartons and other polycoated fiber. Cups can contribute a significant quantity of material to a carton/polycoat bale, making up around 10-25% of that bale by weight. This additional volume can be welcome as it allows the MRF to reach truckload quantities sooner.

FPI has an equipment grant and technical assistance program for MRFs who require additional equipment to process paper cups.

Contamination

FPI commissioned studies of food residue on foodservice and food-contact packaging in the residential recycling stream in 2013 and 2014. These studies found that the amount of residue in foodservice packaging was similar to any other type of food contact packaging and determined to be consistent with what markets are accepting. Cups are used to contain liquids, and generally, residual liquid drains out of the cup by the time it reaches the MRF.

The real-world experiences of communities and MRF accepting cups indicate that with good resident education, paper cups and other foodservice packaging can be added successfully while reducing overall contamination. The communities and MRFs that have participated in FPI's Community Partnership program have not reported any problems with quality or marketability of bales as a result of adding paper cups, and the foodservice items added via the partnerships remain in their programs.

The Ability for Waste Generators to Easily Identify and Properly Prepare the Material

Paper cups are easily identifiable by resident, and easy to describe and depict in program guidance due to their distinct shape, and the consistent use of the term "paper cup" to refer to them, both in the recycling industry and among the lay public.

The only preparation needed is to empty the cup and remove the lid or any other ancillary items.

FPI inventoried the messaging used in leading recycling programs, the terminology recommended by several industry groups, and conducted a resident messaging survey, that is specific to foodservice packaging in order to develop best practices. FPI employs these findings in every Community Partnership program and resident communications for program additions. These best practices include recommended terminology, effective graphics, and simple preparation instructions aimed at promoting recycling of clean and empty items and minimizing contamination ([the resident education kit, including the study results, is available for download](#)). The recommended graphics feature clean, empty cups, with no lids or straws attached. This messaging strategy has proven effective, and our partner communities have reported reductions in residue following the communications campaign.

Economic Factors

Recent years have seen dramatic changes in market pricing for mixed paper, as well as fundamental changes in the supply of sorted office paper (SOP) and other grades. As with any material, strong pricing helps to drive MRF investments in sortation. Mixed paper has averaged \$55/ton over the last 6 months and is currently trading at around \$40 - 45/ton in the Northwest (based on data from [recyclingmarkets.net](#)). Due to different pricing dynamics for mixed paper vs. polycoat bales, the fact that cups may be marketed in more than one grade can be

an advantage; FPI has observed that some MRFs seek to maintain operational flexibility to direct cups to the most economically advantageous bale.

Appendices

- Moore & Associates: White paper
- Multiple companies: Joint mill statement
- FPI and AF&PA: FAQ for Mills
- FPI: FSP in Mixed Paper Bales: Audit Results
- FPI: End market list
- RRS, Reclay StewardEdge, and Moore Recycling: MRF Flow Study
- FPI: Food Residue Study Overview
- FPI: Community Partnership Results Summary

White Paper: The State of Paper Cup Recycling

January 27, 2022

1. The Evolution of Paper Cup Recovery Efforts

Residential Paper Cup Recycling in the US

In 2011 the Foodservice Packaging Institute (FPI) formed an alliance of restaurant and foodservice packaging industry leaders to investigate how paper-based single-use foodservice packaging could become more widely recycled. A series of studies indicated that at least half the packaging generated by foodservice locations makes its way back to the home. In the case of paper cups, sources suggest that as much as 70% leave the store.¹ The Paper Recovery Alliance (PRA) was formed with the initial task of benchmarking the types of paper cups in use, where cups are used, and where cups end up at 'end-of-life'. If most single-use cups are taken to home or work, cup collection at the store will have limited impact. The PRA determined that the best opportunity for paper cup recovery efforts would be through existing residential recycling programs, whether curbside or drop-off.

FPI's research showed that paper cups were treated differently than other types of paper foodservice packaging in residential recycling programs. While pizza boxes, paper bags, and molded fiber trays were generally accepted by most recycling programs, paper cups were usually explicitly excluded. Emmet County, Michigan started an initiative to collect and recycle cups in 2009, becoming the first location in the US to do so.

Emmet County provides a unique example of several key elements coming together at the right time. The county started by identifying end markets first. The local Materials Recovery Facility (MRF) was already sorting polycoated aseptic and gabletop cartons and marketing these to a tissue-producing mill in a nearby county. After discussion with the county, the mill agreed to experiment and try using cups along with the cartons. In order to get the community involved, the county developed educational materials about cups and added these to grocery store shelves where aseptic and gabletop cartons were sold. A local artist developed a series of sculptures composed of recycled materials that were available on request for public and private events, creating substantial word-of-mouth publicity that paper cups could now be recycled. Emmet County was initially hesitant to add cups to local programs because of limited space at the MRF, but ultimately interest from the purchasing mill provided enough encouragement to continue. The county now collects cups through residential curbside, business curbside, schools, and special events.²

Other early adopter cities such as Seattle and New York City followed suit, introducing paper cups into residential recycling in the 2010-14 period.³ San Francisco added cups to residential recycling programs in 2017.⁴

FPI continued to improve understanding of the potential for paper cup recovery from the residential stream by conducting a variety of studies on contamination, MRF material flow, and bale composition. With the additional knowledge generated, it was evident that paper cups could be a viable target for recovery through residential recycling programs. FPI understood that identifying end markets for recovered cups was the first step and began discussion with mills across the US to explore their ability to process paper cups.

With end markets under development, the next step was to expand 'supply.' FPI developed a program called Community Partnerships that engages local communities, encouraging them to include foodservice packaging in curbside recycling. The program will help communities:

- Conduct outreach to stakeholders such as MRFs, waste haulers, and end market buyers;
- Collect data on recycling stream composition and other metrics; and
- Develop communications and messaging to complement education and outreach done by the community.

Communities are also eligible for grants to assist with resident education on the additions to the program, as well as reducing contamination. This program indirectly benefits local MRFs that receive materials from the curbside programs, and ultimately end market buyers.⁵

Since 2017, FPI's Community Partnerships program has added paper cups to curbside recycling programs for approximately four million households, in the following locations:

- Washington, D.C. (launched 2017)
- Louisville, KY (launched 2017)
- Chattanooga, TN (launched 2017)
- Denver, CO (launched 2018)
- Sioux Falls, SD (launched 2019)
- Clark County, IN (launched 2019)
- Kent County, MI (launched 2020)
- St. Lucie County, FL (launched 2020)
- Athens-Clarke County, GA (launched 2020)
- Lansing, MI (launched 2021)
- East Lansing, MI (launched 2021)
- Atlanta, GA (launched 2021)
- Dekalb County, GA (launched 2021)
- Detroit, MI and surrounding metro area (launched 2021)
- Madison, WI (launched 2021)

Successful Community Partnership programs have developed a knowledge base that is used to support new programs in other communities. Active programs share insights on communications campaign development, data collection, reducing contamination, and the like as new communities incorporate paper cups into their curbside recycling programs.⁶

Residential Paper Cup Recycling in Canada

Ontario, the largest province in Canada (40% of total population) was home to one of the first curbside recycling programs in North America, the Blue Box program, launched in 1981. Since 2002, recycling in Ontario has been based on a stewardship approach where the cost of recycling programs is a shared between producers and municipalities.⁷ Municipalities are required to accept a shortlist of recyclables but can also add items of their choice, which has led municipal programs that vary widely across the province. For example, while the City of Toronto did not accept paper cups in September of 2021, the cities of London and Waterloo did.⁸

In June 2021 Ontario finalized legislation to implement a full Extended Producer Responsibility (EPR) program that will bring a number of changes to recycling in Ontario. It will standardize the items collected across the province; provide recycling in small communities and rural areas that have not had access to date; and will expand the types of buildings to be served by recycling programs (to include multi-family and retirement residential, schools, and public areas). Items accepted will be expanded to include many

single-use foodservice items such as paper cups, paper plates, stir sticks, and the like. The transition to the new program will start with select municipalities in 2023 and is expected to be complete by 2025.^{9,10}

The province of British Columbia was the first in Canada to initiate a full EPR program in 2014. This led to the addition of many types of packaging to curbside recycling, and programs were made consistent across all jurisdictions in the province. As a result, polycoat items such as paper cups and aseptic and gabletop cartons have all been accepted in curbside, multi-family, and drop-off locations for some time.¹¹

Commercial Paper Cup Recycling

Starbucks, the US's second largest quick-serve chain, may have been the first to start thinking about how to make single-serve beverage cups more sustainable. As early as 2006, Starbucks began working with the US Food & Drug Administration (FDA) to allow 10% post-consumer recycled fiber in food contact paper cups. Between 2009 and 2011, Starbucks held several large "Cup Summit" symposiums to generate new ideas and initiate change, in order to meet an internal goal that all of Starbucks cups should be reusable or recyclable by 2015. The symposiums included representatives from all parts of the paper and plastic cup value chain, from municipalities and raw material suppliers through cup manufacturers, and retail and beverage businesses.¹²

At that time, Starbucks implemented in-store recycling in 18 markets and initiated three recycling pilot programs across the country. Starbucks tested the compatibility of post-consumer cups in paper recycling operations at a number of paper mills and demonstrated that used paper cups can be recycled into new paper cups. Eventually, collection efforts from stores were discontinued, however, as contamination was a significant problem and costs were higher than expected. At this point, Starbucks publicly supported FPI's activity in paper cup recycling and encouraged other foodservice organizations to get involved via FPI. Starbucks then began to invest in a broader approach to recycling, focusing on all foodservice packaging including cups, and committed to rolling the program out in stores across North America.¹³

The buzz generated by Starbucks activity during this period encouraged other organizations to take action. In 2010 Green USA's 'Coalition for Resource Recovery' (CoRR) began a pilot project in Manhattan with the objective of recycling paper cups and fast food packaging. CoRR collaborated with the Pratt Institute and The New School, collecting foodservice packaging from The New School's café and paper hot beverage cups from seven Starbucks' stores in Manhattan. The educational institution designed collection bins and implemented consumer education in the form of posters and tabletop signage. While this effort did not progress beyond the pilot project, it did generate valuable learning regarding the technical aspects of repulping and recycling paper cups due to the volume of material that was collected.¹⁴

Canada's largest coffee chain, Tim Hortons, tried an alternative approach to paper cup recycling in 2011. Using Nova Scotia as a test region, Tim Hortons began to collect paper cups at over 150 stores in the province. A partnership was developed with a regional molded fiber producer that tested methods to turn paper cups into molded fiber take-out trays. The "Cup-to-Tray" program had some success in the region and Tim Hortons became the first quick-service restaurant in Canada to 'close the loop' and recycle used cups into another product.¹⁵ Since that time, Tim Hortons has implemented a number of other initiatives to collect and divert cups from restaurants across the country.

Early efforts at commercial recycling of paper cups were well received by consumers at the time. Though many did not survive long term, the ground work was laid for more recent advances. In December 2018, a Denver-area hauler and MRF operator announced they would begin accepting cups generated by coffee shop customers in the area in the commercial recycling stream.

In early 2020, the City of Vancouver, Canada initiated a pilot study in which coffee cups are collected in specially designed bins in commercial buildings in downtown Vancouver. The pilot is part of an existing recycling program in BC called 'Return-It' that recovers 12 types of beverage containers, along with a range of other hard-to-recycle products.¹⁶ The pilot has been on hold as a result of the

pandemic, but the city plans to relaunch the program in the spring of 2022.¹⁷

Currently most global foodservice organizations, including many FPI members, are actively working to reduce waste and improve the sustainability of single-use packaging. The current packaging sustainability goals of several of the largest US foodservice organizations are outlined in more detail below.

2. Processing Cups at the Materials Recovery Facility (MRF)

Recovered Paper Grades and Cups

The vast majority of paper cups on the US market are made from solid bleached sulfate (SBS) white paperboard fibers with a polyethylene (PE) coating. Wax coated cups are virtually extinct and while new types of coatings that may be more readily recycled by mills are starting to emerge, market penetration of the new coatings is very low in the US (coatings are discussed in more detail below).¹⁸

Post-consumer cups may be found in several of ISRI's (Institute of Scrap Recycling Industries) standard grade designations, including:¹⁹

- #37 Sorted Office Paper (SOP)
- #52 Aseptic Packaging and Gabletop Cartons (Cartons)
- #54 Mixed Paper (specifically Residential Mixed Paper (RMP))
- #56 Sorted Residential Paper & News (SRPN)

Comparison of the annual **production volume** of each of these grades in the US in 2020, relative to cups, shows the following:²⁰

• #54 Residential Mixed Paper	4,055,000 tons
• #37 SOP	2,555,000 tons
• #56 SRPN	1,961,000 tons
• #52 Cartons	630,000 tons
• Post-Consumer Cups	683,000 tons

After collection in the residential recycling stream, used cups, cartons, and other paper products are transferred for sorting at a MRF (Materials Recovery Facility). The easiest pathway for cups to follow at the MRF is through the paper line to the Mixed Paper grade. The vast majority of MRFs that accept cups pack them in Mixed Paper, although small quantities may end up in SOP or SRPN. Anecdotally, at least one MRF has occasionally directed cups to SOP bales. A few MRFs pack a carton bale which, when cups are included, becomes described as a 'mill specific polycoat' bale, a bale that is not standard, but specific to a particular mill end-user.²¹

Since 2018, a number of larger mill companies that do not buy grade #52 Cartons have announced they will accept cups in Mixed Paper. Among the small number of US and Canadian mills that buy cartons, several have indicated that they will accept cups in the carton bale. In effect, cups are similar to other paper-based polycoated food packaging such as ice cream tubs and frozen food boxes in that they are a good source of high quality SBS for mills, when the mills can handle the poly coating. It is possible that in future, a 'polycoated paperboard packaging' grade could be developed and paper cups could be included in that grade.²²

Flow of Paper Cups through the MRF

When a MRF is interested in adding a new item such as paper cups to its list of explicitly accepted materials, there are a number of issues to consider. A successful cup recovery effort will have at least 3 elements. First, demand from an end market buyer for the targeted paper grade must be assured.

Second, in order to maximize potential volume, the MRF needs to partner with the local municipality and provide public education to develop awareness about the opportunity to recycle a new item such as cups through residential programs. Finally, the MRF must anticipate how the new item will flow through sorting operations to become part of a recovered paper grade, taking size and shape of the targeted material into account as well.²³

In the past, conventional wisdom held that when cups were 'sorted' at the MRF, flattened cups would remain in the paper stream while 3-dimensional cups would flow to the container line. Numerous flow studies have now shown that while paper cups may move through the MRF in different ways, the vast majority of cups actually flow to the container line. Percentages vary with MRF practices and equipment, but recent studies have shown that typically around 70% to 90% of 3-dimensional cups flow to the container line, while around 60% to 80% of flattened cups do so.²⁴

The destination success rate is influenced by the fiber/fines screening technology in place at the MRF, but size and weight of the cup may be more important than whether it is 3-dimensional. Once a cup is on the container line, it can easily be identified and sorted to be included in mixed paper, cartons, or other paper grades. Alternatively, cups can be intercepted along with other fiber on the container line and redirected to the paper line.

MRFs have begun to invest in optical sorting and robotics in order to improve their ability to sort paper cups, foodservice packaging, and other smaller volume types of paper packaging. Technology investment has been gradual to date, and primarily focused on optical sorting, due to low Mixed Paper prices at this time and the need to develop end markets that accept polycoated paper packaging such as cups. With much improved prices for Mixed Paper (and Old Corrugated Containers) in 2021, growing investment in optical sorting as well as robotics is expected.

In Mixed Paper, cups account for a small percentage of the bale, typically less than 0.5% of the bale by weight. To decrease the number of cups going into Mixed Paper, a handful of MRFs have decided to positively sort cups by picking them from the fiber and/or container line and re-directing them into the carton bunker. Cups that are positively sorted into a carton bale will typically account for 10% to 25% of the bale of combined polycoated paperboards.²⁵

Challenges in Paper Cup Recycling

As with all recovered paper grades, a higher quality bale improves value and marketability. In the past, many MRFs were opposed to accepting cups and other foodservice materials due to concern about food contamination. More recent observation has shown that by the time the cup makes it to the MRF, liquids are usually gone. Cups may be accompanied by plastic lids, straws and stir sticks, but plastic components are also present on other types of paper packaging. MRFs have improved processes to remove more plastic from the paper stream, and mills are able to handle the small volume of such plastic items in recovered paper.²⁶

In most of the US, the decision on what to include in curbside recycling is up to local municipalities. As manufacturers and legislators look to improve sustainability in packaging and expand recycling of small volume package types, these policies are expected to evolve over time in favor of including cups and other polycoated packaging in curbside recycling. A few states in the Northeast, such as Massachusetts, Rhode Island, and Connecticut, have recycling guidelines that do not include cups and other polycoated paper packaging (such as aseptic and gabletop cartons) on the list of mandatory materials that must be collected in curbside recycling. Municipalities ultimately make the final decision however. Many encourage recycling of other items such as cartons, #3 through #7 plastic containers, telephone books, textiles, and discarded mail.²⁷

MRFs may generate cups from commercial or residential sources: some combine the streams for sorting while others sort the streams separately. Either way, the volume of cups is low enough that MRFs are unable to measure the volume of cups from either source, or attach a cost to sorting and baling cups specifically. MRFs with greater volumes of cups may sort cups as a separate grade or as part of a carton/cup bale. Ultimately, which grade to target is a business decision made by the individual MRF. When there is a positive business case, MRFs may aggregate cups and sell as a higher-value grade.²⁸

3. Technical Considerations in Paper Cup Recycling

SBS fibers are among the highest quality paper materials available for recycling. As recovery rates for all paper grades continue to rise in the US, while supply declines, cups could be an excellent additional source of high-quality fibers for the paper industry. In particular, as the supply of printing and writing paper declines, reducing supply of recovered paper for tissue mills, demand for fiber from cups in Tissue & Towel production will likely increase.^{29, 30}

Cup Construction – Coatings

There are two types of paper cups with PE coating: 'poly 1-side' cups have the poly coating applied only to the inside of the cup only and 'poly 2-side' cups have the coating is applied on both sides of the paper substrate before it is made into a cup or container. Poly 1-side cups are typically used for hot beverages. Poly 2-side cups are often used for cold beverages so that the coating on the outside of the cup prevents condensation from softening the cup wall during use. The vast majority of paper cups are poly 1-side cups used for hot beverages. Hot cups are typically made using a PE coating because it can withstand high temperatures without breaking down.

The challenge for mills in using cups and other polycoated paper packaging has always been the time required in the hydro-pulper to remove the paper fiber from the poly layer. A poly 1-side paper cup requires considerably less time for separation from the fiber and creates less waste in the pulping process in comparison to a poly 2-side cup.³¹

Innovation in Cup Coatings and Materials

With the growing importance of sustainability in packaging, the pace of innovation in all types of packaging is increasing. In an effort to produce a more sustainable 'to-go' cup, many alternative types of cup materials and barrier coatings have emerged. In 2018, Closed Loop Partners initiated a competition, the Next Generation Cup Challenge, to accelerate the process of cup innovation. By early 2019, 28 candidates with innovative cup ideas had been selected and 12 winners were announced. Of the 12 winning designs, 3 companies proposed reusable cup systems and several in Europe offered new bio-degradable, plant-based materials for cup construction. One of the US winners produces cups and other foodservice packaging made from molded fiber. The remaining participants proposed alternative barrier coatings to PE that are more easily recyclable and/or compostable.³²

The most common alternatives to PE coatings are polylactic acid (PLA) and water-based aqueous coatings. PLA is a 'bioplastic' made from plant-based materials such as sugar, corn starch, cassava, sugar cane, and sugar beet. When selected as a cup coating, the rationale is usually that it is derived from renewable biomass, not fossil fuels, and may be compostable and/or biodegradable. Yet recycling is a higher and better use than composting because the long fibers in the cup are recycled and used in a new product.

Aqueous coatings, or water-dispersed emulsion polymer coatings, can be used when the barrier layer does not require structural integrity on its own. Aqueous coatings are easier for mills to repulp and recycle than PE coatings because water is part of the paper-making process.³³ US packaging producers continue to develop new substrate materials and coatings for cups and other foodservice packaging that are marketed as more sustainable and environmentally-friendly. However, market penetration is likely still very low as no data appears to be available to measure this trend.

4. End Markets for Recovered Cups

End Markets in North America

The end market mills accepting paper cups include producers of:

- Tissue and towel products
- Recycled paperboard (food and other goods packaging)

- Containerboard (for brown corrugated boxes)
- Recycled market pulp

Prior to 2018, very few North American mills explicitly accepted cups in Mixed Paper. Given FPI's long-standing focus on developing domestic end markets for foodservice packaging, it engaged in several years of outreach and dialog with US mills and provided data and material to mills for testing. Numerous mill trials were conducted. As a result of FPI's efforts, individual mill commitments, and the growing interest across the value chain in more 'circular' packaging alternatives, paper cups are currently accepted at 31 North American mills that consume Mixed Paper bales, and 5 domestic end markets that consume polycoated bales. (see Figure 1 below)

Figure 1: End Markets for Paper Cups in North America, 2022



Source: FPI, 2021

In December 2021, a group of prominent paper mill companies that buy recovered paper signed a “declaration of acceptance” and announced their commitment to increasing the recycling of paper cups. The companies involved include Essity, Georgia Pacific, Graphic Packaging International, Great Lakes Tissue Company, ND Paper, Pratt Industries, Sustana Fiber, and WestRock. This group accounts for 75% of Mixed Paper demand in the US and Canada and represents 31 paper mills that now actively accept cups in Mixed Paper. Senior executives acknowledge that cups provide high quality fiber.³⁴

Appendix A provides several case studies of mills that accept paper cups, describing the volume of material processed and the grades that cups go into. Appendix B contains a list of mills that accept paper cups, and indicates the relevant recovered paper grades for cups. As is the case with all recovered materials, it is necessary to check with mills within the shipping range of any specific MRF in order to determine the status of paper cup acceptance at any point in time.

As is typical for all recovered paper grades, the larger the quantity of material a MRF produces on a

regular basis, the more interested mills will be in the material. This is an area where brokers can be very useful as they frequently accumulate recovered paper from multiple sources in order to ship larger quantities to mills. A list of brokers who deal in recovered paper grades that may contain paper cups is provided in Appendix C

Export Markets

Exports have always been an important part of the US market for recovered paper. In 2020 almost 34% of recovered paper collected in the US was exported to Mexico, Canada, Asia, and other parts of the world, down from 37% in 2019. Exports of recovered paper are declining overall, and Mixed Paper exports in particular are declining at a faster rate. In 2019, 39% of Mixed Paper was exported relative to the 37% for total recovered paper. In 2020, 34% of both total recovered paper and Mixed Paper are exported. This suggests the importance of developing US markets for Mixed Paper which includes polycoated paper packaging such as cups.³⁵

Mexico and Asia are the most important export markets for recovered paper grades containing paper cups, with Korea, India, and Thailand the largest country buyers in Asia. Although the volume of Mixed Paper exported is still substantial, it is particularly important that exporters to Asia ensure the receiving country allows bales that contain post-consumer paper cups.

The primary use of recovered paper cup-containing grades in Asia is for tissue and towel, but in India they are used for printing and writing papers. In Mexico, the primary users are tissue mills, but some paperboard mills are exploring use of the grade.

Export of recovered paper is a specialized part of the paper recycling business and a large percentage of it is handled by export brokers. There are a number of export brokers that handle poly-coated paperboards and have expressed an interest in handling recovered paper cup grades. A list of these brokers and their contacts appear in Appendix C. Although none are headquartered on the west coast of the US, they all operate in that region as well as throughout the US. In addition to export, these companies are also domestic brokers that can be helpful with sales in the US.³⁶

5. Looking Ahead

As consumers and activist groups pressure large chain restaurants and consumer packaged goods brands to make packaging more recyclable, there is growing interest and activity in paper cup recycling. Foodservice organizations, communities, and consumers alike have expectations that more types of single-use packaging should be recycled more often in future. The response from many restaurant brands and other foodservice operators has been to develop sustainability goals for the organization, in which packaging plays a major role. Sustainability goals relating to packaging, including cups, are shown below for some of the largest foodservice operators in the US:³⁷

- **McDonald's:** Goal to source 100% of guest packaging from renewable, recycled or certified sources and to recycle guest packaging in 100% of McDonald's restaurants, by 2025.
- **Starbucks:** Working to reduce waste and promote reusability, Starbucks will be testing recyclable and compostable cups in select cities worldwide in 2022. Starbucks currently uses 10% post-consumer fiber in hot cups, as well as recycled content in paper shopping bags, napkins and cup sleeves.
- **Restaurant Brands International (Tim Hortons, Burger King, Popeye's):** Working with suppliers to innovate and reduce the use of packaging, transition to more sustainable materials, and help guests to reuse and recycle.
- **Inspire Brands (Dunkin'):** Majority of packaging currently has one or more sustainability attributes. 100% of packaging is recyclable where facilities exist, 30% of packaging is made with recycled content, 35% is compostable, and 30% is biodegradable.

- **Delaware North (hospitality & foodservice management):** Goal is to source 100% of single-use packaging products in the US from materials that are recyclable, renewable, compostable or contain post-consumer content, by 2025. Will prioritize products with environmentally sound certifications such as Forest Stewardship Council or Biodegradable Packaging Institute.

The impact of meeting the goals outlined on foodservice packaging is something that will develop and will be monitored over time. Another factor that has impacted recycling over the past two years is the pandemic. We know that residential waste collection volume has increased substantially since spring 2020 while commercial volume has declined due to the surge in 'working-from home' (WFH) among office workers. With more residents at home all day, and greater use of take-out restaurant meals vs. dine-in, the volume of foodservice packaging being disposed at home may well have increased. In addition, consumers may have heightened awareness if their curbside programs do not include foodservice and paper cup recycling.

The increase in WFH trend is expected to gradually diminish over the next year or two as workers return to the office, however, it seems likely that not all will return to the office. The percentage who continue to WFH will most likely stay higher than it was pre-pandemic, implying that volumes of residential waste will remain at higher levels than pre-pandemic. This suggests a potential increase in the volume of cups available from residential sources – unless home workers have switched from take-out beverages to making their own. No data is available yet to determine the impact of many factors on cups in the residential recycling stream, however, if WFH remains high, past estimates of cup residential recycling potential may need to be revised upwards. At the same time, when workers do begin to return to the office, the opportunity to discover the types of recovery processes that work best in restaurants and workplaces will open up.

6. Conclusions

While developing the processes needed to recycle paper cups from the curbside recycling has taken considerable time and research, FPI has now built a solid foundation and will continue to expand this initiative. In the last 2-3 years, significant progress has been made in adding cups to residential recycling programs, and identifying end-markets at mills. At least 20 residential curbside programs across the US, representing hundreds of communities, now explicitly accept cups. A total of 31 individual paper mills, plus 1 building product manufacturer, now accept cups. This suggests a significant opportunity to continue the expansion of cup recovery through residential recycling programs.

At the majority of MRFs, cups currently go into Mixed Paper bales, while a small number of MRFs do a positive sort into a carton and cup bale. The growth of optical sorting is helping to reduce the cost of positive sorting, but the most challenging issue at the MRF is the length of time it takes to build a bale, given the low volume of cups and similar material such as cartons. An opportunity to improve volume through development of a polycoated bale grade is apparent.

As the use of alternative barrier coatings to PE begins to expand, cups and other polycoated packaging will eventually become easier for mills to manage. Market share of alternative coatings for cups is too low for measurement in North America at present, but the growth of more easily recyclable coatings and cup materials in Europe suggests there is potential for widespread adoption in the long term.

APPENDIX A:

CASE STUDIES OF MRFs ACCEPTING CUPS

WestRock Recycling, Chattanooga, TN

End market: WestRock Chattanooga paper mill, who accepts paper cups in Mixed Paper bales

Plant size: Medium (4,000 to 7,500 tons per month range)

Paper grade sold: #54 Mixed Paper

Sorting method: Manual sorting on the paper line. Sorting paper cups and other SBS food service paper containers.

Residential / Commercial inbound material: 40% residential, 60% commercial, which is higher than normal on the commercial side. However, paper cups are primarily originating from the residential single stream program.

Other observations: Currently cup volume is not measured due to limited volume. Investment in sorting automation would be considered if the volume could increase to the 50 tons/month range.

WestRock Chattanooga is very unique, having the end market and processing facility located in the same city. This is a great example of how to start small and grow using the resources and synergies within a major paper company.

GFL – Alpine Recycling, Denver, CO

End market: Domestic paper mill

Plant size: Large (7,500 tons per month or more)

Residential / Commercial inbound material: 65% residential, 35% commercial. Paper cups are coming from their residential single stream program.

Paper grade sold: #52 Aseptic Packaging and Gable Top Cartons

Sorting method: Mechanical sorting using robotics through artificial intelligence

Other observations: GFL Denver avoids typical foodservice containers due to high contamination concerns, but does include aseptic packaging (Tetra Pak), clean ice cream cartons, and clean popcorn tubs.

Millennium Recycling, Sioux Falls, SD

End market: Domestic paper mill

Plant size: Small (2,000 to 4,000 tons per month)

Residential / Commercial inbound material: 65% residential, 35% commercial. Paper cups are coming primarily from their residential single stream program.

Paper grade sold: #54 Mixed Paper

Sorting method: Manual, leaving paper cups in the Mixed Paper stream. On the processing side, they leave any clean paperboard products including SBS cartons, paper cups, and plates in the Mixed Paper stream.

Other observations: Two critical components for the MRF's success were establishing a consistent sales market through WestRock's St. Paul, MN mill and working with the local Sioux Falls municipality to add paper cups to the recyclable material list. Adding paper cups to the Mixed Paper stream did not add cost to the MRF and was a simple and effective solution. Millennium Recycling is proactive in its resident communication, utilizing its website, blog, and social media. The MRF makes a commitment to ongoing education regarding acceptable recyclables, including paper cups.

APPENDIX B:

North American Paper Mills/Manufacturers that Accept Paper Cups

Paper Mills:

Cascades, Ashland, VA – Mixed Paper (opening in 2022)

Cascades, Niagara Falls, NY – Mixed Paper

Cascades, Kingley Falls, QC – Mixed Paper

Essity, Barton, AL – Mixed Paper

Essity, Menasha, WI – Mixed Paper

Essity, Middletown, OH – Mixed Paper

Essity, South Glens Falls, NY – Mixed Paper

Georgia-Pacific, Green Bay, WI – Mixed Paper

Georgia-Pacific, Muskogee, OK – Mixed Paper

Graphic Packaging International, Battle Creek, MI – Mixed Paper

Graphic Packaging International, East Angus, QC – Mixed Paper

Graphic Packaging International, Middletown, OH – Mixed Paper

Graphic Packaging International, Kalamazoo, MI – Mixed Paper

Great Lakes Tissue, Cheboygan, MI – together with Aseptic Packaging and Gable-Top Cartons

Green Bay Packaging, Green Bay, WI – Mixed Paper

ND Paper (sourcing via ACN), Fairmont, WV – Mixed Paper

Pratt, Conyers, GA – Mixed Paper

Pratt, Shreveport, LA – Mixed Paper

Pratt, Staten Island, NY – Mixed Paper

Pratt, Valparaiso, IN – Mixed Paper

Pratt, Wapakoneta, OH – Mixed Paper

Sustana (Breakey Fiber), Levis, QC – together with Aseptic Packaging and Gable-Top Cartons

Sustana (Fox River Fiber), DePere, WI – together with Aseptic Packaging and Gable-Top Cartons

WestRock, Aurora, IL – Mixed Paper

WestRock, Battle Creek, MI – Mixed Paper

WestRock, Chattanooga, TN – Mixed Paper

WestRock, Dallas, TX – Mixed Paper

WestRock, Eaton, IN – Mixed Paper

WestRock, Missisquoi, VT – Mixed Paper

WestRock, St. Paul, MN – Mixed Paper

WestRock, Stroudsburg, PA – Mixed Paper

Building Materials:

Continuous Materials, Des Moines, IA – together with Aseptic Packaging and Gable-Top Cartons

**APPENDIX C:
Export Broker Contacts**

Ekman Recycling Group
Wall Township, NJ
Brian Heckel
brian.heckel@ekmangroup.com
732-202-9500

Federal International
St. Louis, MO
Sam Still
samstill@federalinternational.com
314-721-3377

GP Recycling (Georgia Pacific)
Jericho, NY
Mike Belus
mike.belus@gapac.com
516-770-1030

The Paper Tigers, Inc.
Schaumburg, IL
Nick Halper, President
NHalper@papertigers.com
847-919-6500

Wilmington Paper
Pine Brook, NJ
Brett Lurie
BML@WPCRMS.com
973-445-2382

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²⁰ Moore & Associates internal database

²¹ RRS

²² Moore & Associates

²³ RRS

²⁴ RRS

²⁵ RRS

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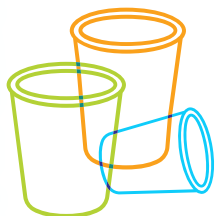
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³⁷ Courtesy of FPI

We Want Your Paper Cups!



OUR COMMITMENT TO RECYCLING

We, the undersigned organizations, are committed to increasing paper cup recycling. With the ever-increasing need to accelerate the recovery of foodservice packaging, we have taken many foundational and intentional steps to increase the viability of paper cup recycling and ensure end market acceptance.

A HIGHLY DESIRABLE RECYCLED MATERIAL

Paper cups are made with long, bleached fiber that are highly desired by paper mills because it adds strength and quality to new products made with recycled fiber. To date, there are 28 paper mills across eight companies in North America that accept residential mixed paper bales with paper cups included. Additionally, there are 5 mills/facilities across three companies that accept paper cups into bales of aseptic and gable top cartons ("Grade 52" bales). Participating paper mills have performed pulpability testing and/or mill trials to determine their ability to successfully recover fiber from paper cups and use the fiber in their furnish.

MAKING NEW EVERYDAY PRODUCTS

To provide a liquid barrier to the fiber, paper cups have a coating either on the inside (for hot drink cups) or on both sides (for cold drink cups). The pulping systems in use at our mills can separate the coatings from the fiber and recover the fiber as a feedstock for new products. Yield from the cup is in the 70 to 90 percent range, depending on whether the cup has a single or double sided coating and the pulping system in use. These fiber products go on to be made into a variety of everyday items such as cereal boxes, facial tissues, corrugated boxes, and new paper cups!

ADDING PAPER CUP RECYCLING

Material recovery facilities (MRFs) can add paper cups to their accepted material list. Communities can advocate for the inclusion of paper cups in their recycling stream by working with their waste haulers and MRFs.

A list of mills that accept paper cups and a map are on the next page. You can also find them on an interactive map [here](#).

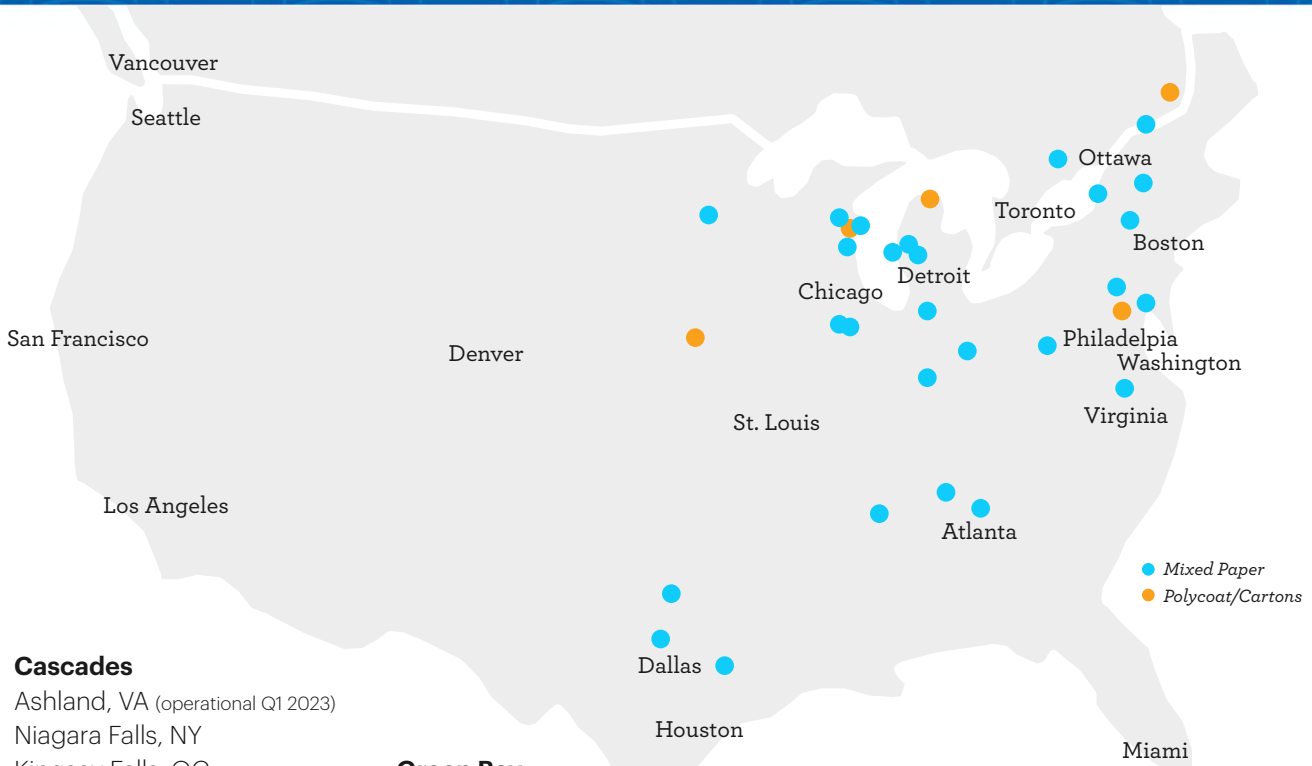
JOIN THE PAPER CUP RECYCLING MOVEMENT

Many of us are members of the Foodservice Packaging Institute, which provides industry-funded grants to MRFs, waste haulers, and communities that expand paper cup recycling access, increase current recovery capabilities, and educate residents on new paper cup recycling programs. If you are interested in partnering with FPI to add paper cup recycling to your recycling program, visit www.recyclefsp.org or email recyclefsp@fpi.org.

Additional information about paper cup recycling may be found at: www.recyclepapercups.org.



We Want Your Paper Cups!



Cascades

Ashland, VA (operational Q1 2023)
Niagara Falls, NY
Kingsey Falls, QC

Continuus

Des Moines, IA
Philadelphia, PA

Essity

Barton, AL
Menasha, WI
Middletown, OH
South Glens Falls, NY

Georgia-Pacific

Green Bay, WI
Muskogee, OK

Graphic Packaging International

Battle Creek, MI
East Angus, QC
Middletown, OH
Kalamazoo, MI

Great Lakes Tissue

Cheboygan, MI

Green Bay Packaging

Green Bay, WI

ND Paper

Fairmont, WV

Pratt

Conyers, GA
Shreveport, LA
Staten Island, NY
Valparaiso, IN
Wapakoneta, OH

Sustana

Levis, QC
DePere, WI

WestRock

Aurora, IL
Battle Creek, MI
Chattanooga, TN
Dallas, TX
Eaton, IN
Missisquoi, VT
St. Paul, MN
Stroudsburg, PA

THE MIXED PAPER MILLS ON THIS LIST REPRESENT:



of the U.S./Canadian mixed paper demand
(% by quantity consumed)



of the U.S./Canadian mills consuming mixed paper
(% by mill count)

Generators should contact end markets directly or via their broker to determine specifications and terms.
*as of 1/2022

FAQs ON RECYCLING PAPER CUPS FOR PAPER MILLS

As paper mills consider whether to accept bales containing paper cups, mills may have a variety of questions. Below are answers to some of the most anticipated questions:

Why should I accept bales with paper cups?

Paper cups are typically made with long, virgin fibers, something all mills find valuable. And, at a time where traditional sources of fiber – like newsprint and office paper – are in decline, mills may be looking for new sources of valuable fiber. In addition, cup fiber may lend strength to short fiber.

What materials are found in a typical paper cup?

Paper cups typically consist of bleached white virgin fiber with a thin polymer coating. Often, this coating is made from polyethylene (PE), but sometimes polylactic acid (PLA) is used. While wax may have been a common coating in the past, this is not true today. They also don't include wet strength chemicals, as they are not needed when a poly coating is used. Cups may contain low levels of starch.

Cups for hot liquid applications typically have one polymer layer on the inside of the cup, while cups for cold applications have two polymer layers, one on the inside and one on the outside. This coating provides insulation and helps prevent leaks. The coating ranges from roughly 5 to 12 percent by weight of the finished cup, depending on whether it's a cold or hot cup, and whether it has a PE or PLA coating.

While polymer coatings are used on almost all cups today, new repulpable water-based coatings are entering the market that can replace the traditional poly coatings.

Hot cups have printing ink directly on the fiber, while cold cups have ink on the exterior polymer coating. This is an important distinction, considering not all mills have deinking capabilities.

What happens to the poly coating after the pulping process?

That depends on the mill. In most cases, the poly will be sent to a landfill with any other residuals. In other cases, a mill may be able to recycle it or send it to a waste-to-energy facility. The industry is also working on processing innovations. For example, an emerging technology utilizes heat and pressure to extract usable fiber from polycoated and food-soiled packaging.

In which bales can I expect to see paper cups?

Based on the findings of a MRF flow study conducted several years ago (highlights found [here](#)), paper cups typically end up in mixed paper (ISRI grade #54) or carton bales (ISRI grade #52). They may also be sorted into other bales, like sorted office paper. Incoming material, operational considerations and preferences of paper end markets are factors used by the MRF to determine which bales will contain cups.

What fiber yield can I expect when recycling paper cups?

Yield correlates closely to the percent fiber versus polymer by weight, therefore fiber yields can be expected in the roughly 88 to 95 percent range. Yield may be higher with new repulpable coatings.

Won't my mill be flooded with paper cups if I decide to accept them?

While paper cups are part of our busy lives, the reality is that they are a very small part of the recovered fiber stream. According to industry estimates, there are roughly 600,000 tons of paper cups produced annually in the U.S. That is less than one percent of all paper and paperboard produced in the U.S. in 2018.

Research sponsored by the Foodservice Packaging Institute found that if the paper cups are included in a mixed paper bale, you can expect less than 0.5 percent of that bale to be paper cups. This is based on industry estimates as well as bale audits of residential mixed paper from two cities (New York City and Seattle) that accept paper cups for recycling.

If the paper cups are directed to a carton bale, you can expect 25 percent of that bale to be paper cups, based on industry estimates. According to one mill currently accepting bales with cartons and cups, cups represent about 10 to 20 percent of the bale. Adding cups to this bale provides additional volume, which may be desirable given that cartons are another low-volume commodity.

Aren't cups too contaminated with food to be recycled?

No. Cups and other foodservice packaging items are no more contaminated than commonly recycled food-contact items like bottles, jars or cans. This assertion is based on two studies done in Boston and Delaware that examined food contamination found in curbside recycling programs. And, in both studies, the majority of the samples of foodservice packaging was rated as low-residue (1-2 on a scale of 1-5). Read more about the studies [here](#) or watch the webinar on this topic [here](#).

Since cups are used to contain liquids, the contents are easily emptied (and residents are likely to empty the cups before recycling to avoid spills in the home). In addition, any liquid left in the cups when recycled is expected to drain out during transport to the MRF.

Will I be able to process bales with paper cups?

That depends. All mills are different. As mill equipment and capabilities vary, it is recommended that mills conduct trials before accepting cups. Some mill experience suggests that the polymer coating can separate readily during pulping in both continuous and batch pulping processes. Mill cleaning systems enable the removal of the separated polymer strips from the pulping process. However, other mills have reported challenges with effectively separating the polymer coating in their pulping processes and/or cleaning systems.

If my mill wants to run a trial first, what should I consider?

If you're interested in running a trial, first know that we are here to help! Having helped other mills with trials, here are a few considerations:

- *Sourcing cups:* If you need help sourcing paper cups, or bales with paper cups, please let us know. It's up to you whether you want to run a trial with just pre-consumer cups, or post-consumer in a bale of your

choice. You may want to start with pre-consumer, and if that's successful, move to post-consumer bales. We can also help you determine the quantity of cups to include in the trial, based on the expected volumes of cups in the marketplace that are available or expected to be recycled.

- *Metrics:* You probably have metrics you'll want to track, but be sure to note the following (applicability may vary depending on whether you are running a trial with pre- or post-consumer cups):
 - Whether fiber is being consumed or is part of the tailings coming out of the pulper
 - Amount of poly in the pulper
 - Acceptability of polycoat (as a percentage)
 - Yield of typical bales containing paper cups
 - Yield loss
 - General contamination level in bales
 - Non-fiber material in bales
 - Storage issues: degradation of bales while in storage; storage time; storage requirements
 - De-trashing composition
 - Odor and insect/rodent presence
 - Residue

- *Length of trial:* This is for each mill to decide, but it's assumed that it will be for a finite period of time, providing the mill an opportunity to better understand the processing capabilities in mill operations, including the pulpability and yield of this material. A minimum of eight hours is recommended.

What's the next step if I decide I'd like to accept post-consumer paper cups in my mills?

First, let us know in which fiber grades/bale types you'll accept cups. Ideally, you're willing to communicate this acceptance publicly and be placed in our online end markets map (found [here](#)) and list (found [here](#)). But, if you prefer a less public approach initially, we'll work with you to find a suitable one. For example, you can communicate this via your buyers to your existing suppliers. We can also help by letting MRFs in your region know of your willingness to accept bales with paper cups (feel free to reach out directly, too!).

Finally, if you really want some added exposure, we're always looking for paper mills to highlight successful paper cup recycling. Just let us know and we'll contact you regarding future articles, speaking opportunities, etc.

Produced by the American Forest & Paper Association and FPI's Paper Cup Alliance.

Foodservice Packaging in Mixed Paper Bales: Audit Results

Background

The Foodservice Packaging Institute's Paper Recovery Alliance (PRA) and Plastics Recovery Group (PRG) are working to increase the recovery of foodservice packaging by overcoming real and perceived barriers. One of the barriers for paper foodservice packaging was concerns expressed by mills and materials recovery facilities (MRFs) about adding these items to standard commodity bales such as mixed paper. To that end, the PRA had developed “desktop” estimates of the quantities of foodservice packaging that would be present in these bales when communities promoted collection of paper foodservice packaging for recycling. In order to test these estimates against “real world” examples, the PRA decided to conduct audits of mixed paper bales.

The Study

In order to better understand the amount and type of paper foodservice packaging that is being recovered through the residential curbside recycling system in communities that currently accept paper FSP, a team led by RRS sorted six mixed paper bales from two markets (New York City and Seattle) in October 2014. The sort sought to quantify the following types of paper foodservice packaging items:

- Hot Drink Cups
- Cold Drink Cups
- Takeout Containers
- Paperboard Pizza Box
- Cup Sleeves
- Takeout Bags
- Beverage Carriers
- Egg Boxes

All eight targeted material categories were listed as accepted on the websites of the New York City and Seattle recycling programs as of October 2014.

Sorting the hot and cold cup categories was based on a visual inspection and relied in large part on factors such as brand (e.g. soda vs. coffee), caution statements, etc. The target materials were all weighed and noted. The balance of the bales were mixed paper and other contaminants.

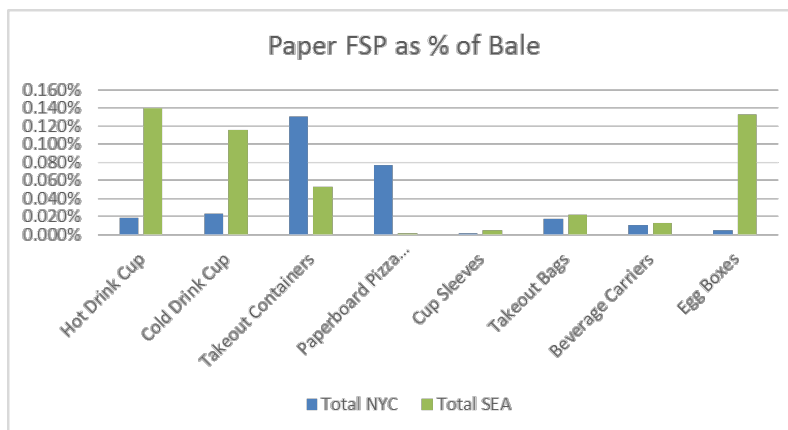


The Results

In total, foodservice packaging comprised only several pounds (approximately 2.5-10 lbs) out of each bale. On a percentage basis, samples from both cities averaged under 0.5%. The Seattle samples had a higher proportion of foodservice packaging (averaging 0.48%) than New York City (averaging 0.28%). For comparison, PRA’s “desktop” estimates projected that paper foodservice packaging would make up of 3% of a mixed paper bale, given a future foodservice packaging recovery rate of 10%.

The prevalence of paper foodservice packaging item types found in each bale varied substantially between types of packaging, and the relative mix differed significantly by city.

Paper Foodservice Packaging as a % of Bale Weight (averaged by city)

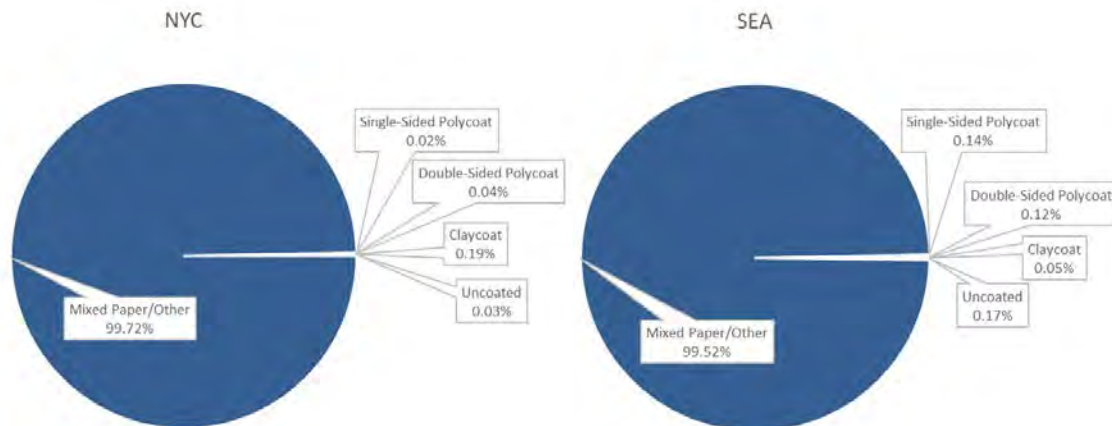


While it is impossible to determine the exact reasons for these differences, some factors contributing to these findings may include:

- different consumption patterns;
- different packaging mix due to local foodservice market shares and regulatory landscapes (polystyrene foam has been banned in Seattle since 2009);
- the availability of composting options in Seattle; and
- different histories of the recycling programs and resident education.

While item type is of interest for resident education and ability to sort at the MRF, the inclusion of coatings (i.e. clay versus single- or double-sided polycoat) will be of greater relevance to end markets.

Foodservice Packaging by Coating type, as Percentage of Bale



Contractor’s Conclusions

Overall, the bale audits found very low levels of foodservice packaging material in mixed paper – foodservice packaging made up an average of 0.48% in Seattle and 0.28% in New York City.

Possible factors contributing to these findings include:

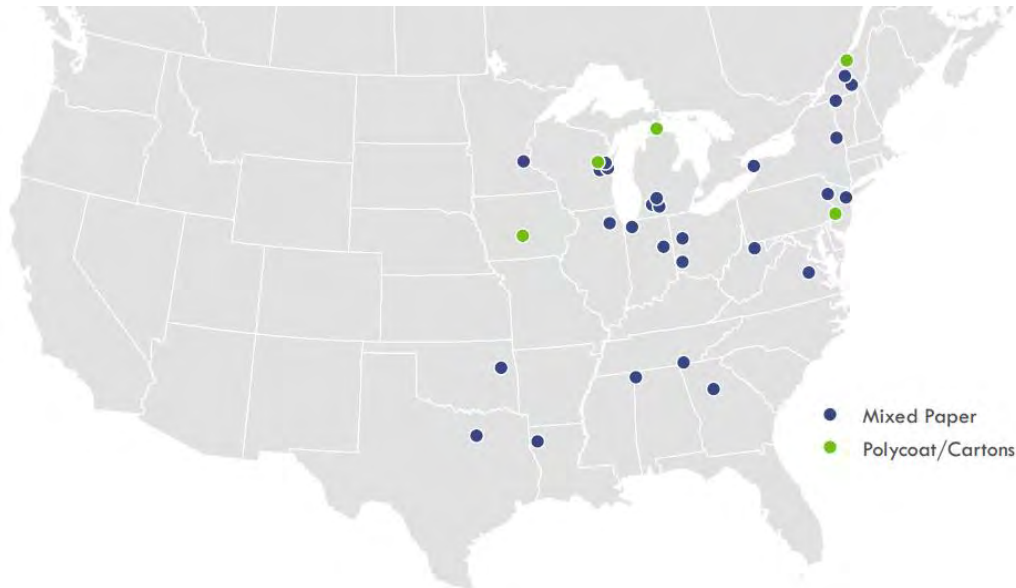
- low recovery rates for foodservice packaging, in general;
- low awareness in New York City that foodservice packaging can be recycled; and
- the composting option for some paper foodservice packaging in Seattle.

FPI would like to thank the City of Seattle, Republic Services, Paper Fibres Corp., and Recycle Ann Arbor for participating in the study.

More information on FPI’s recovery projects may be found at www.fpi.org/stewardship.



End Markets for Post-Consumer Paper Cups



FPI has assembled a list of US and Canadian end markets that have confirmed their acceptance of post-consumer poly-coated (i.e. PE-coated or PLA-coated) paper cups in commonly traded commodity bales. This listing is provided for reference only. Generators should contact end markets directly or via their broker to determine specifications and terms.

Mixed Paper Markets

The following mills purchase residential mixed paper bales containing paper cups. Some also accept other paper foodservice packaging.

Cascades, Ashland, VA (operational Q1 2023)
Cascades, Kingsey Falls, QC
Cascades, Niagara Falls, NY
Essity, Barton, AL
Essity, Menasha, WI
Essity, Middletown, OH
Essity, South Glens Falls, NY
Georgia-Pacific, Green Bay, WI
Georgia-Pacific, Muskogee, OK
Graphic Packaging International, Battle Creek, MI
Graphic Packaging International, East Angus, QC
Graphic Packaging International, Middletown, OH
Graphic Packaging International, Kalamazoo, MI
Green Bay Packaging, Green Bay, WI

ND Paper (sourcing via ACN), Fairmont, WV
Pratt, Conyers, GA
Pratt, Shreveport, LA
Pratt, Staten Island, NY
Pratt, Valparaiso, IN
Pratt, Wapakoneta, OH
WestRock, Aurora, IL
WestRock, Battle Creek, MI
WestRock, Chattanooga, TN
WestRock, Dallas, TX
WestRock, Eaton, IN
WestRock, Missisquoi, VT
WestRock, St. Paul, MN
WestRock, Stroudsburg, PA

If you would like to suggest an additional end market for addition to this list, please contact recyclefsp@fpi.org. An interactive map of end markets for other commodities, and additional resources on recovery of foodservice packaging are available at: www.recycleFSP.org.

Polycoat / Carton Markets

The following mills purchase bales containing paper cups along with aseptic and gabletop cartons.

Continuus, Des Moines, IA

Continuus, Philadelphia, PA

Great Lakes Tissue, Cheboygan, MI

Sustana (Breakey Fiber), Levis, QC

Sustana (Fox River Fiber), DePere, WI

If you would like to suggest an additional end market for addition to this list, please contact recyclefsp@fpi.org. An interactive map of end markets for other commodities, and additional resources on recovery of foodservice packaging are available at: www.recycleFSP.org.

January 2022



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MRF MATERIAL FLOW STUDY

FINAL REPORT | APRIL 2015

COMMISSIONED BY



PREPARED BY RRS IN CONJUNCTION WITH:



INTRODUCTION

The famous Greek philosopher Heraclitus captured the essence of the recycling industry over 2,500 years ago when he penned the phrase, “Nothing endures but change.” The march of packaging innovation and technology, and the persistently changing habits of consumers continue to dictate the changing mix of materials that enters a material recovery facility (MRF). Over the past decade, there has been a continual decline in the once dominant materials including newspaper, glass and metal cans. At the same time, a host of other packaging types have emerged, presenting new recovery opportunities. Recycling programs throughout the country have responded by expanding the list of materials accepted for recycling, notably including a wide range of plastics and cartons. For the MRFs that receive the material, it is not always easy to keep sorting technologies and techniques on pace with this expanding mix.

STUDY OVERVIEW

Packaging companies have an interest in ensuring that the packages they produce or sell their products in have the opportunity to be recycled. The ability to recycle the package can be a consumer’s deciding factor in the purchase of a particular product. This, and the desire to minimize environmental footprints, are the drivers behind the recently completed MRF Material Flow Study.

MRFs are the intersection between consumers, residents and the industrial infrastructure that creates the products and packaging we use every day. To better understand the recyclability of their packaging, five diverse associations – the Carton Council, Foodservice Packaging Institute (FPI), American Chemistry Council (ACC), National Association for PET Container Resources (NAPCOR) and the Association of Postconsumer Plastics Reprocessors (APR) – joined together to study how numerous materials flowed through the MRF. They contracted with RRS, Reclay StewardEdge (RSE) and Moore Recycling Associates to develop a standard methodology and execute it at five MRFs.

KEY CONCLUSIONS

In studying the performance of specific materials through different MRF environments, a number of general takeaways became clear. These conclusions could help to serve as guidelines to improve recovery across the recovery value chain – from residents and municipalities to packaging designers and MRF operators and engineers, and everyone else in between.

AUDIENCE	KEY TAKEAWAYS
Packaging Designers	<ul style="list-style-type: none"> Form, material and rigidity have a significant effect on a product’s “sortability” in the MRF Light-weighting of plastics can decrease recovery in a single stream MRF due to loss to the paper streams
MRF Operators	<ul style="list-style-type: none"> More equipment steps (disc screen decks or other separation equipment) can improve accuracy of splitting two-dimensional from three-dimensional materials Properly maintaining the disc screens (cleaning and replacing discs) can significantly reduce loss of containers to the paper stream Minimizing compaction to maintain the form/shape of incoming material improves separation Continually training sorters to recognize a wide range of acceptable packaging is of growing importance
MRF Equipment Designers	<ul style="list-style-type: none"> Further research and development is needed to improve consistency of behavior of non-bottle plastics in the MRF Further testing and refining of optical sorter programming is needed to effectively optically sort a wider range of packaging
Municipalities	<ul style="list-style-type: none"> Regular communications with local MRFs is critical to understanding behavior of materials currently accepted and identifying additional materials that could be added As the list of acceptable materials grows, continual education for residents is essential to keeping contamination to a minimum For single stream programs, education to the consumer to not crush materials can improve their recovery
Recycling Industry	<ul style="list-style-type: none"> Continually evaluate and match MRF product quality and end market capabilities to ensure true recovery

ABOUT THIS REPORT

This study examined the behavior of numerous individual products in the MRF, yielding data on cups, clamshells, containers, domes/trays, bottles, tubs, lids, gable-top and aseptic cartons, and other materials. Funders of this study have gained a greater awareness of the opportunities and obstacles regarding the recovery of each of these materials and will apply this new knowledge to increase recovery.

While the detailed data on each material are not presented within this report, key findings regarding material flows, sorting technologies, and other sorting and design related considerations are explained, along with the study's methodology.

STUDY METHODOLOGY

There were three stated goals of the study:

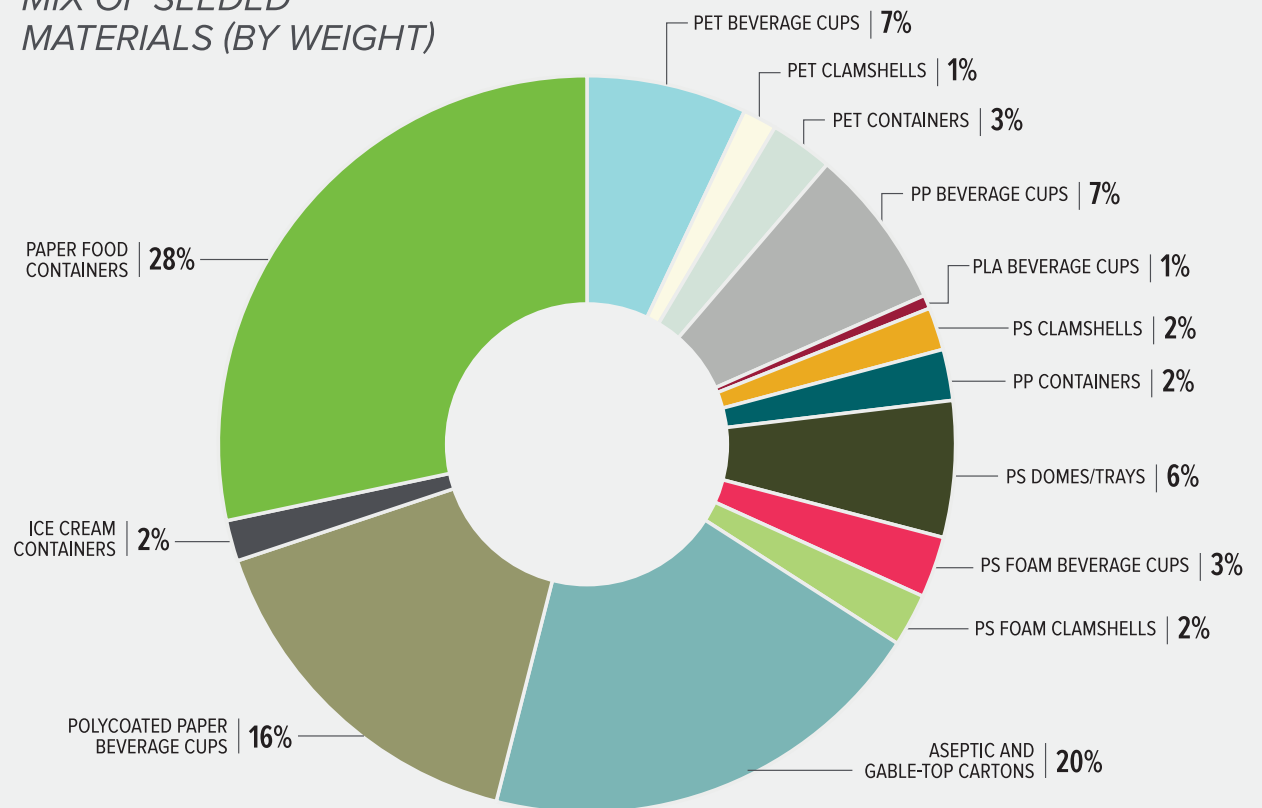
1. Learn how materials similar to the test samples and other study materials would flow through typical MRF environments;
2. Determine which of the study materials, not currently accepted by MRFs, could potentially be recycled using existing MRF infrastructure; and
3. Start to develop an understanding of what sort processes could be modified to allow effective recovery of sample materials

The study focused on a broad range of materials, many that are currently widely

accepted and some that are very rarely included in recycling programs. Materials that are not commonly accepted for recycling were brought in and added, or “seeded”, to the normal stream received by the MRF. To simulate a realistic recovery scenario, care was taken to add materials at levels that corresponded to their relative prevalence in the marketplace. In other words, more common materials were seeded in larger amounts (by weight) than less common ones.

The plastic materials studied included cups, clamshells, domes/trays, bottles, tubs, lids and other containers. Each was classified by resin identification code and in some categories including containers and tubs, by size as well. The paper products studied included cups, ice cream containers, gable-top and aseptic cartons, and take-out food containers. Figure 1 shows the representative mix of materials that was seeded.

FIGURE 1
MIX OF SEEDED MATERIALS (BY WEIGHT)



In each of the five MRFs that served as test sites for this study, a standard methodology was applied to analyze the flow of materials. This methodology was, in essence, quite simple and could be replicated for other materials or repeated in other MRFs.

- The MRF set aside enough inbound recyclable material to run their facility for 3 hours (between 30 and 100 tons). This represented the average material that the facility processes on a day to day basis.
- The study team worked with the MRF staff to mix the seeded packaging into the inbound material. In each facility, the seeded materials represented about 1% of the incoming stream by weight.
- Sort staff was trained on how to handle the seeded materials. In general, the materials were allowed to flow where they naturally did within the facility and sorters were instructed to not pick and dispose of the seeded materials as residue. However, each seeded package was given one or more target commodity streams and if, for example paper beverage cups flowed to the container line, the sorters were directed to positively sort them to the carton bale and if they flowed to the paper line they were allowed to stay in the mixed paper bale. Seeded materials therefore flowed to existing MRF products – new product grades were not produced for the seeded materials.
- The facility processed the material for 3 hours. During the processing, video cameras were set up to monitor the flow of materials and the actions of the sorters.
- Random samples of the main products were taken either as loose samples or from random bales. The target sample weight was about 600 pounds for each of the products and, where possible, multiple samples were taken of each product or the majority of the product was sorted.
- Each of the samples was sorted into 104 categories. The plastic sort categories were chosen to match other studies commissioned by ACC, APR, NAPCOR, and others.

Ideally, tests were run during a time that the facility was not planning to operate, so as not to hinder normal operations. MRFs operate on extremely tight timelines, and without careful scheduling a study could easily create problematic disruptions.

DATA ANALYSIS

Based on the data collected, two analyses were performed. The first was characterizations of each of the product streams. These were completed for each of the samples of a single product and then averaged to get the product characterization. Product characterizations showed how much of that stream was composed of each sort category. An example is shown in Figure 2. The product characterizations are important for end

The MRFs at which this study was conducted were chosen to represent the wide diversity of facilities that currently process recyclables nationwide. Here are some of their key descriptors and differentiators:

- 1 dual stream and 4 single stream facilities
- Throughput range (tons per hour): 10 tph – 35 tph
- Four different equipment manufacturers
- Number of optical sorters ranged from 0 – 5
- Varying combinations of disc screens and other mechanical separation equipment

PRODUCT CHARACTERIZATIONS WERE CALCULATED FOR THE FOLLOWING STREAMS:

Mixed Paper	Mixed Paper/ Newspaper ¹	cHDPE
Newspaper	PET	nHDPE
Cartons	Mixed Plastics ²	Residue

¹ Some facilities only marketed one grade of paper

² Also included a HDPE/PP Tubs and Lids grade

markets to understand the quality and composition of a MRFs products. For this study, it was important to see if the addition of seeded materials would increase contamination of existing product streams.

The second analysis used the characterizations to determine the destination of each of the study materials. For example, if 10,000 paper beverage cups were introduced into

the MRF, how many would end up in the mixed paper, how many in the carton bale and how many in the residue and other categories. This analysis was the key to understanding how the materials flowed in the MRF environment. Examples of this analysis are shown in the Results section.

RESULTS

While a diverse set of MRFs was chosen for the study, the results presented here are specific to the MRFs studied, as different results can be achieved by modifying equipment layouts, operating protocols and material streams.

Key findings are grouped by type of MRF, type of sortation equipment and material form and prevalence.

DUAL STREAM SYSTEMS

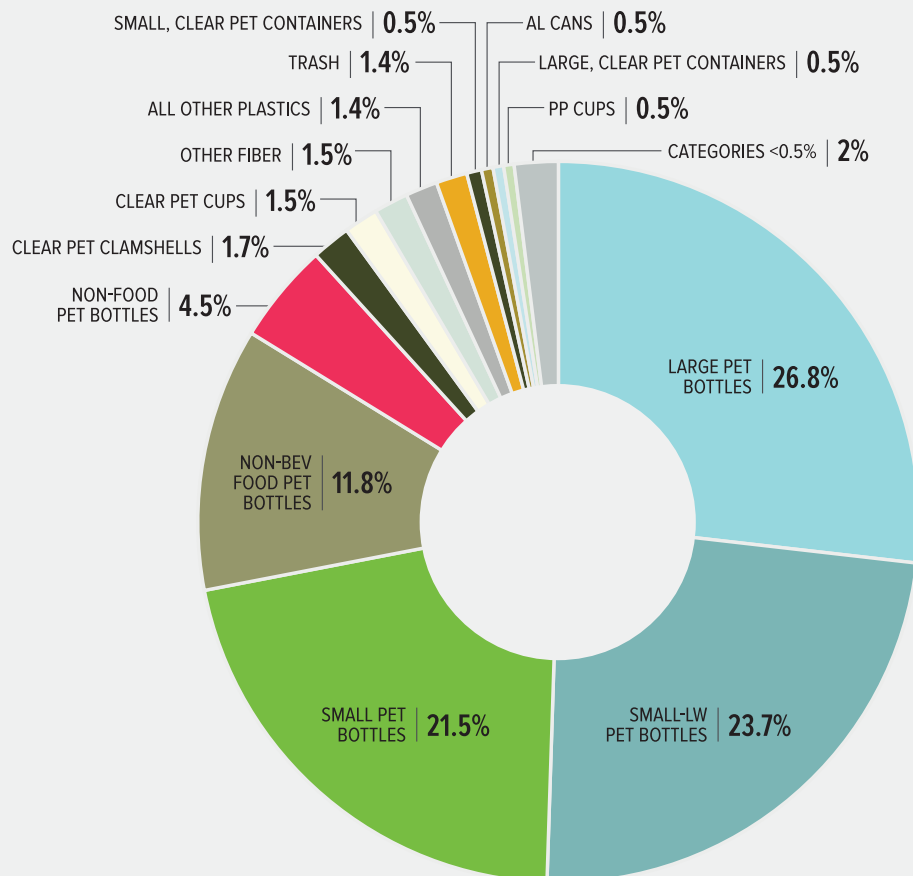
Two types of MRFs were included in the study: one dual stream and four single stream. While only one MRF was dual stream, one comparison about the difference between dual and single stream systems can be made.

Dual stream systems, which are declining nationally in favor of single stream systems, require residents to separate paper materials from metal, glass and plastic containers. As will be highlighted in the next section, dual stream systems offer the advantage of reducing loss of plastics and other containers to the paper streams. On the other hand, as the material mix has expanded to new packaging types, it isn't always well understood to by residents in which stream they should be included. For MRFs, it is more difficult to sort these containers from the paper stream than it is from the container stream, making this a real obstacle.

SINGLE STREAM SYSTEMS

While single stream systems allow for easier communication to consumers about how to recycle (and simplify collection systems), the difficulty in separating the materials is passed

FIGURE 2
*EXAMPLE PRODUCT STREAM CHARACTERIZATION:
PET, AVERAGED ACROSS ALL 5 MRFs*



onto the MRF. One of the key observations in this study is that there are wide variations in how effective single stream facilities are in separating paper from the containers. To accomplish this separation, single stream facilities use a series of disc screens and other equipment that all utilize the difference in shape between paper and containers. Flat materials (generally 2-dimensional) will travel to the top of the screen and to one series of conveyors, while bottles and other containers (generally 3-dimensional) will either fall through the screens or tumble to the bottom to a different series of conveyors.

There are numerous factors that affect the ability of single stream equipment to accurately separate the 2D and 3D materials. They include equipment design factors (such as screen design and angle), operation issues (such as overloading the screens, cleaning the screens, and wet material), maintenance issues (such as wear to discs) and collection issues (such as excessive compaction of the material by residents or collection vehicles). Further, the packaging design itself can also affect the flow of individual materials. All of these variables cannot be evaluated in one study, but general conclusions are possible.

BEST PRACTICES FOR ACCURATE 2D/3D SEPARATION IN SINGLE STREAM MRFs:

- Avoid loading screens past their design throughput
- Clean screens of material that are wrapped around the shafts
- Replace worn and damaged discs
- Minimize compaction of material by residents and collection trucks
- Keep material dry

SCREENS

In this study, plastics separation by screens was examined in depth and the analysis can act as a surrogate for other container material types, such as aluminum and steel. The amount of plastics (including bottles, containers, clamshells and cups) lost to the paper stream varied from 3% to 12%. The two MRFs that experienced a 12% loss of plastics to the paper

stream were both medium sized single stream facilities (25-30 rated tons per hour (tph)) that had fewer screens than the larger two (35 tph). After seeing the screening effectiveness data from this study, both replaced worn discs in their disc screens and reported a significant improvement in the 2D/3D separation. The facility that experienced a 3% loss of plastic to the paper stream was a large MRF with an adequate number of screens for the incoming volume and material type (note: this facility was the top performer across the entire study). Interestingly, the facility with 8% loss was similar to the 3% facility, but it had two distinct operational issues that were not normal for their facilities: material was wetter than normal due to heavy snow storms, and space constraints on the tip floor caused by equipment failures resulted in handling of the material significantly more than normal (including driving over it with a loader). These results suggest that a well maintained facility with an adequate number of screens for the incoming volume and material mix, operating under normal conditions can achieve very low losses of containers to paper products.

Note: Both large single stream MRFs, which had better success than the medium single stream MRFs at separating the plastic containers from the paper, were equipped with 4 sets of disc screens: an OCC screen for separating cardboard or “old corrugated containers”; 2 ONP screens for separating “old newspapers” and a polishing screen for cleaning up the mixed paper stream. The two medium MRFs had 1 less paper screen each. Depending on the facility, this study indicates that the extra screens can help improve the accuracy of the 2D/3D separation in single stream MRFs.

FORM

The form of a package had a strong influence on the loss of packaging to the paper streams. As can be seen in Table 1, the plastic clamshells had a much higher likelihood of flattening and moving with the paper streams. The rounder materials (including bottles, cups and containers) all had much lower loss rates, and less than 5% was lost at the top performing MRFs, Small, lightweight water bottles were more likely than other bottles to move with the paper with a loss rate of 15%. The cups, containers and clamshells still enter the MRFs in much lower quantities than bottles. They made up 11% of the plastics stream, even with the seeded materials. Aseptic and gable-top cartons had a higher average loss rate to the paper

streams, although it is interesting to note it was the only packaging type to have one facility with no loss to the paper stream. In all five MRFs, they marketed a Grade 52 for cartons and pulled them from the container line.

OPTICAL SORTERS

Another piece of equipment in MRFs that can help improve separation of materials are optical sorters. Optical sorters can recognize materials based on what they are made of along with their size and shape. All four single stream facilities had at least one optical sorter, and the two large facilities had 3–4. Optical sorter efficiency was difficult to determine from this study because for each optically sorted commodity there were one or more manual sorters for quality control, both on the material that was positively sorted and what was missed. Therefore a manual sorter could remove a PET cup that was positively sorted by the optical sorter into the PET bale or another could mistakenly sort a PP cup that resembled one from PET into the PET bale. However, there were two interesting cases that are worth noting with the optical sorters.

Many of the materials that were tested as part of this study are light weight, meaning a sorter (either human or optical) needs to handle more pieces in order to sort a ton. At the only single stream facility without an optical sorter for the cartons, the manual sorter who normally sorts cartons was asked to positively sort any paper beverage cups and ice cream containers. With the volume of cups and ice cream containers, the sorter was overwhelmed and the manager chose to add a second sorter to that station. This implies that as more lightweight materials are added to the MRF, either more manual sorters will need to be added or optical sorters may be able to help increase the sorting throughput.

Even for a trained manual sorter, recognizing the resin type for each item as it goes by on a conveyor is very difficult. The PP and PET cups that were seeded for the test were both clear plastic and very similar in style. Averaged across all five facilities, approximately 20% of the PP cups were found in the PET bales. This is likely due to manual sorters positively sorting them to the PET stream because they so closely resembled PET cups. As more diverse packaging, including different sizes, shapes, colors, materials and purposes, continues to enter the MRF, improvements in technology and training to keep bale quality high will likely be necessary.

Similarly at one MRF, the optical sorter was set to sort all HDPE and PP and manual sorters then sorted that stream into nHDPE, cHDPE and a HDPE/PP Tubs and Lids grade. The cHDPE bale at that MRF had a much higher percentage of PP (8%) than the other MRFs (less than 2%). This further emphasizes the sorting challenges facing MRFs.

MATERIAL PREVALENCE

MRFs have been designed to separate bottles and cans from magazines and newspaper. During this study, extensive data was collected on the behavior of specific packaging types in the MRF environment. It shows that MRFs are doing quite well with these prevalent materials, although even these materials are not being correctly sorted at 100%. At best, the study showed a recovery of 93% of an individual package type, with much of the loss to other products and not to residue alone. Similarly for small (<1L), regular weight

TABLE 1
LOSS RATE OF PACKAGING MATERIALS TO THE PAPER STREAMS

FORM	AVERAGE LOSS RATE TO PAPER STREAM	LOSS RATE AT BEST PERFORMING SINGLE STREAM MRF
Plastic Bottles	5%	2%
Plastic Cups	10%	3%
Plastic Containers	12%	2%
Plastic Clamshells	29%	12%
Aseptic and Gable-top Cartons	18%	0%

PET bottles and all size cHDPE bottles, results are shown in Figure 3. Compare those figures to results for small (<10") PET non-bottle containers and cHDPE non-bottle containers as shown in Figure 4. Note that for all results, the data from each of the five MRFs was averaged to form a composite of the behavior across all facilities. According to RRS's database, approximately 50% of the material nationally is processed through the largest 20% of MRFs. Therefore, the larger MRFs were weighted more heavily than the smaller facilities when combining the data.

Why do bottles flow more consistently to the proper bale than tubs and other non-bottle containers? There are many likely reasons for these results. The first, and likely most important, is relative amount of material. During the tests, there were greater than 20 times more regular weight PET bottles than small PET containers (by weight). Including all types of PET bottles and both large and small containers, there were greater than 30 times more bottles (by weight). Although not as pronounced, there were still 8 times as many colored HDPE bottles as containers and tubs. Package types that are more prevalent in the stream are more likely to be targeted by manual sorters if they are missed or misdirected by the optical sorters or disc screens, thereby increasing their recovery. In addition, the equipment is tuned to increase the recovery of the

FIGURE 3
DESTINATION OF SMALL, REGULAR WEIGHT (< 1L) PET BEVERAGE BOTTLES (TOP) AND ALL CHDPE BOTTLES

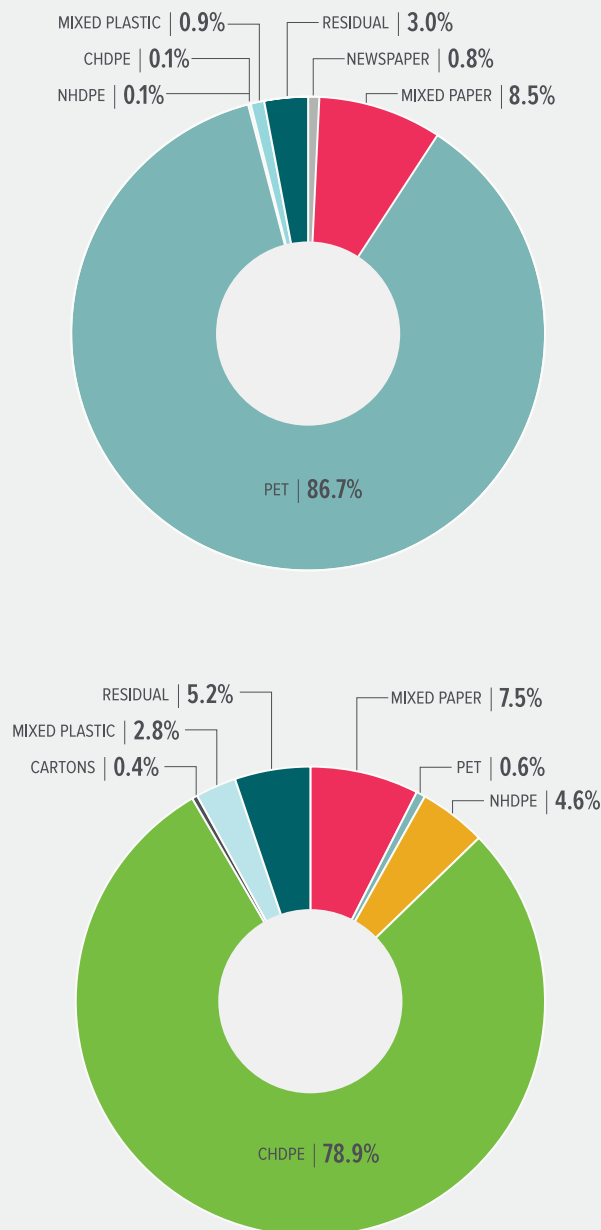


FIGURE 4
DESTINATION OF SMALL PET CONTAINERS (TOP) AND CHDPE CONTAINERS (ALL NON-BOTTLE CONTAINERS & TUBS, < 10" DIAMETER)

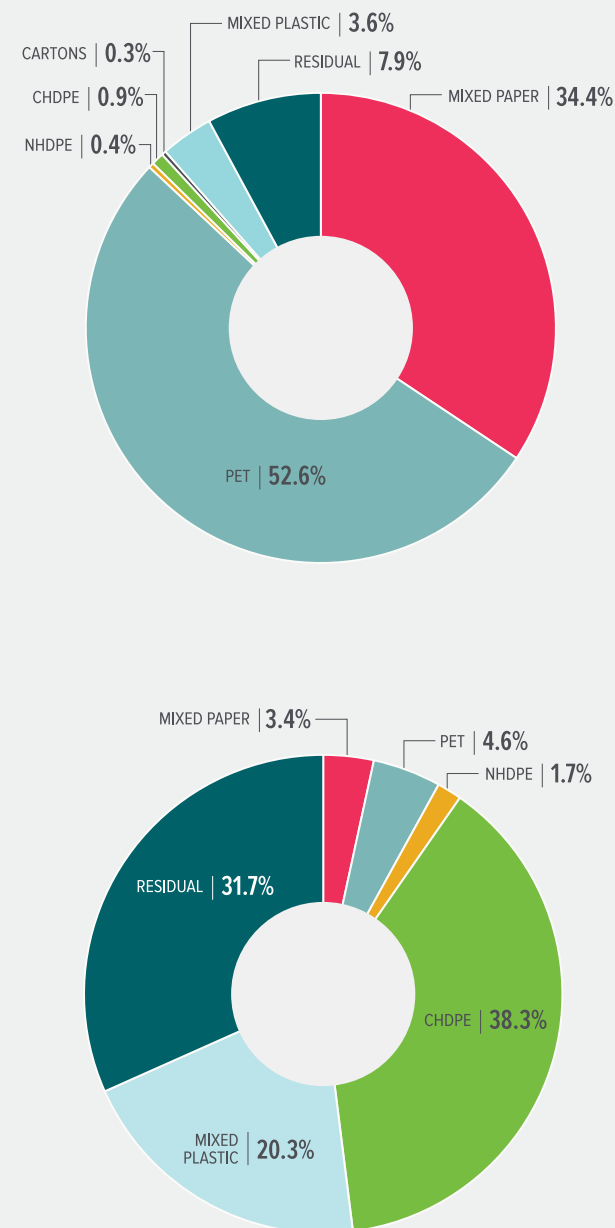
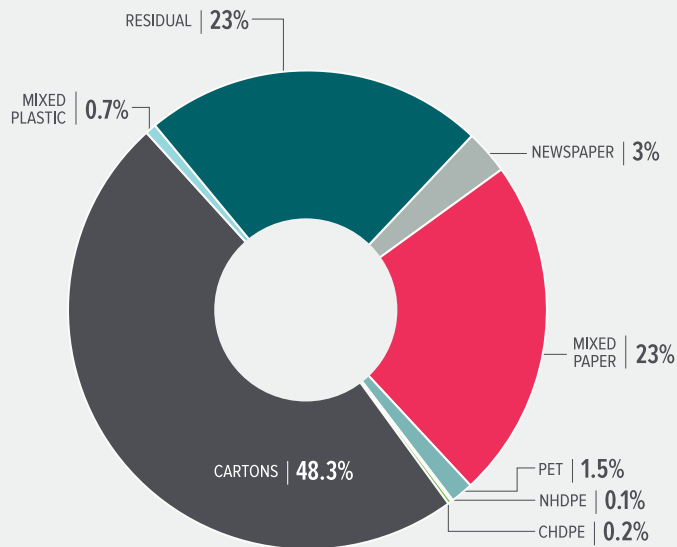
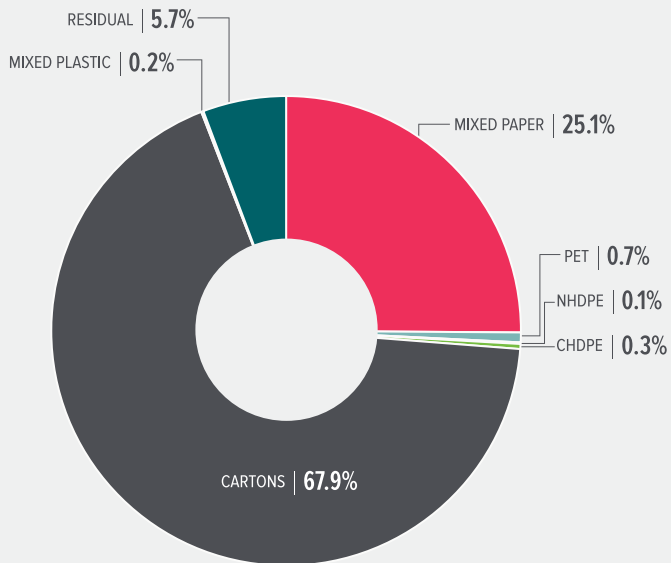


FIGURE 5
DESTINATION OF CARTONS
(TOP) AND PAPER BEVERAGE CUPS



most common materials and may not perform as consistently on less common package types.

Secondly, to target the PET and cHDPE non-bottle containers would take two different strategies. The majority of the PET containers not in the PET bale are lost to the paper stream. However, very little of the cHDPE containers were in the paper stream, but most of the loss was to the residue stream, likely because they were not captured from the container line either by the optical or manual sorters. Finally, the size and shape of the containers can be quite varied in comparison to the bottles, with many containers being flatter and having open tops, which reduces the ability to hold the shape during handling and sorting. This will continue to cause less consistency on the disc screens and other equipment.

ADDING NEW MATERIALS

The study also specifically assessed the MRF “sortability” of some packaging materials that are not currently accepted extensively by recycling programs nationwide but are in fact growing in many communities, including: paper beverage cups, ice cream containers and polystyrene foam cups and clamshells. Figure 5 compares the behavior of aseptic and gable-top cartons to paper beverage cups.

As one example, the paper beverage cups had a strong tendency to flow to the container line (similar to cartons and plastic cups). A higher percentage were lost to residue which, based on review of the test setup and sorter training, was most likely from the container line. This could be due to manual sorters being less familiar seeing them or being overwhelmed when the optical sorter didn’t catch them. Further study could be done to better understand the effectiveness of optical sorters on different types of cups and if programming could be improved to recognize them.

CONCLUSIONS

This study demonstrates the power of examining a material’s inherent behavior in a MRF environment. Understanding how that material will flow allows for informed, operational actions to maximize recovery of that material. It is a useful exercise, as was done here, to look at not only new materials (that aren’t currently accepted) to see which MRF end-products they can be a part of, but also to see how currently accepted materials, both prevalent and not, are being recovered. Recycling is a complicated system of consumer behavior, collection programs, sorting at MRFs and end markets. All stages of the value chain need to be similarly examined to create a full picture of recyclability. As shown in this study, examining and solving material processing challenges at the modern MRF is a necessary step in achieving success for the recycling industry of the future.



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Food Residue Overview

FOOD RESIDUE IN FOODSERVICE PACKAGING RECYCLING: Overview of FPI Food Residue Studies

Background

The Foodservice Packaging Institute's Paper Recovery Alliance and Plastics Recovery Group have been working on overcoming barriers to recovery of foodservice packaging, and one of the often-cited reasons foodservice packaging is not accepted for recycling is the concern about increased levels of food contamination.

The Studies

To address this concern, two studies were conducted, to learn whether foodservice packaging (such as take-out containers or pizza boxes) set out for recycling were more contaminated than food contact packaging (such as peanut butter jars or pasta boxes) that has traditionally been accepted at single stream material recovery facilities (MRFs). DSM Environmental Services, Inc., conducted the studies in Boston, MA (Sept-Oct 2013) and Delaware (July 2014).

The process for each study included a sampling of materials between approximately 2,600 and 4,700 pounds of randomly selected residential curbside recyclables collected in different areas of the selected locations. For all recycling samples, corrugated, mixed paper, plastic tubs and lids, aluminum cans and foils/pans, were sorted into two categories, foodservice packaging or other packaging in contact with food (e.g. jars, tubs, cans, and boxes from prepackaged grocery items). The sort team then used a visual rating system to assess and record how much food residue was present on the selected categories, ranking all materials from 1 (clean) to 5 (highly contaminated, containing uneaten food remnants in addition to residue).

The Results

In both Boston and Delaware, the majority of the samples of foodservice packaging was rated as low-residue (1-2). In the Boston study, there was no appreciable difference in contamination rates between foodservice and food contact packaging. The overwhelming



majority of the samples were extremely clean. In the Delaware study, the proportion of foodservice packaging in high residue levels (4-5) was small and virtually identical to that of food contact packaging. Accordingly, the total proportion of items rated low and middle residue levels (1-3) was essentially the same among foodservice and food contact packaging and formed the majority, however some of the foodservice packaging material types showed a slight shift from the low (1-2) to the middle rating (3) when compared to the food contact packaging. While tolerance for food residue will vary by material and market, the levels ranked 1-3 are believed to be consistent with what markets are generally accepting today as part of the mix of commodities process by MRFs.

The studies yielded some additional observations that help to place this analysis in perspective.

1. Recyclables at the Boston study were exceptionally clean overall, which led the sort team to conclude that while the study was representative of the Boston area, it may not be representative of recycling set outs in other cities. In contrast, the Delaware study samples contained a higher proportion of commingled refuse and appeared to have more soiling from compaction and cross-contamination with refuse in the trucks. As a result, it was challenging in some cases to determine if the surface contamination on the items originated in the recycling truck or if it was food residue from the original packaging contents. (For the purposes of the sort, residue on the exterior was assumed to be contamination from the truck, and residue on the interior was assumed to be food residue.)
2. The most meaningful comparison associated with both sorts was probably the plastic tubs, cups and clamshells category. The sample size in both studies was robust, and covered a broad range of contamination levels for both food contact and foodservice packaging. Neither the Boston nor the Delaware study found an appreciable difference between food residue levels in foodservice and food contact packaging in this category.



Contractor's Conclusions

Based on the findings of these two studies, it appears that overall, the mix of foodservice packaging items recycled at curbside has comparable levels of food residue to that found in food contact packaging. Commingling with refuse seems to have a significant impact on the cleanliness of recyclables, regardless of how clean the recyclables were the consumer placed them in the recycling cart.

The studies at Boston and Delaware presented great opportunities to gather useful data on the issue of adding foodservice packaging to recycling programs. FPI would like to thank the City of Boston, Casella, the Delaware Solid Waste Authority, and ReCommunity for participating in the study. *More information on FPI's recovery projects may be found at www.fpi.org/stewardship.*










The goal of FPI’s Community Partnership Program is to add foodservice packaging – paper and plastic cups, take-out containers, pizza boxes and paper carryout bags – to residential recycling and/or composting programs in communities throughout the U.S. and Canada, diverting valuable materials from landfills into higher and better uses.

In 2017, FPI launched the Community Partnership Program, which screens and assists partner communities in adding foodservice packaging as an accepted material in residential recycling or composting programs. The process involves engaging stakeholders throughout the recovery value chain to identify the available end markets and confirm how these materials will flow through the materials recovery facility (MRF). Once a partner community has been selected, FPI works closely with the MRF and community on operational aspects and outreach efforts to make adding foodservice packaging a success. Selected partner communities are also eligible for grant funding to assist with educating residents on the additions to the program, providing a great opportunity to remind them what should be recycled and/or composted and discourage contamination.

On the following pages, check out the successes that FPI’s Community Partners have had when adding foodservice packaging to their city’s recycling programs.








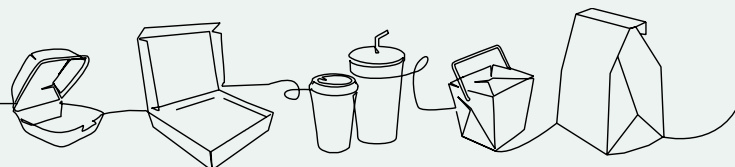
COMMUNITY PARTNERSHIP PROGRAM: INTRODUCTION AND RESULTS






 Community Partner	 Number of Households	 Foodservice Packaging Accepted	 MRF Audit Results	 Engagement
Chattanooga, TN Launched September 2017	178,000	FSP Added: <ul style="list-style-type: none"> Paper cups Paper take-out containers Molded fiber carriers/take-out containers Molded fiber egg cartons Pizza boxes Plastic take-out containers FSP Already Accepted: <ul style="list-style-type: none"> Paper bags Plastic cups 	<ul style="list-style-type: none"> Contamination decreased from 14% to 8% Increase in proportion of fiber collected from 62% to 73% 	<ul style="list-style-type: none"> Increased traffic to city's recycling webpage by 116% 46% increase in cart or bin requests from residents
Louisville, KY Launched October 2017	106,000	FSP Added: <ul style="list-style-type: none"> Paper cups FSP Already Accepted: <ul style="list-style-type: none"> Paper take-out containers Paper bags Molded fiber carriers/take-out containers Molded fiber egg cartons Pizza boxes Plastic cups Plastic take-out containers Aluminum foil containers 	<ul style="list-style-type: none"> Contamination decreased from 17% to 16% Fiber increased from 61% to 65% 	<ul style="list-style-type: none"> Increased traffic to city's website by 45% 33% increase in cart requests by residents Social media engagements increased by 234%

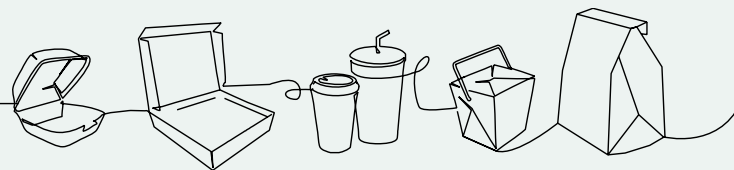







COMMUNITY PARTNERSHIP PROGRAM: INTRODUCTION AND RESULTS

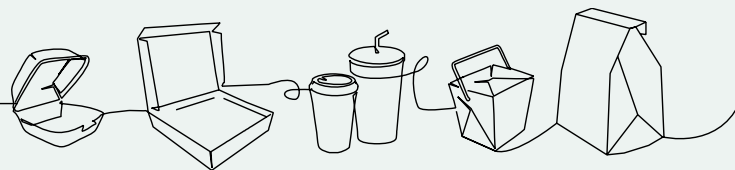
 Community Partner	 Number of Households	 Foodservice Packaging Accepted	 MRF Audit Results	 Engagement
Washington, D.C. Launched October 2017	105,000	FSP Added: <ul style="list-style-type: none"> • Paper cups • Paper take-out containers • Paper plates • Plastic cups • Plastic take-out containers • Plastic lids • Plastic plates FSP Already Accepted: <ul style="list-style-type: none"> • Paper bags • Molded fiber egg cartons • Pizza boxes • Aluminum foil containers 	<ul style="list-style-type: none"> • Contamination decreased from 33% to 26% • Mixed paper increased from 9% to 20% 	<ul style="list-style-type: none"> • Outreach video on recycling FSP viewed 140,000 more times than expected • Roughly 9 to 10 million impressions using bus/rail ads
Denver, CO Launched November 2018	240,000	FSP Added: <ul style="list-style-type: none"> • Paper cups FSP Already Accepted: <ul style="list-style-type: none"> • Aluminum foil containers • Paper bags • Molded fiber egg cartons • Pizza boxes • Plastic cups • Plastic take-out containers 	Paper cups have increased the volume of the poly-coat/carton bale by 15-20% resulting in faster generation of commodity truckloads.	<ul style="list-style-type: none"> • City-wide promotional mailer sent via postcard • Mailer launched to 141,000 HH included link to recycling survey • 55% of survey respondents became aware recycling paper cups after the initial launch announcement • 45% were already recycling paper cups








 Community Partner	 Number of Households	 Foodservice Packaging Accepted	 MRF Audit Results	 Engagement
Millennium Recycling: Sioux Falls, SD Launched February 2019	200,000	FSP Added: <ul style="list-style-type: none"> Paper cups FSP Already Accepted: <ul style="list-style-type: none"> Aluminum foil containers Paper take-out containers Paper bags Molded fiber carriers/take-out containers Molded fiber egg cartons Pizza boxes 	The Millennium MRF sends truckloads of mixed paper bales to a paper mill in St. Paul, MN. Approximately 40% of inbound material is made up of mixed paper, 0.3% of material is estimated to be paper cups.	<ul style="list-style-type: none"> Website updates, press releases and Facebook posts announced acceptance of paper cups Facebook posts received over 799 clicks and made nearly 8,500 impressions
Kent County, MI Launched October 2019 Paper Cups November 2020	309,000	FSP Added: <ul style="list-style-type: none"> Plastic cups Plastic tubs/containers/trays Rigid plastic cups Rigid plastic clamshells/containers Aluminum foil containers/pans/trays Paper cups (Nov 2020) FSP Already Accepted: <ul style="list-style-type: none"> Aluminum foil Paper bags Pizza boxes Molded fiber egg cartons Molded fiber carriers/take-out containers 	<ul style="list-style-type: none"> Benchmark MRF residue measured at 12% Paper FSP (cups & containers) measured at .02% of inbound composition during benchmark audit 	<ul style="list-style-type: none"> Residential recycling survey received more than 1,200 responses Drop off center signage placed Ad reached 17K residents



 Community Partner	 Number of Households	 Foodservice Packaging Accepted	 MRF Audit Results	 Engagement
Clark County, IN Launched November 2019	110,000	FSP Added: <ul style="list-style-type: none"> • Paper cups • Paper take-out clamshells/containers/trays • Paper bags • Pizza boxes • Molded fiber carriers/containers • Molded fiber egg cartons • Plastic cups • Plastic clamshells/containers • Rigid plastic cups • Rigid plastic clamshells/containers 	Nearly six months after the launch, monthly recycling tonnage delivered to the MRF increased 10-13%.	<ul style="list-style-type: none"> • County saw increased website traffic after their initial partnership launch: <ul style="list-style-type: none"> - Pre-launch: Average of 1,855 monthly visits - Post-launch: Average of 12,057 monthly visits
St. Lucie County, FL Launched December 2020	234,000	FSP Added: <ul style="list-style-type: none"> • Paper cups FSP Already Accepted: <ul style="list-style-type: none"> • Paper bags • Pizza boxes • Molded fiber carriers/take-out containers • Molded fiber egg cartons • Aluminum foil containers/pans/trays • Plastic cups • Plastic clamshells/containers • Rigid plastic cups • Rigid plastic clamshells/containers 	Results Pending	<ul style="list-style-type: none"> • Campaign rolled out to 234,000 HHs • 742 recycling survey respondents • FB ad received 70K impressions and 3K clicks • PRA/PRG Community Partnership to promote additional suite of FSP



 Community Partner	 Number of Households	 Foodservice Packaging Accepted	 MRF Audit Results	 Engagement
Athens-Clarke County, GA Launched January 2021	47,000	FSP Added: <ul style="list-style-type: none"> • Paper cups • Paper take-out containers FSP Already Accepted: <ul style="list-style-type: none"> • Paper bags • Pizza boxes • Molded fiber carriers/take-out containers • Molded fiber egg cartons • Aluminum foil containers/pans/trays • Plastic cups • Plastic clamshells/containers • Rigid plastic cups • Rigid plastic clamshells/containers 	Results Pending	<ul style="list-style-type: none"> • Three local media placements • Facebook ad campaign received 5,227 engagements; 325 clicks • Video received 4,800 plays • 3 truck wraps (co-sponsor opportunity) • Window clings for restaurants • 50+ attendees drive-thru coffee media day

Interested in learning more about how to become a Community Partner? Please visit www.recyclefsp.org or email info@fpi.org.



Oregon Statewide Recycling Collection List and Producer-Collection Materials for Recycling

This information is submitted by the Foodservice Packaging Institute in response to the February 3, 2022 Request for Information: Oregon statewide recycling collection list and producer-collected materials (for recycling).

We welcome questions and can provide additional details upon request. Please contact:
Ashley Elzinga
571-407-1434
aelzinga@fpi.org

Background

The Oregon Department of Environmental Quality has requested technical information that can be used to evaluate materials against evaluation criteria set forth in statute. The Oregon Plastic Pollution and Recycling Modernization Act was passed into law in 2021 requiring numerous changes that are intended to modernize and stabilize recycling services in Oregon.

The Foodservice Packaging Institute (FPI) was founded in 1933 and is the leading authority for the North American foodservice packaging industry. FPI encourages the responsible use of all foodservice packaging through promotion of its benefits and members' products. Serving as the voice of the industry to educate and influence stakeholders, FPI provides a legal forum to address the challenges and opportunities facing the foodservice packaging industry.

FPI's core members are foodservice packaging manufacturers and their raw material and machinery suppliers. With over 75 members, FPI includes approximately 90% of the entire industry in North America.

FPI is committed to reducing the impact of its products on the environment and is dedicated to making sure these items recovered and diverted from the landfill. FPI has a separately funded recovery group with a focus on paper and plastic cups, containers, bags, and boxes. Since 2011, this group has been working with communities, recycling facilities, composters, and end markets to expand to find stable and sustainable recovery solutions for these valuable materials. This group receives technical support from Resource Recycling Systems (RRS).

Through the [Community Partnership program](#) that launched in 2017, FPI has partnered with 15 residential programs to add foodservice items to their accepted material lists. The specific items are determined through consultation with the individual program, the Material Recovery Facilities (MRF) and end markets that process the community's materials. Once FPI determines viability for inclusion of foodservice packaging materials into the prospective community recovery program, FPI works with the city and/or municipality to educate residents

on best practices for recovery. This education campaign is a crucial component of every Community Partnership and helps elevate the whole community recovery program, not just the foodservice items. Because these efforts are market-based, they have proven stable and sustainable without further assistance from FPI, and the partners report numerous benefits to their programs.

This RFI submission provides information regarding polyethylene terephthalate (PET) cups and other PET thermoforms to support decisions around their inclusion in the uniform statewide collection list (USCL). The data has been compiled with the assistance of technical consultant, RRS), who has conducted ongoing research on recycling and recyclability of these materials for FPI and other clients.

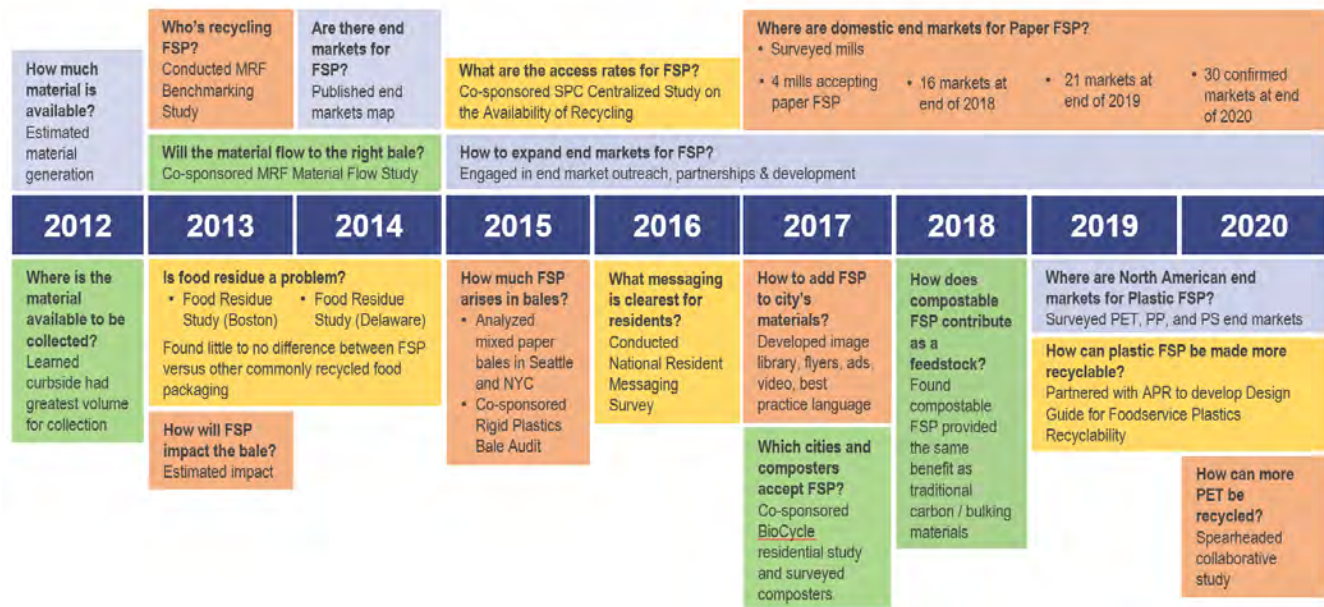
Plastics: PET Cups and other PET Thermoforms

PET resin, designated with the #1 resin identification code, is the most common resin used to make containers and packaging, including drink cups, clamshells, egg cartons, and other thermoformed packaging. Due to its physical appearance and barrier properties, PET is often used for food packaging applications.

FPI Research

Since the inception of FPI's recovery efforts over ten years ago, FPI has been conducting research on recyclability of foodservice packaging in order to understand and overcome potential barriers to its recovery. This research has provided the foundation for FPI's successful Community Partnership program. Many of these studies have been collaborations with other industry stakeholders including the Association of Plastic Recyclers, the National Association for PET Container Resources (NAPCOR), and the Sustainable Packaging Coalition. Since 2012, much of this research has been conducted with technical support from RRS and other technical experts including Cascadia Consulting, DSM, Stina (formerly More Recycling), and Moore and Associates. Below is an overview of these research efforts and the questions they were designed to address.

Overview of FPI's Foundational Research



Overviews of studies are available at www.recycleFSP.org

Studies of particular relevance for PET Thermoforms cups and containers can be found in the appendices. They include research in the following areas:

- [Food Residue Studies](#)
- [MRF Flow Studies](#)
- Mixed Plastic Bale Sorts ([2015](#) and [2021](#))
- Reclaimer Surveys (reflected in FPI's [End Markets Map](#))
- [PET Thermoform Recycling Cost and Material Flow Analysis](#)

FPI has spearheaded and is currently engaged in a PET Thermoform Recycling Cost and Material Flow project. This is a national-scope, multi-stakeholder project to identify optimal recycling pathways for PET thermoforms. Partners include the following recycling trade groups, thermoform manufacturers, MRFs, and end markets:

- Association of Plastic Recyclers
- Sustainable Packaging Coalition
- The Recycling Partnership
- National Association for PET Container Resources (NAPCOR)
- Northeast Recycling Council (NERC)
- Amcor

- Danone North America
- Driscoll's
- Eastman
- Loop Industries
- Mondelez International
- Sonoco

The Phase 1 study found that PET thermoform recovery is viable, either through segregation of PET thermoforms at the MRF level, or processing at PET reclaimers. It identified key research questions to address in further defining an intervention and investment pathway that will lead to broader recycling of PET thermoforms. Outcomes from Phase 1 of this project can be found in a public report, entitled “PET Thermoform Recycling Cost & Material Flow Analysis” that can be found in the Appendix.

The Phase 2 scope is currently in progress and includes field testing of interventions required to enable greater collection, sorting and processing and recycling of PET thermoforms. The outcomes of this research will inform the investments that will be made by the newly launched [PET Recycling Coalition](#) initiated by The Recycling Partnership. FPI will hold an advisor role on the PET Recycling Coalition.

The Stability, Maturity, Accessibility and Viability of Responsible End Markets

The following map shows end markets in North America that accept PET thermoforms, either in thermoform-only bale or in bales with PET bottles and thermoforms. The list is a result of a bi-annual survey of plastics reclaimers, last conducted in 2020. FPI maintains an interactive map of end markets by commodity at <https://www.recyclefsp.org/end-markets-map>.



Figure 1. End Markets that Accept PET Thermoforms. Source: <https://www.recyclefsp.org/end-markets-map>

This includes the following reclaimers:

- rPlanet Earth - Vernon California: PET Bottles and Thermoform Bales
- Green Impact – Vernon, California: PET Thermoform-only Bales
- Global Plastics Recycling - Perris, California: PET Bottles and Thermoform Bales; PET Thermoform-only Bales
- Green Impact - Ciudad Juarez, Mexico: PET Thermoform-only Bales
- Direct Pack – Tlaquepaque, Mexico: PET Thermoform-only Bales
- Merlin – Calgary, Alberta: PET Bottles and Thermoform Bales
- EcoStar - Madison, Wisconsin: PET Bottles and Thermoform Bales
- Dak – Richmond, Indiana: PET Bottles and Thermoform Bales
- Mohawk Industries – Summerville, GA: PET Bottles and Thermoform Bales
- Clear Path – Fayetteville, NC: PET Bottles and Thermoform Bales

- Meltech – Tilbury, Ontario: PET Bottles and Thermoform Bales
- BMP Recycling – Shelburne, Ontario: PET Bottles and Thermoform Bales
- Klockner Plastic – Vilel d’Anjou, Quebec: PET Bottles and Thermoform Bales
- Plastrec – Joliette, Quebec: PET Bottles and Thermoform Bales

According to Phase 1, outcomes of the PET Thermoform Recycling Cost and Material Flow project, end markets that accept PET thermoforms within the bottle bale are typically operationally constrained to allow no more than 10% thermoform by weight. The acceptance thresholds for the reclaimers listed above are documented in the interactive map.

According to NAPCOR, the thermoform market continues to grow, with 134 million lbs. reaching end markets in 2020 (NAPCOR), nearly all taking place in US and Canada:

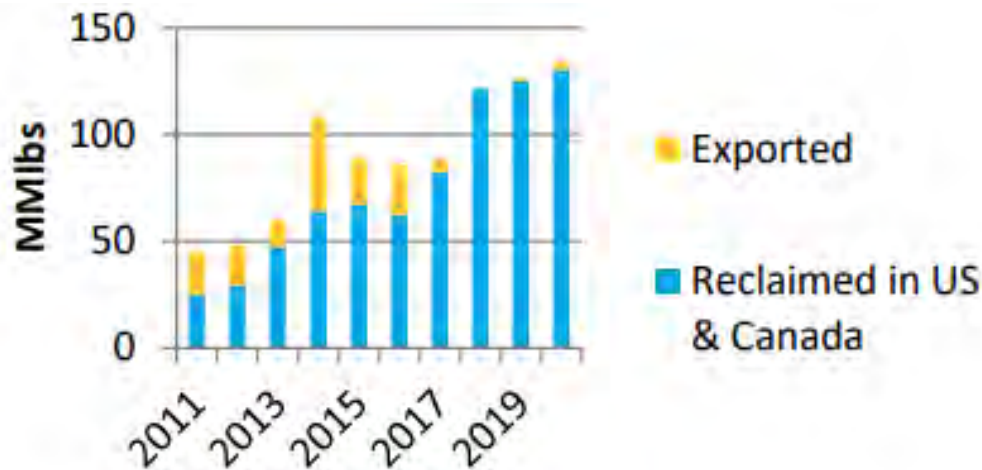


Figure 2. PET Thermoforms Recovered in US & Canada (NAPCOR PET Recycling Report, 2020)

RRS market research (not published) on flow of PET thermoform materials across North America indicates PET bales from the Northwest reach markets in the Midwest and Southeast US, in addition to Canada and Mexico.

In addition to the above mature markets, there are emergent markets seeking to source PET thermoforms as a feedstock. This includes the following:

- Eastman, located in Kingsport, Tennessee, is currently in the process of procuring material for a 2023 start up. The facility will have capacity of 100,000 metric tons to produce polyester material. Eastman procures both PET thermoform bales with any percentage of colored PET and is open to accept any colored/opaque PET bales. The full Eastman letter of support can be found in the Appendix.

- Republic is developing a [reclamation facility](#) in Las Vegas that will have a capacity to consume 65 million lbs. per year of PET. It is our understanding that this facility will consolidate PET flows from many MRFs and will have the capacity to segregate and process PET thermoforms.
- EFS Plastics, located in Lethbridge, Alberta, has seen rapid growth in throughput capacity in recent years. EFS desires supply growth of PET feedstock, in addition to other materials collected from households. EFS is eager to work with communities and MRFs in Oregon. The full letter of support from EFS Plastics can be found in the Appendix.

The Anticipated Yield Loss for the Material During the Recycling Process

MRF Capture / yield loss

According to a 2015 MRF Flow study commissioned by FPI:

- 61% of PET clamshells¹ made it into its target PET bale
- 77% PET cups made it into its target PET bale

Most PET cup and clamshell (thermoforms) loss in a MRF is due to the flow of material to the mixed paper line. This is due to the materials flattening in the collection process and becoming two dimensional and moving over the screen with other fiber, rather than flowing with the three-dimensional materials to the container line. Other research conducted by RRS (not published) found that adding quality control on the paper line to redirect PET thermoforms to the container line would increase the capture rate to nearly 90%. RRS research has also found that optical sorters effectively capture more than 90% of the thermoforms that flow through them, so if PET thermoforms make it to the container line they have a very high likelihood of capture.

Reclaimer Capture / Yield Loss

According to interviews with reclaimers, PET cups and thermoforms see a yield loss of approximately 30% when run as a segregated stream on a system designed to process thermoforms. In cases where thermoforms are run on systems designed predominantly for bottle capture, the yield loss ranges from 30 to 50%. For purposes of comparison, the estimated yield loss in a typical curbside collected PET bottle bale is 38% (see Appendix for a report by Closed Loop Partners, *Cleaning the rPET Stream: How we scale post-consumer recycled PET in the US*).

The Material's Compatibility with Existing (Oregon) Recycling Infrastructure

According to FPI research most foodservice packaging is discarded at home or in the workplace. This means that residential curbside collection offers significant potential for capturing this material to achieve optimal diversion. Due to conditions spurred by the ongoing pandemic, takeout and delivery have likely prompted more opportunity for at home collection.

¹ This study does not refer to thermoforms. Flow of clamshells in a MRF are similar to that of any thermoformed item in general. However, thermoform flow in a MRF does vary by size shape and resin.

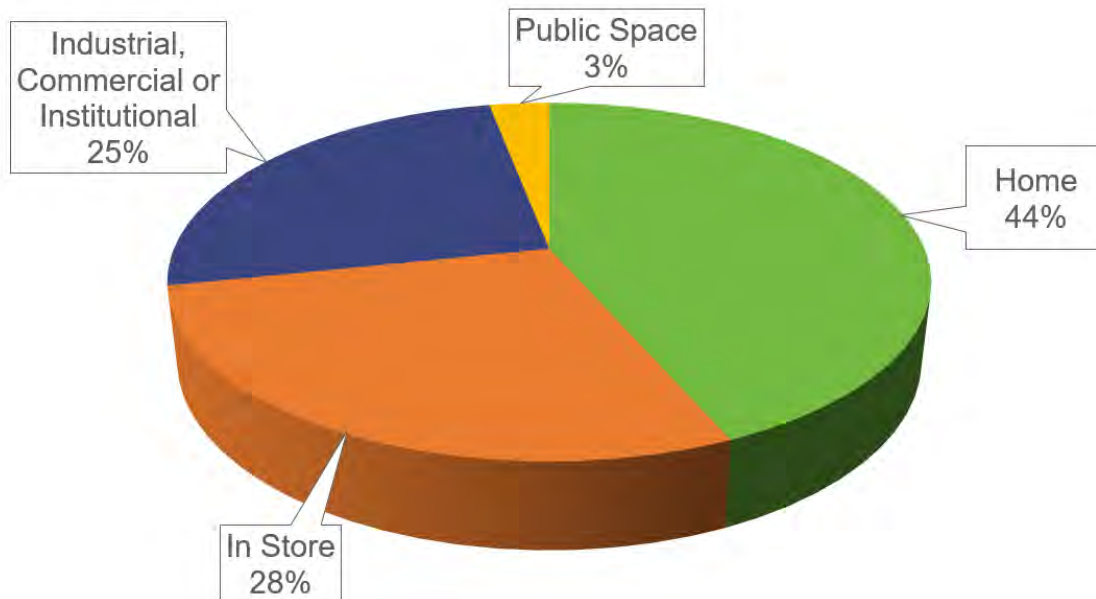


Chart showing breakdown of foodservice packaging by point of disposal

PET cups and other PET thermoforms are not currently collected in most households throughout the state. If added to the list they would reach MRFs and could be expected to follow the baseline flow of this material into PET bottle or mixed plastic bales at a similar rate of capture as described above, with higher baseline capture of PET cups and the majority of loss for thermoforms going into mixed paper bales, some of which could be redirected through manual QA/QC. Current MRF best practice includes incorporating optical sortation for PET, as well as enhanced quality control on the paper line. As such, if the implementation of the Recycling Modernization Act leads to the upgrade of Oregon’s MRFs to current state of the art, MRF capture rates of approximately 90% would be achieved.

Currently, PET thermoforms are collected and marketed through private subscription services offered by Ridwell in the Portland Metro region.

The Amount of the Material Available

Oregon Waste Characterization studies do not distinguish PET cups and thermoforms.

According to the NAPCOR 2020 PET Recycling Report² there are 1.8 billion lbs. of PET cups and thermoform packaging generated in the US and Canada. When looked at on a per capita basis this amounts to 4.9 lbs. per

² This report is not public and must be paid for to access. It is therefore not included in the appendices.

year per person. Extrapolated to Oregon population results in an estimated 20.67 million lbs. of this material generated annually in the state.

According to Phase 1 outcomes of the PET Thermoform Recycling Cost and Material Flow project, provided in the Appendix, PET Thermoforms represent .25%-.75% of total MRF throughput. This average includes MRFs in communities that explicitly accept thermoforms and those that do not. As more recycling access is developed for these materials that fraction is likely to increase, though there are no specific projections available.

These estimates indicate that there is as much, or more, PET thermoform material generated as there are natural HDPE bottles, therefore the volume is likely sufficient to target for increased recovery.

The Practicalities of Sorting and Storing the Material

PET thermoforms are routinely sorted in MRFs across the US, either into mixed bales with PET bottles, or into thermoform-only bales. See anticipated yield loss section above for more detail.

Contamination

There are multiple aspects of contamination to consider. One issue is food residue on the packaging. According to a series of studies looking at food residue in foodservice packaging conducted by FPI in 2013 and 2014 the amount of residue in foodservice packaging was similar to any other type of food contact packaging and determined to be consistent with what markets are accepting (see Food Residue Overview in the Appendix). Cups are used to contain liquids, and generally, residual liquid drains out of the cup by the time it reaches the MRF.

Another issue is related to cross contamination, when the material flows to the non-target material stream. As noted above PET cups and other PET thermoforms behave differently in this respect:

- The tendency of PET thermoform containers to flatten and travel with the two dimensional paper materials leads to some contamination of the paper stream when PET thermoforms are collected if proper quality control measures are not in place. However, it is important to keep in mind that the scale of that contamination. PET thermoforms are less than 1% of the MRF's material flow, while paper materials make up 50 to 70% of a typical MRF stream. Cross contamination and yield loss can be reduced by adding quality control on the mixed paper line.
- As noted above, PET cups are less susceptible to cross contamination.

The real-world experiences of communities and MRF accepting PET cups and thermoforms indicate that with good resident education, PET cups and other PET thermoforms, and other foodservice packaging, can be added successfully while reducing overall contamination. The communities and MRFs that have participated in FPI's Community Partnership program have not reported any problems with quality or marketability of bales as a

result of adding PET cups and thermoforms, and the foodservice items added via the partnerships remain in their programs.

FPI inventoried the messaging used in leading recycling programs, the terminology recommended by several industry groups, and conducted a resident messaging survey in order to develop its best practices, which it employs in Community Partnership program with the resident communications for each program addition. These best practices include recommended terminology, effective graphics, and simple preparation instructions aimed at promoting recycling of clean and empty items and minimizing contamination. The graphics feature clean, empty cups, with no lids or straws attached. This messaging strategy has proven effective, and our partner communities have reported reductions in residue following the communications campaign.

The Ability for Waste Generators to Easily Identify and Properly Prepare the Material

PET cups and thermoforms are easily identifiable due to high clarity and reference to the #1 resin identification code. Alternatively, residents of programs that use broader language such as “plastic cups and containers” can usually identify the accepted items intuitively.

The only preparation needed is to empty the cup and remove the lid or any other ancillary items.

FPI inventoried the messaging used in leading recycling programs, the terminology recommended by several industry groups, and conducted a resident messaging survey, that is specific to foodservice packaging in order to develop best practices. FPI employs these findings in every Community Partnership program and resident communications for each program addition. These best practices include recommended terminology, effective graphics, and simple preparation instructions aimed at promoting recycling of clean and empty items and minimizing contamination ([the resident education kit, including the study results, is available for download](#)). The recommended graphics feature clean, empty cups, with no lids or straws attached. This messaging strategy has proven effective, and our partner communities have reported reductions in residue following the communications campaign.

Economic Factors.

Most PET thermoforms are marketed as a fraction of PET bottle bales and are generally accepted up to 10% in volume. There is an emerging grade of PET thermoform bale which has had pricing on average in the Pacific northwest of \$.08/lb. over the past six months (recyclingmarkets.net). PET curbside bottle bales have averaged \$.14/lb. over that same period in the region.

Environmental Factors from a Life Cycle Perspective

According to a 2020 NAPCOR Lifecycle Assessment the use of recycled PET (rPET) as a substitute for virgin PET results in:

- 60% reduction of greenhouse gas emissions
- 75% lower total energy demand
- 40% less process and transportation energy expended

See Appendix for more details.

Appendix

- FPI: Food Residue Overview
- FPI: MRF Material Flow Study
- FPI: Plastic Cup Bale Sort Findings
- RRS: PET Thermoform Recycling Cost & Material Flow Analysis
- NAPCOR: Updated Polyethylene Terephthalate Resin Life Cycle Analysis and Calculator
- Closed Loop Partners: Cleaning the rPET Stream: How we scale post-consumer recycled PET in the US
- Eastman Letter of Support
- EFS Plastics Letter of Support



Food Residue Overview

FOOD RESIDUE IN FOODSERVICE PACKAGING RECYCLING: Overview of FPI Food Residue Studies

Background

The Foodservice Packaging Institute's Paper Recovery Alliance and Plastics Recovery Group have been working on overcoming barriers to recovery of foodservice packaging, and one of the often-cited reasons foodservice packaging is not accepted for recycling is the concern about increased levels of food contamination.

The Studies

To address this concern, two studies were conducted, to learn whether foodservice packaging (such as take-out containers or pizza boxes) set out for recycling were more contaminated than food contact packaging (such as peanut butter jars or pasta boxes) that has traditionally been accepted at single stream material recovery facilities (MRFs). DSM Environmental Services, Inc., conducted the studies in Boston, MA (Sept-Oct 2013) and Delaware (July 2014).

The process for each study included a sampling of materials between approximately 2,600 and 4,700 pounds of randomly selected residential curbside recyclables collected in different areas of the selected locations. For all recycling samples, corrugated, mixed paper, plastic tubs and lids, aluminum cans and foils/pans, were sorted into two categories, foodservice packaging or other packaging in contact with food (e.g. jars, tubs, cans, and boxes from prepackaged grocery items). The sort team then used a visual rating system to assess and record how much food residue was present on the selected categories, ranking all materials from 1 (clean) to 5 (highly contaminated, containing uneaten food remnants in addition to residue).

The Results

In both Boston and Delaware, the majority of the samples of foodservice packaging was rated as low-residue (1-2). In the Boston study, there was no appreciable difference in contamination rates between foodservice and food contact packaging. The overwhelming



majority of the samples were extremely clean. In the Delaware study, the proportion of foodservice packaging in high residue levels (4-5) was small and virtually identical to that of food contact packaging. Accordingly, the total proportion of items rated low and middle residue levels (1-3) was essentially the same among foodservice and food contact packaging and formed the majority, however some of the foodservice packaging material types showed a slight shift from the low (1-2) to the middle rating (3) when compared to the food contact packaging. While tolerance for food residue will vary by material and market, the levels ranked 1-3 are believed to be consistent with what markets are generally accepting today as part of the mix of commodities process by MRFs.

The studies yielded some additional observations that help to place this analysis in perspective.

1. Recyclables at the Boston study were exceptionally clean overall, which led the sort team to conclude that while the study was representative of the Boston area, it may not be representative of recycling set outs in other cities. In contrast, the Delaware study samples contained a higher proportion of commingled refuse and appeared to have more soiling from compaction and cross-contamination with refuse in the trucks. As a result, it was challenging in some cases to determine if the surface contamination on the items originated in the recycling truck or if it was food residue from the original packaging contents. (For the purposes of the sort, residue on the exterior was assumed to be contamination from the truck, and residue on the interior was assumed to be food residue.)
2. The most meaningful comparison associated with both sorts was probably the plastic tubs, cups and clamshells category. The sample size in both studies was robust, and covered a broad range of contamination levels for both food contact and foodservice packaging. Neither the Boston nor the Delaware study found an appreciable difference between food residue levels in foodservice and food contact packaging in this category.



Contractor's Conclusions

Based on the findings of these two studies, it appears that overall, the mix of foodservice packaging items recycled at curbside has comparable levels of food residue to that found in food contact packaging. Commingling with refuse seems to have a significant impact on the cleanliness of recyclables, regardless of how clean the recyclables were the consumer placed them in the recycling cart.

The studies at Boston and Delaware presented great opportunities to gather useful data on the issue of adding foodservice packaging to recycling programs. FPI would like to thank the City of Boston, Casella, the Delaware Solid Waste Authority, and ReCommunity for participating in the study. *More information on FPI's recovery projects may be found at www.fpi.org/stewardship.*





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MRF MATERIAL FLOW STUDY

FINAL REPORT | APRIL 2015

COMMISSIONED BY



PREPARED BY RRS IN CONJUNCTION WITH:



INTRODUCTION

The famous Greek philosopher Heraclitus captured the essence of the recycling industry over 2,500 years ago when he penned the phrase, “Nothing endures but change.” The march of packaging innovation and technology, and the persistently changing habits of consumers continue to dictate the changing mix of materials that enters a material recovery facility (MRF). Over the past decade, there has been a continual decline in the once dominant materials including newspaper, glass and metal cans. At the same time, a host of other packaging types have emerged, presenting new recovery opportunities. Recycling programs throughout the country have responded by expanding the list of materials accepted for recycling, notably including a wide range of plastics and cartons. For the MRFs that receive the material, it is not always easy to keep sorting technologies and techniques on pace with this expanding mix.

STUDY OVERVIEW

Packaging companies have an interest in ensuring that the packages they produce or sell their products in have the opportunity to be recycled. The ability to recycle the package can be a consumer’s deciding factor in the purchase of a particular product. This, and the desire to minimize environmental footprints, are the drivers behind the recently completed MRF Material Flow Study.

MRFs are the intersection between consumers, residents and the industrial infrastructure that creates the products and packaging we use every day. To better understand the recyclability of their packaging, five diverse associations – the Carton Council, Foodservice Packaging Institute (FPI), American Chemistry Council (ACC), National Association for PET Container Resources (NAPCOR) and the Association of Postconsumer Plastics Reprocessors (APR) – joined together to study how numerous materials flowed through the MRF. They contracted with RRS, Reclay StewardEdge (RSE) and Moore Recycling Associates to develop a standard methodology and execute it at five MRFs.

KEY CONCLUSIONS

In studying the performance of specific materials through different MRF environments, a number of general takeaways became clear. These conclusions could help to serve as guidelines to improve recovery across the recovery value chain – from residents and municipalities to packaging designers and MRF operators and engineers, and everyone else in between.

AUDIENCE	KEY TAKEAWAYS
Packaging Designers	<ul style="list-style-type: none"> • Form, material and rigidity have a significant effect on a product’s “sortability” in the MRF • Light-weighting of plastics can decrease recovery in a single stream MRF due to loss to the paper streams
MRF Operators	<ul style="list-style-type: none"> • More equipment steps (disc screen decks or other separation equipment) can improve accuracy of splitting two-dimensional from three-dimensional materials • Properly maintaining the disc screens (cleaning and replacing discs) can significantly reduce loss of containers to the paper stream • Minimizing compaction to maintain the form/shape of incoming material improves separation • Continually training sorters to recognize a wide range of acceptable packaging is of growing importance
MRF Equipment Designers	<ul style="list-style-type: none"> • Further research and development is needed to improve consistency of behavior of non-bottle plastics in the MRF • Further testing and refining of optical sorter programming is needed to effectively optically sort a wider range of packaging
Municipalities	<ul style="list-style-type: none"> • Regular communications with local MRFs is critical to understanding behavior of materials currently accepted and identifying additional materials that could be added • As the list of acceptable materials grows, continual education for residents is essential to keeping contamination to a minimum • For single stream programs, education to the consumer to not crush materials can improve their recovery
Recycling Industry	<ul style="list-style-type: none"> • Continually evaluate and match MRF product quality and end market capabilities to ensure true recovery

ABOUT THIS REPORT

This study examined the behavior of numerous individual products in the MRF, yielding data on cups, clamshells, containers, domes/trays, bottles, tubs, lids, gable-top and aseptic cartons, and other materials. Funders of this study have gained a greater awareness of the opportunities and obstacles regarding the recovery of each of these materials and will apply this new knowledge to increase recovery.

While the detailed data on each material are not presented within this report, key findings regarding material flows, sorting technologies, and other sorting and design related considerations are explained, along with the study's methodology.

STUDY METHODOLOGY

There were three stated goals of the study:

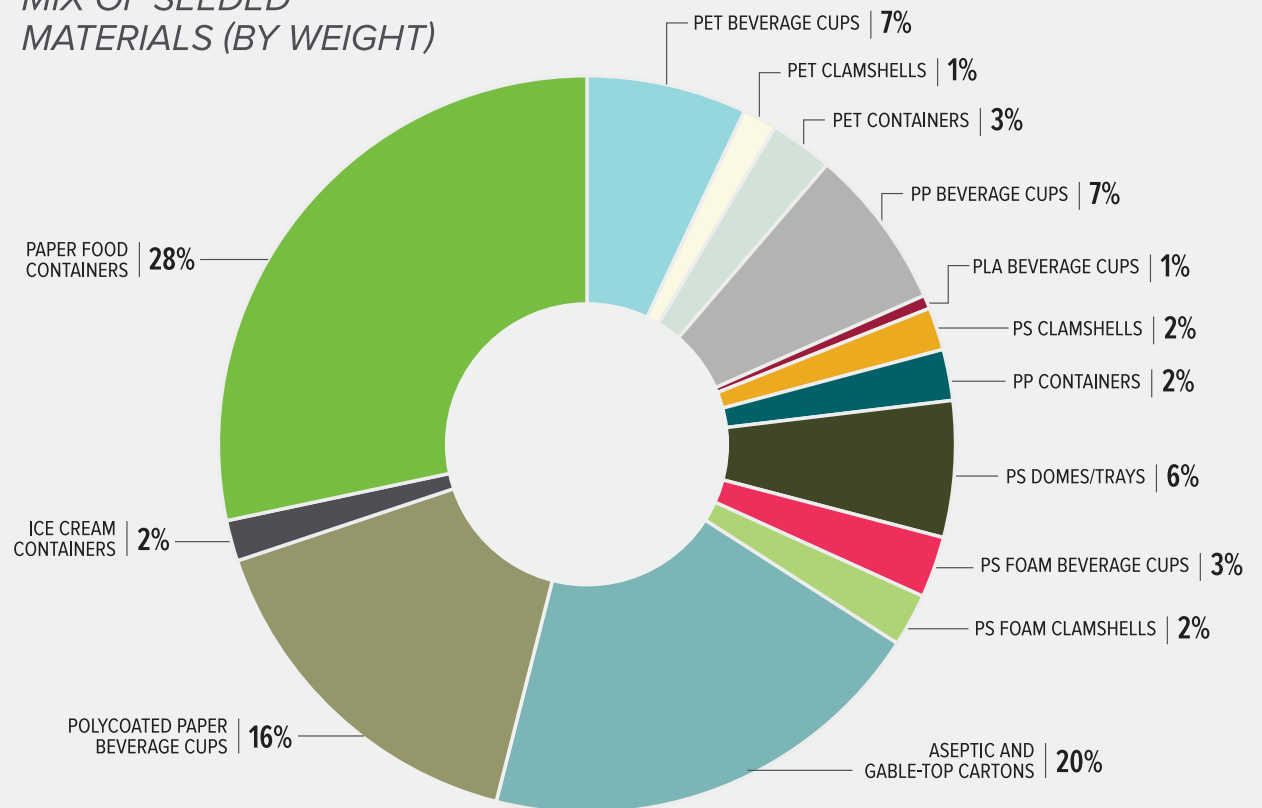
1. Learn how materials similar to the test samples and other study materials would flow through typical MRF environments;
2. Determine which of the study materials, not currently accepted by MRFs, could potentially be recycled using existing MRF infrastructure; and
3. Start to develop an understanding of what sort processes could be modified to allow effective recovery of sample materials

The study focused on a broad range of materials, many that are currently widely

accepted and some that are very rarely included in recycling programs. Materials that are not commonly accepted for recycling were brought in and added, or “seeded”, to the normal stream received by the MRF. To simulate a realistic recovery scenario, care was taken to add materials at levels that corresponded to their relative prevalence in the marketplace. In other words, more common materials were seeded in larger amounts (by weight) than less common ones.

The plastic materials studied included cups, clamshells, domes/trays, bottles, tubs, lids and other containers. Each was classified by resin identification code and in some categories including containers and tubs, by size as well. The paper products studied included cups, ice cream containers, gable-top and aseptic cartons, and take-out food containers. Figure 1 shows the representative mix of materials that was seeded.

FIGURE 1
MIX OF SEEDED MATERIALS (BY WEIGHT)



In each of the five MRFs that served as test sites for this study, a standard methodology was applied to analyze the flow of materials. This methodology was, in essence, quite simple and could be replicated for other materials or repeated in other MRFs.

- The MRF set aside enough inbound recyclable material to run their facility for 3 hours (between 30 and 100 tons). This represented the average material that the facility processes on a day to day basis.
- The study team worked with the MRF staff to mix the seeded packaging into the inbound material. In each facility, the seeded materials represented about 1% of the incoming stream by weight.
- Sort staff was trained on how to handle the seeded materials. In general, the materials were allowed to flow where they naturally did within the facility and sorters were instructed to not pick and dispose of the seeded materials as residue. However, each seeded package was given one or more target commodity streams and if, for example paper beverage cups flowed to the container line, the sorters were directed to positively sort them to the carton bale and if they flowed to the paper line they were allowed to stay in the mixed paper bale. Seeded materials therefore flowed to existing MRF products – new product grades were not produced for the seeded materials.
- The facility processed the material for 3 hours. During the processing, video cameras were set up to monitor the flow of materials and the actions of the sorters.
- Random samples of the main products were taken either as loose samples or from random bales. The target sample weight was about 600 pounds for each of the products and, where possible, multiple samples were taken of each product or the majority of the product was sorted.
- Each of the samples was sorted into 104 categories. The plastic sort categories were chosen to match other studies commissioned by ACC, APR, NAPCOR, and others.

Ideally, tests were run during a time that the facility was not planning to operate, so as not to hinder normal operations. MRFs operate on extremely tight timelines, and without careful scheduling a study could easily create problematic disruptions.

DATA ANALYSIS

Based on the data collected, two analyses were performed. The first was characterizations of each of the product streams. These were completed for each of the samples of a single product and then averaged to get the product characterization. Product characterizations showed how much of that stream was composed of each sort category. An example is shown in Figure 2. The product characterizations are important for end

The MRFs at which this study was conducted were chosen to represent the wide diversity of facilities that currently process recyclables nationwide. Here are some of their key descriptors and differentiators:

- 1 dual stream and 4 single stream facilities
- Throughput range (tons per hour): 10 tph – 35 tph
- Four different equipment manufacturers
- Number of optical sorters ranged from 0 – 5
- Varying combinations of disc screens and other mechanical separation equipment

PRODUCT CHARACTERIZATIONS WERE CALCULATED FOR THE FOLLOWING STREAMS:

Mixed Paper	Mixed Paper/ Newspaper ¹	cHDPE
Newspaper	PET	nHDPE
Cartons	Mixed Plastics ²	Residue

¹ Some facilities only marketed one grade of paper

² Also included a HDPE/PP Tubs and Lids grade

markets to understand the quality and composition of a MRFs products. For this study, it was important to see if the addition of seeded materials would increase contamination of existing product streams.

The second analysis used the characterizations to determine the destination of each of the study materials. For example, if 10,000 paper beverage cups were introduced into

the MRF, how many would end up in the mixed paper, how many in the carton bale and how many in the residue and other categories. This analysis was the key to understanding how the materials flowed in the MRF environment. Examples of this analysis are shown in the Results section.

RESULTS

While a diverse set of MRFs was chosen for the study, the results presented here are specific to the MRFs studied, as different results can be achieved by modifying equipment layouts, operating protocols and material streams.

Key findings are grouped by type of MRF, type of sortation equipment and material form and prevalence.

DUAL STREAM SYSTEMS

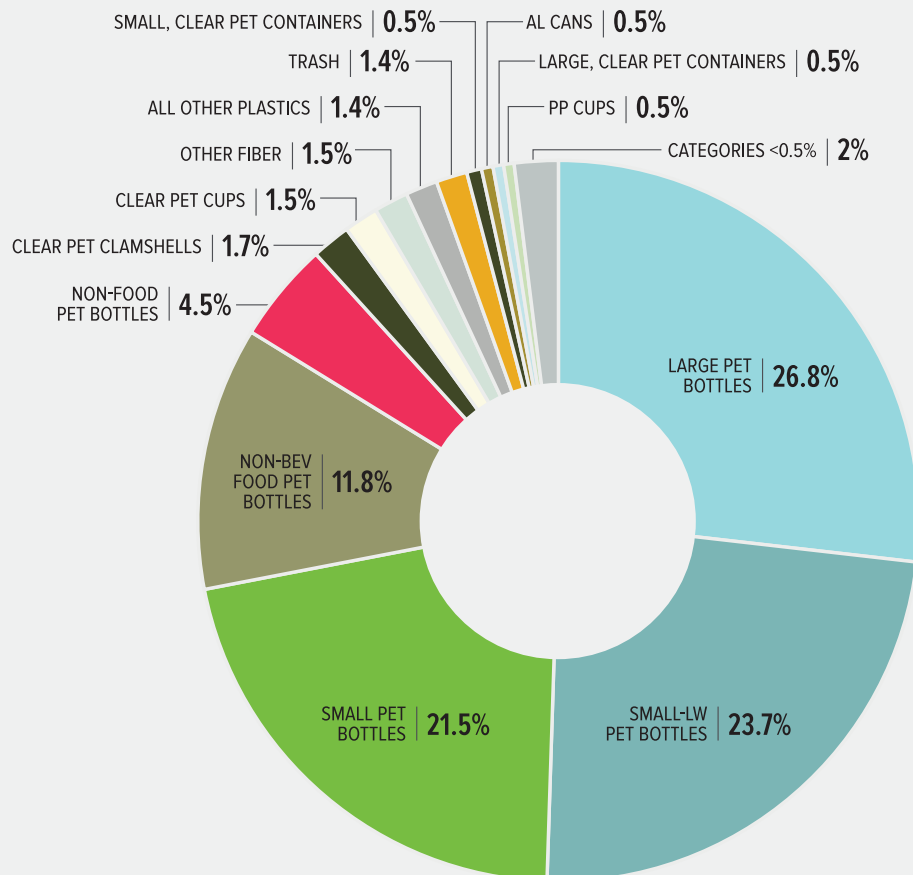
Two types of MRFs were included in the study: one dual stream and four single stream. While only one MRF was dual stream, one comparison about the difference between dual and single stream systems can be made.

Dual stream systems, which are declining nationally in favor of single stream systems, require residents to separate paper materials from metal, glass and plastic containers. As will be highlighted in the next section, dual stream systems offer the advantage of reducing loss of plastics and other containers to the paper streams. On the other hand, as the material mix has expanded to new packaging types, it isn't always well understood to by residents in which stream they should be included. For MRFs, it is more difficult to sort these containers from the paper stream than it is from the container stream, making this a real obstacle.

SINGLE STREAM SYSTEMS

While single stream systems allow for easier communication to consumers about how to recycle (and simplify collection systems), the difficulty in separating the materials is passed

FIGURE 2
*EXAMPLE PRODUCT STREAM CHARACTERIZATION:
PET, AVERAGED ACROSS ALL 5 MRFs*



onto the MRF. One of the key observations in this study is that there are wide variations in how effective single stream facilities are in separating paper from the containers. To accomplish this separation, single stream facilities use a series of disc screens and other equipment that all utilize the difference in shape between paper and containers. Flat materials (generally 2-dimensional) will travel to the top of the screen and to one series of conveyors, while bottles and other containers (generally 3-dimensional) will either fall through the screens or tumble to the bottom to a different series of conveyors.

There are numerous factors that affect the ability of single stream equipment to accurately separate the 2D and 3D materials. They include equipment design factors (such as screen design and angle), operation issues (such as overloading the screens, cleaning the screens, and wet material), maintenance issues (such as wear to discs) and collection issues (such as excessive compaction of the material by residents or collection vehicles). Further, the packaging design itself can also affect the flow of individual materials. All of these variables cannot be evaluated in one study, but general conclusions are possible.

BEST PRACTICES FOR ACCURATE 2D/3D SEPARATION IN SINGLE STREAM MRFs:

- Avoid loading screens past their design throughput
- Clean screens of material that are wrapped around the shafts
- Replace worn and damaged discs
- Minimize compaction of material by residents and collection trucks
- Keep material dry

SCREENS

In this study, plastics separation by screens was examined in depth and the analysis can act as a surrogate for other container material types, such as aluminum and steel. The amount of plastics (including bottles, containers, clamshells and cups) lost to the paper stream varied from 3% to 12%. The two MRFs that experienced a 12% loss of plastics to the paper

stream were both medium sized single stream facilities (25-30 rated tons per hour (tph)) that had fewer screens than the larger two (35 tph). After seeing the screening effectiveness data from this study, both replaced worn discs in their disc screens and reported a significant improvement in the 2D/3D separation. The facility that experienced a 3% loss of plastic to the paper stream was a large MRF with an adequate number of screens for the incoming volume and material type (note: this facility was the top performer across the entire study). Interestingly, the facility with 8% loss was similar to the 3% facility, but it had two distinct operational issues that were not normal for their facilities: material was wetter than normal due to heavy snow storms, and space constraints on the tip floor caused by equipment failures resulted in handling of the material significantly more than normal (including driving over it with a loader). These results suggest that a well maintained facility with an adequate number of screens for the incoming volume and material mix, operating under normal conditions can achieve very low losses of containers to paper products.

Note: Both large single stream MRFs, which had better success than the medium single stream MRFs at separating the plastic containers from the paper, were equipped with 4 sets of disc screens: an OCC screen for separating cardboard or “old corrugated containers”; 2 ONP screens for separating “old newspapers” and a polishing screen for cleaning up the mixed paper stream. The two medium MRFs had 1 less paper screen each. Depending on the facility, this study indicates that the extra screens can help improve the accuracy of the 2D/3D separation in single stream MRFs.

FORM

The form of a package had a strong influence on the loss of packaging to the paper streams. As can be seen in Table 1, the plastic clamshells had a much higher likelihood of flattening and moving with the paper streams. The rounder materials (including bottles, cups and containers) all had much lower loss rates, and less than 5% was lost at the top performing MRFs, Small, lightweight water bottles were more likely than other bottles to move with the paper with a loss rate of 15%. The cups, containers and clamshells still enter the MRFs in much lower quantities than bottles. They made up 11% of the plastics stream, even with the seeded materials. Aseptic and gable-top cartons had a higher average loss rate to the paper

streams, although it is interesting to note it was the only packaging type to have one facility with no loss to the paper stream. In all five MRFs, they marketed a Grade 52 for cartons and pulled them from the container line.

OPTICAL SORTERS

Another piece of equipment in MRFs that can help improve separation of materials are optical sorters. Optical sorters can recognize materials based on what they are made of along with their size and shape. All four single stream facilities had at least one optical sorter, and the two large facilities had 3–4. Optical sorter efficiency was difficult to determine from this study because for each optically sorted commodity there were one or more manual sorters for quality control, both on the material that was positively sorted and what was missed. Therefore a manual sorter could remove a PET cup that was positively sorted by the optical sorter into the PET bale or another could mistakenly sort a PP cup that resembled one from PET into the PET bale. However, there were two interesting cases that are worth noting with the optical sorters.

Many of the materials that were tested as part of this study are light weight, meaning a sorter (either human or optical) needs to handle more pieces in order to sort a ton. At the only single stream facility without an optical sorter for the cartons, the manual sorter who normally sorts cartons was asked to positively sort any paper beverage cups and ice cream containers. With the volume of cups and ice cream containers, the sorter was overwhelmed and the manager chose to add a second sorter to that station. This implies that as more lightweight materials are added to the MRF, either more manual sorters will need to be added or optical sorters may be able to help increase the sorting throughput.

Even for a trained manual sorter, recognizing the resin type for each item as it goes by on a conveyor is very difficult. The PP and PET cups that were seeded for the test were both clear plastic and very similar in style. Averaged across all five facilities, approximately 20% of the PP cups were found in the PET bales. This is likely due to manual sorters positively sorting them to the PET stream because they so closely resembled PET cups. As more diverse packaging, including different sizes, shapes, colors, materials and purposes, continues to enter the MRF, improvements in technology and training to keep bale quality high will likely be necessary.

Similarly at one MRF, the optical sorter was set to sort all HDPE and PP and manual sorters then sorted that stream into nHDPE, cHDPE and a HDPE/PP Tubs and Lids grade. The cHDPE bale at that MRF had a much higher percentage of PP (8%) than the other MRFs (less than 2%). This further emphasizes the sorting challenges facing MRFs.

MATERIAL PREVALENCE

MRFs have been designed to separate bottles and cans from magazines and newspaper. During this study, extensive data was collected on the behavior of specific packaging types in the MRF environment. It shows that MRFs are doing quite well with these prevalent materials, although even these materials are not being correctly sorted at 100%. At best, the study showed a recovery of 93% of an individual package type, with much of the loss to other products and not to residue alone. Similarly for small (<1L), regular weight

TABLE 1
LOSS RATE OF PACKAGING MATERIALS TO THE PAPER STREAMS

FORM	AVERAGE LOSS RATE TO PAPER STREAM	LOSS RATE AT BEST PERFORMING SINGLE STREAM MRF
Plastic Bottles	5%	2%
Plastic Cups	10%	3%
Plastic Containers	12%	2%
Plastic Clamshells	29%	12%
Aseptic and Gable-top Cartons	18%	0%

PET bottles and all size cHDPE bottles, results are shown in Figure 3. Compare those figures to results for small (<10") PET non-bottle containers and cHDPE non-bottle containers as shown in Figure 4. Note that for all results, the data from each of the five MRFs was averaged to form a composite of the behavior across all facilities. According to RRS's database, approximately 50% of the material nationally is processed through the largest 20% of MRFs. Therefore, the larger MRFs were weighted more heavily than the smaller facilities when combining the data.

Why do bottles flow more consistently to the proper bale than tubs and other non-bottle containers? There are many likely reasons for these results. The first, and likely most important, is relative amount of material. During the tests, there were greater than 20 times more regular weight PET bottles than small PET containers (by weight). Including all types of PET bottles and both large and small containers, there were greater than 30 times more bottles (by weight). Although not as pronounced, there were still 8 times as many colored HDPE bottles as containers and tubs. Package types that are more prevalent in the stream are more likely to be targeted by manual sorters if they are missed or misdirected by the optical sorters or disc screens, thereby increasing their recovery. In addition, the equipment is tuned to increase the recovery of the

FIGURE 3
DESTINATION OF SMALL, REGULAR WEIGHT (< 1L) PET BEVERAGE BOTTLES (TOP) AND ALL CHDPE BOTTLES

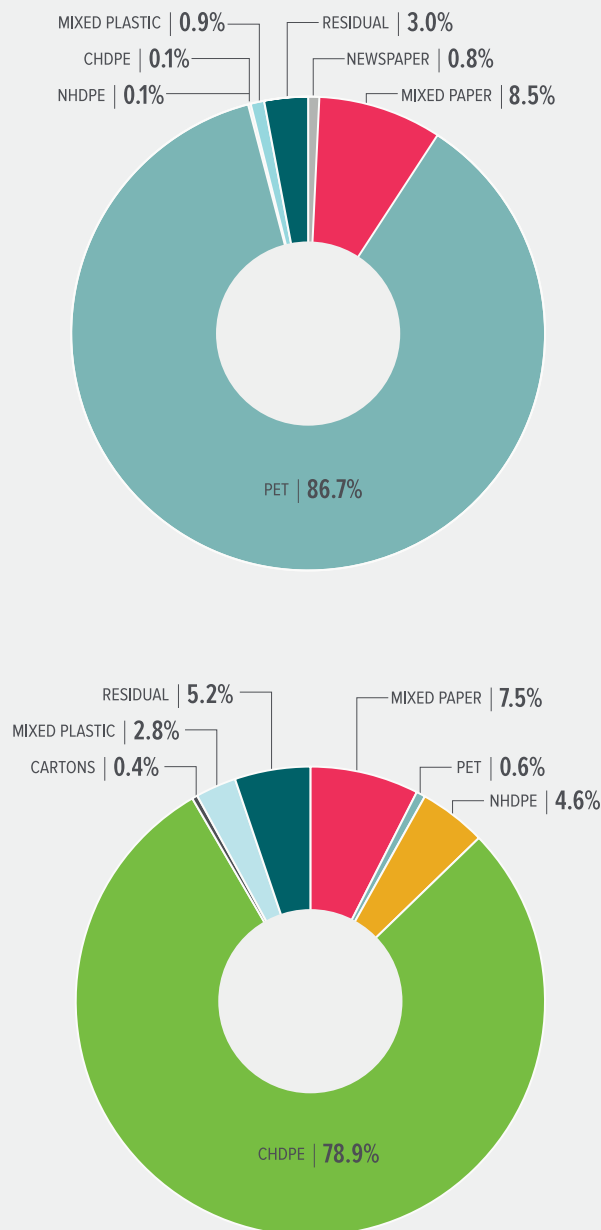


FIGURE 4
DESTINATION OF SMALL PET CONTAINERS (TOP) AND CHDPE CONTAINERS (ALL NON-BOTTLE CONTAINERS & TUBS, < 10" DIAMETER)

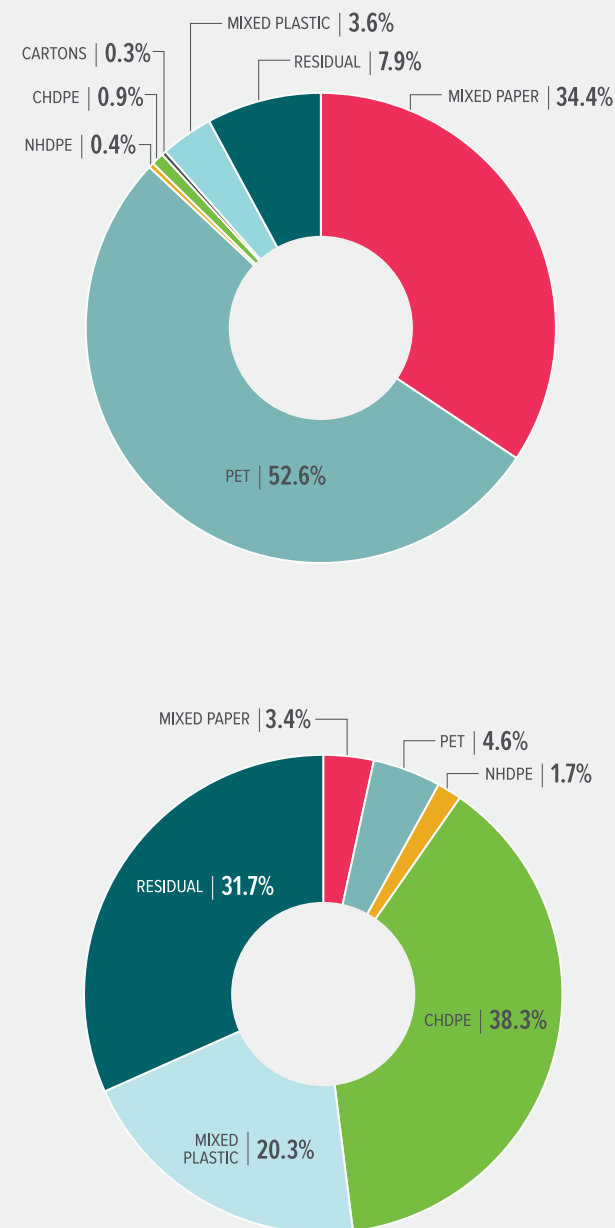
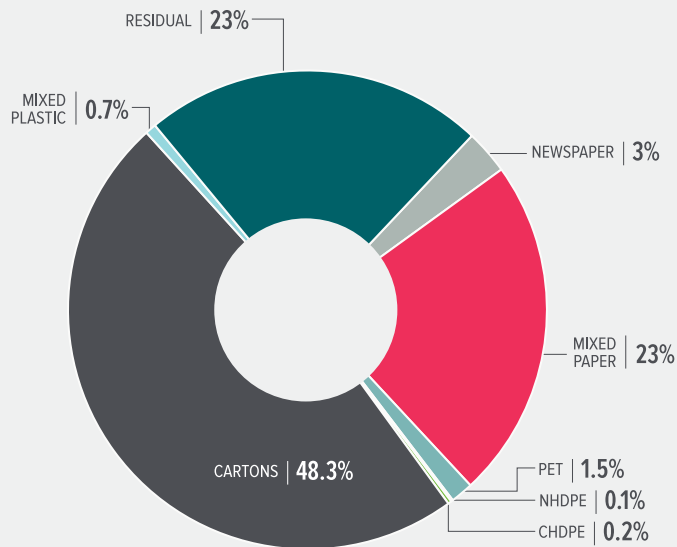
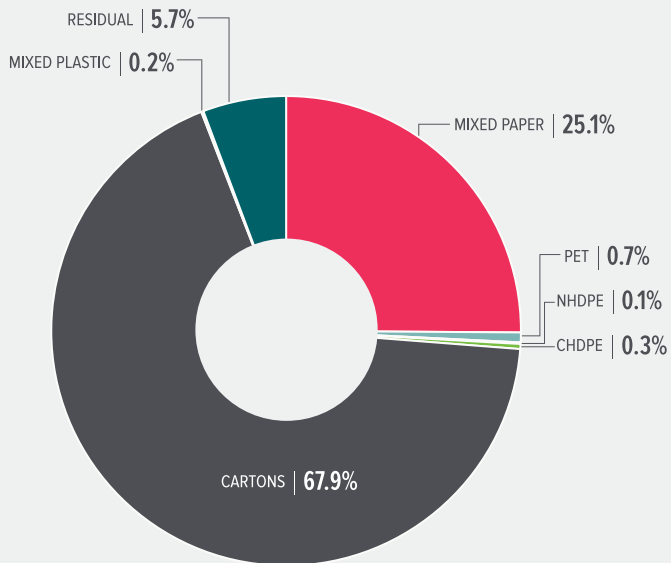


FIGURE 5
DESTINATION OF CARTONS
(TOP) AND PAPER BEVERAGE CUPS



most common materials and may not perform as consistently on less common package types.

Secondly, to target the PET and cHDPE non-bottle containers would take two different strategies. The majority of the PET containers not in the PET bale are lost to the paper stream. However, very little of the cHDPE containers were in the paper stream, but most of the loss was to the residue stream, likely because they were not captured from the container line either by the optical or manual sorters. Finally, the size and shape of the containers can be quite varied in comparison to the bottles, with many containers being flatter and having open tops, which reduces the ability to hold the shape during handling and sorting. This will continue to cause less consistency on the disc screens and other equipment.

ADDING NEW MATERIALS

The study also specifically assessed the MRF “sortability” of some packaging materials that are not currently accepted extensively by recycling programs nationwide but are in fact growing in many communities, including: paper beverage cups, ice cream containers and polystyrene foam cups and clamshells. Figure 5 compares the behavior of aseptic and gable-top cartons to paper beverage cups.

As one example, the paper beverage cups had a strong tendency to flow to the container line (similar to cartons and plastic cups). A higher percentage were lost to residue which, based on review of the test setup and sorter training, was most likely from the container line. This could be due to manual sorters being less familiar seeing them or being overwhelmed when the optical sorter didn’t catch them. Further study could be done to better understand the effectiveness of optical sorters on different types of cups and if programming could be improved to recognize them.

CONCLUSIONS

This study demonstrates the power of examining a material’s inherent behavior in a MRF environment. Understanding how that material will flow allows for informed, operational actions to maximize recovery of that material. It is a useful exercise, as was done here, to look at not only new materials (that aren’t currently accepted) to see which MRF end-products they can be a part of, but also to see how currently accepted materials, both prevalent and not, are being recovered. Recycling is a complicated system of consumer behavior, collection programs, sorting at MRFs and end markets. All stages of the value chain need to be similarly examined to create a full picture of recyclability. As shown in this study, examining and solving material processing challenges at the modern MRF is a necessary step in achieving success for the recycling industry of the future.



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Background

The composition of bales of recycled materials is constantly evolving as the mix of packaging in the market changes. It is particularly important to understand how our products are captured and recovered through the residential stream and their prevalence in bales marketed by material recovery facilities. To build on knowledge gained during prior studies, between November 2020 and February 2021, FPI participated in an audit of #3-#7 bales to obtain a current snapshot of bale composition.

The RRS-led audit was conducted at Michigan State University's Recycling Center. During the audit, RRS sorted by resin and format. To better enable comparison with previous studies, the methodology was reviewed by the Association of Plastic Recyclers (APR) and other project funders and efforts were made to align with the bale audit methodology utilized by Stina, Inc. (formerly More Recycling) to facilitate comparison with past studies. This paper summarizes findings related to PP, PS and PET cups in mixed plastics bales.

The Study

FPI's goal in participating in the study was to get a better understanding of the prevalence of plastic cups in the mixed plastics bales, as well as breakdown by plastic resin type of the cups in the bales. Note that the study focused on cups rather than other foodservice containers, since other container types are used in multiple applications and distinguishing between foodservice and non-foodservice applications (such as pre-packaged food) is not feasible in the context of a bale sort.

The bale sort included a total of nine #3-#7 (pre-picked) bales from nine North American material recovery facilities located in the Northeast, Southeast, Midwest and Western regions of the US. The sampled bales were further classified into two bale types:

- Pre-picked Rigids Plastics: With Bulky (two of the nine bales)
- Pre-Picked Rigids Plastic: No Bulky (seven of the nine bales)

The Results

Resulting data showed that cups made up a small portion of all the bales sorted, with the *Pre-picked Rigids Plastics: No Bulky* bales averaging just over 6 percent of the total bale weight. The *Pre-picked Rigids Plastics: With Bulky* contained a lower proportion of cups.

The cups were further sorted by resin: polystyrene (PS), polypropylene (PP), and polyethylene terephthalate (PET). The majority (over 60%) of plastic cups found in all #3-7 bales were made of PP. The balance of cups in the bales split between PS and PET.

In comparison to the 2015 data, overall cup prevalence in the pre-picked/no bulky (#3-7) bales was unchanged at just over 6 percent.

In the pre-picked/with bulky (#3-#7) bales, the proportions of cup resins had shifted considerably, with PP the dominant cup resin in the bale rather than PS per the 2015 results. However, due to the small number of pre-

picked/with bulky (#3-#7) bales sorted, it is unclear whether this is representative of a broader trend in that bale type.

This bale sort study shows that plastic cups are still successfully reaching plastic reclaimers, where they can be recycled into new products. By including cups and other non-bottle plastic containers in residential recycling programs, communities can provide a pathway for these cups and containers to be recycled.

Complete results from the Mixed Plastics Bale Sort Study are available to PRG members. More information on recycling of foodservice packaging may be found at www.recyclefsp.org.



PET THERMOFORM RECYCLING COST & MATERIAL FLOW ANALYSIS

December 2, 2020



PROJECT SCOPE

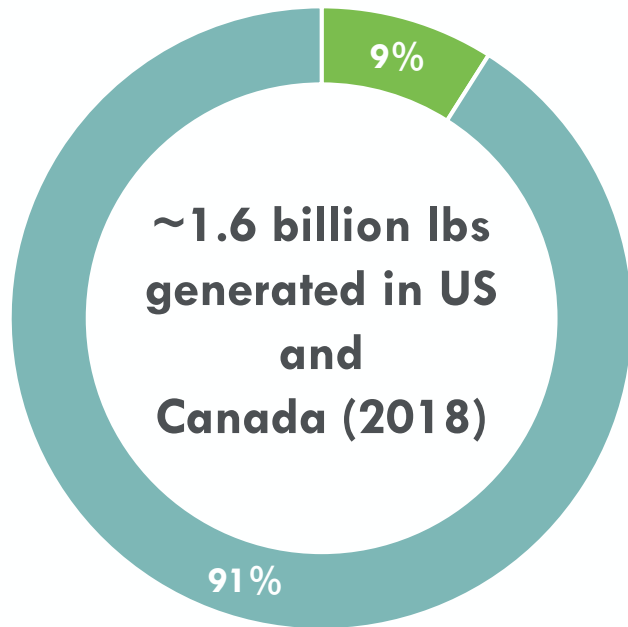
- This multi-partner project set out to:
 - Estimate the total generation and current recovery of PET thermoforms
 - Understand the current PET thermoform sorting and reclamation landscape
 - Determine potential future pathways for PET thermoform recycling
 - Highlight the potential opportunities and challenges associated with each pathway

PROJECT PARTNERS



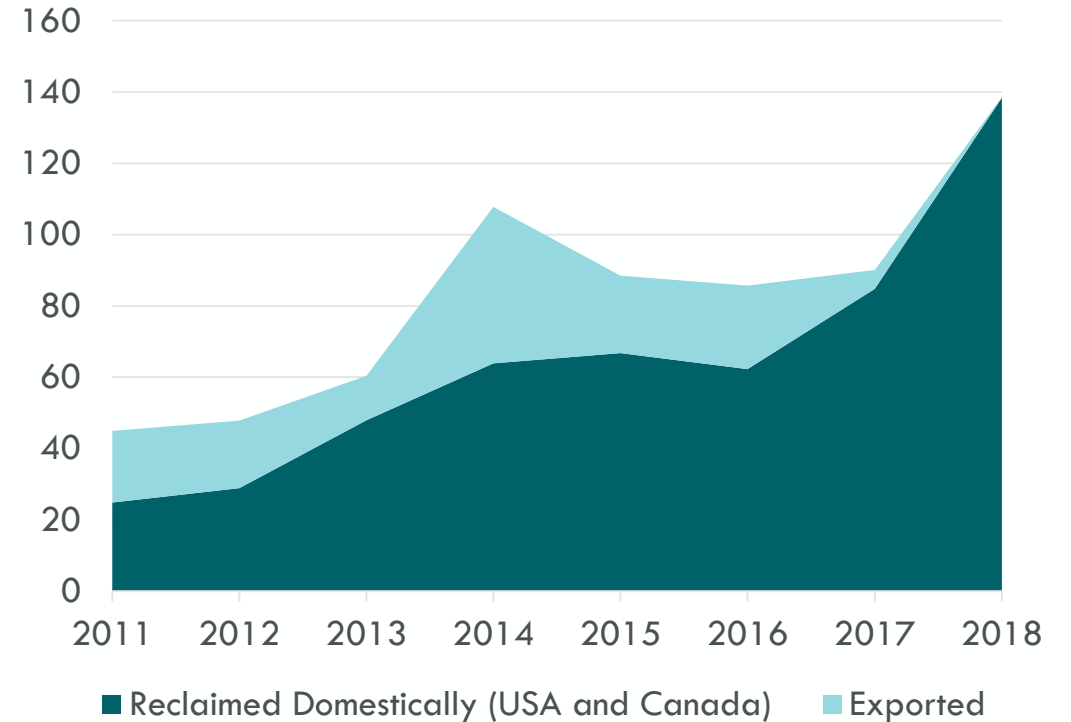
PET THERMOFORM RECOVERY* TRENDS IN THE US AND CANADA

Estimated PET Thermoform Generation and Recovery in the US and Canada in 2018



■ Recovered ■ Unrecovered

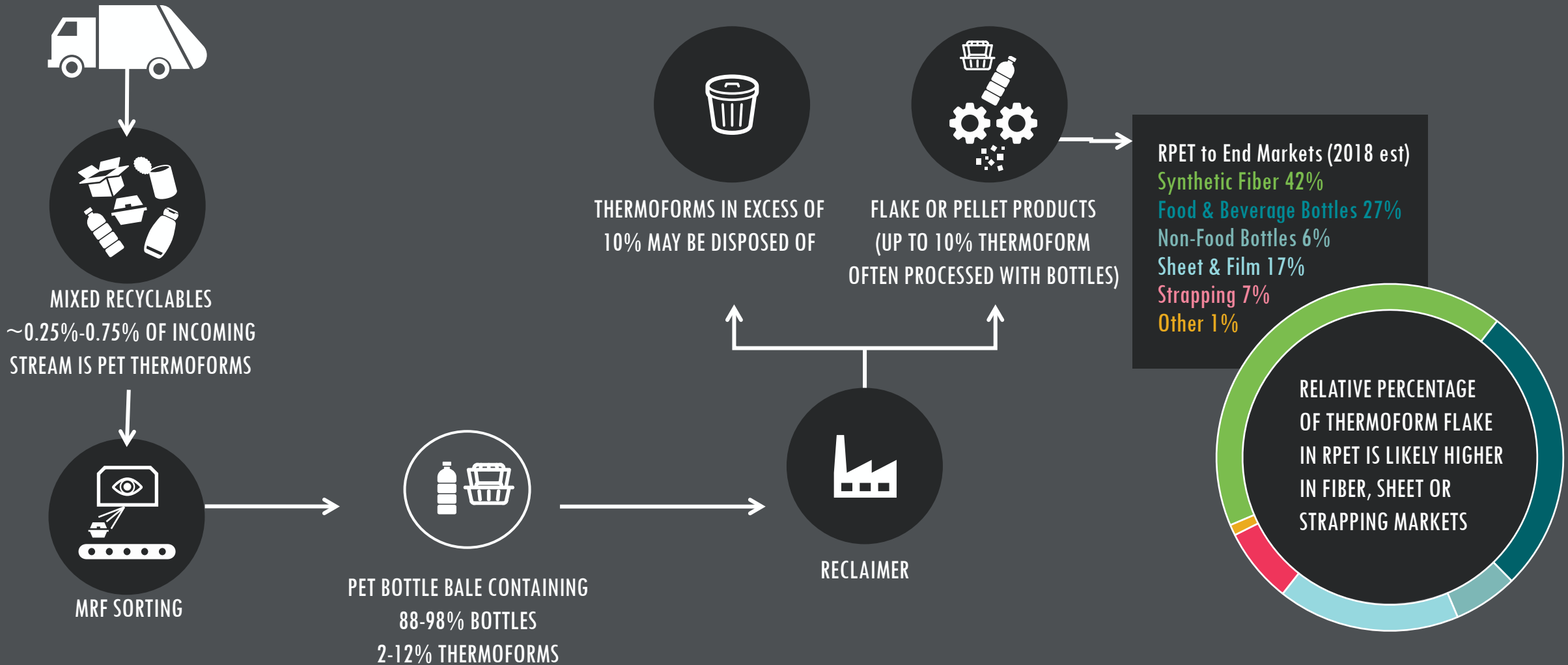
PET Thermoform Recovery in the US and Canada (MM Lbs)



Source: NAPCOR

*PET thermoform recovery, as reported by NAPCOR, represents the amount collected for recycling and sold to reclaimers.

TYPICAL THERMOFORM FLOW / EXISTING SYSTEM





MRF SURVEY FINDINGS

Many MRF respondents are open to sorting a separate PET thermoform stream (segregated from PET bottles), particularly if some or all of the following conditions are met:

- Consistent, stable markets
- Sufficient price
- Reasonable throughput volumes
- Adequate space to convey/bunker

Most respondents report that grants would be helpful to address infrastructure needs—sortation, robotics, conveyers, etc.—assuming consistent, reliable end markets

RECLAIMER SURVEY FINDINGS

- PET reclaimers seek to utilize all PET purchased (including thermoforms), but are typically operationally constrained to no more than ~10% of bale to meet rPET specs
- PET reclaimers' core business is PET bottle processing to established end markets; they consider it outside their core business to accommodate higher thermoform volumes in bottle stream, or to separate them out to re-market or process separately
- Mixed plastic processors derive value from reclamation of olefins, not from PET thermoforms, but may be open to it with sufficient value and stable end markets (for thermoform flake or for bale resale)



POTENTIAL PET THERMOFORM RECOVERY CHANNELS EVALUATED



MRF



PET RECLAIMERS



PRF



PET THERMOFORM RECYCLING PATHWAY OPTIONS EVALUATED

OPTION 1: Status Quo. The MRF sorts all PET into a mixed PET thermoform/bottle bale. The PET bale is sent to the reclaimer and processed into flake or pellet.

OPTION 2: The MRF sorts all PET into a mixed PET thermoform/bottle bale. The PET bale is sorted at the reclaimer into separate thermoform and bottle streams and thermoforms are separately processed into flake or pellet on-site.

OPTION 3: The MRF sorts all PET into a mixed PET thermoform/bottle bale. The PET bale is sorted at the reclaimer into separate thermoform and bottle streams. The thermoform stream is baled and sent to thermoform-only recycling.

OPTION 4: The MRF sorts and bales PET bottles and PET thermoforms separately. The PET thermoform bales are sent directly to PET thermoform-only recycling markets.

OPTION 5: The MRF sorts PET thermoforms in a mixed plastic bale. The mixed plastics bale is sent to a PRF or mixed plastic recycler. The PRF / mixed plastic recycler sorts and bales a PET thermoform-only stream and sends to reclaimer for further processing or PET thermoform-only recycling markets.

POTENTIAL PET THERMOFORM FLOW IN MRFS



Expand capture of PET thermoforms for recycling, increasing volumes to PET markets



Use optical sort for all PET; manual and/or robotic sort to separate out PET thermoforms, if needed



Produce commodity bales:

1. PET thermoform-only bales for market
2. Mixed PET bottle/ thermoform bale, potentially with higher % of thermoforms, or
3. Mixed Plastic Bale



POTENTIAL MRF ROLES IN PET THERMOFORM RECOVERY

This study evaluated three options for sorting PET thermoforms in MRFs.

1. If PET reclaimers were able to handle greater percentages of thermoforms (higher than 10% or current operational limits), MRFs could operate within the existing flow construct and produce bales of mixed PET bottles and thermoforms, with higher levels of thermoforms than is current practice
2. MRFs with an optically sorted PET stream could manually or robotically sort PET thermoforms from the PET line, and redirect them to a thermoform-only bale
3. MRFs with an optically sorted PET stream could manually or robotically sort PET thermoforms from the PET line, and redirect them to a mixed plastic bale

From a technical perspective, removing thermoforms from the PET stream is a fairly simple change, assuming the market supports the costs, the facility has the space and design to allow for conveyance and storage, and the throughput volumes are adequate for timely shipment of material.

While implementing MRF sorting of PET thermoforms is arguably the most ready-to-implement pathway, achieving scale would require engagement of hundreds of MRFs, rather than tens of reclaimers.

POTENTIAL PET THERMOFORM FLOW IN RECLAIMERS



Broaden bale specs to allow for greater % of thermoforms – communicate back to MRFs and communities to expand access



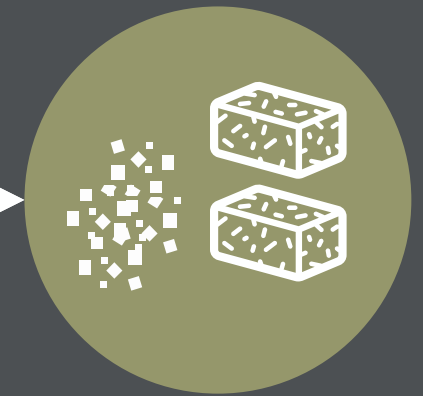
SORT/PROCESS Mixed PET bottle / PET thermoform

Sort & process all PET to rPET end market(s)
(Option 1)



SORT/PROCESS PET thermoform only

Manual/ robotic / optical sort for PET thermoforms. Process or sell PET thermo material (Options 2 & 3)



PRODUCE FOR MARKET

1. Mixed bottle / thermoform rPET flake/pellet,
2. Thermoform rPET flake/pellet, and/or
3. PET thermoform (or mixed PET out-throw) bales



POTENTIAL PET RECLAIMER ROLES IN THERMOFORM RECOVERY

The study evaluated potential reclaimer roles for sorting and / or processing PET thermoforms:

1. PET reclaimers could make process or system changes to allow them to process higher proportions of PET thermoforms in bottle / thermoform mixed feedstock
2. PET reclaimers could sort thermoforms out of the incoming material stream and run them separately from bottles, to produce thermoform rPET flake
3. PET reclaimers could sort thermoforms out of the incoming material stream and rebale / resell them to a thermoform-only market
4. PET thermoform-only recyclers (mechanical reclaimers and/or chemical recyclers) could process thermoform bales produced by MRFs, PRFs or PET bottle reclaimers (that sort and market thermoforms)

Working with PET reclaimers has the advantage of involving fewer points of intervention and most options have low marginal cost (reflecting sorting, handling and transportation only). However, it is potentially more technically and commercially challenging, with no appetite expressed by the PET bottle reclaimers surveyed.

POTENTIAL PET THERMOFORM FLOW IN PRFS / MIXED PLASTIC RECLAIMERS



Purchase mixed plastic bales from MRFs with higher rate of thermoforms



SORT

Manual / robotic / optical sort for PET thermoforms



PRODUCE FOR MARKET

PET thermoform bale



POTENTIAL PRF / MIXED PLASTICS RECLAIMER ROLES IN PET THERMOFORM RECOVERY

The study evaluated the option of having plastics recycling facilities (PRFs) or mixed plastic reclaimers accept PET thermoforms in mixed plastic bales and sort those thermoforms out for resale to a PET thermoform-only market.

This pathway would face the following challenges:

1. PRFs have not proven to be a viable stand-alone business model;
2. Mixed plastics reclaimers typically harvest PP and PE from mixed plastic bales and do not often remarket other materials present in the bales.

Like the PET reclaimer pathway, this approach would require fewer interventions to achieve a scaled impact. However, ongoing marginal costs would likely be higher.



COST ANALYSIS APPROACH

- The project sought to identify the marginal costs of each pathway and option analyzed
 - Includes additional costs to sort, bale and transport a material stream, such as PET thermoforms
 - Reflects ongoing costs that would need to be supported by the marketplace, either through processing fees or end market values
 - Compares the costs for each option to the current (baseline) pathway where PET thermoforms flow with bottles in the MRF to the PET reclaimer
 - Does not include the cost of capital, equipment, overhead, or other fixed or operational costs of MRFs and / or reclaimers

NOTE: marginal costs are not the only factor to determining the most feasible approach. Technical and logistical constraints were also evaluated.



PET THERMOFORM RECYCLING PATHWAY OPTIONS EVALUATED

OPTION 1: Status Quo. The MRF sorts all PET into a mixed PET thermoform/bottle bale. The PET bale is sent to the reclaimer and processed into flake or pellet.

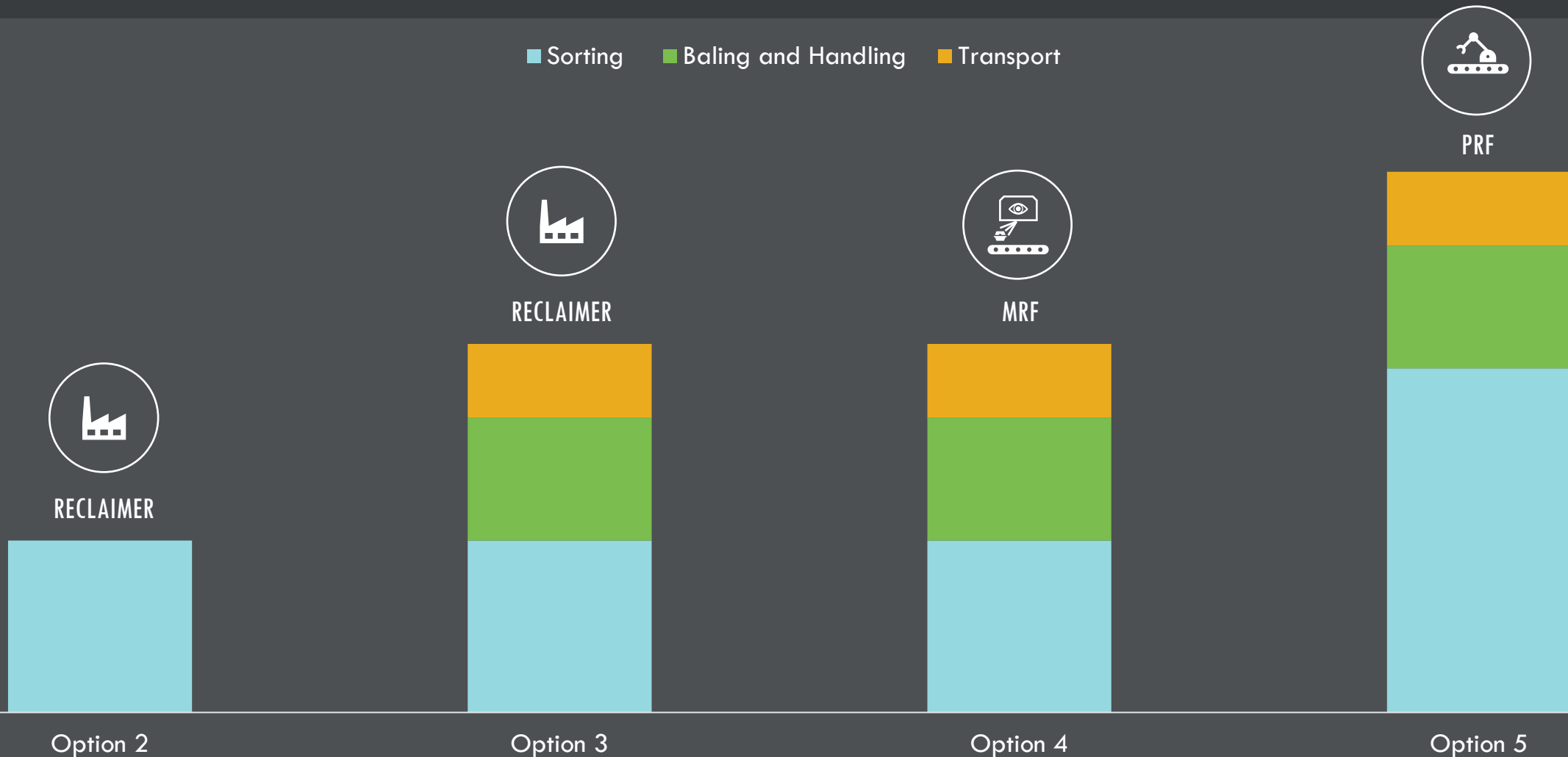
OPTION 2: The MRF sorts all PET into a mixed PET thermoform/bottle bale. The PET bale is sorted at the reclaimer into separate thermoform and bottle streams and thermoforms are separately processed into flake or pellet on-site.

OPTION 3: The MRF sorts all PET into a mixed PET thermoform/bottle bale. The PET bale is sorted at the reclaimer into separate thermoform and bottle streams. The thermoform stream is baled and sent to thermoform-only recycling.

OPTION 4: The MRF sorts and bales PET bottles and PET thermoforms separately. The PET thermoform bales are sent directly to PET thermoform-only recycling markets.

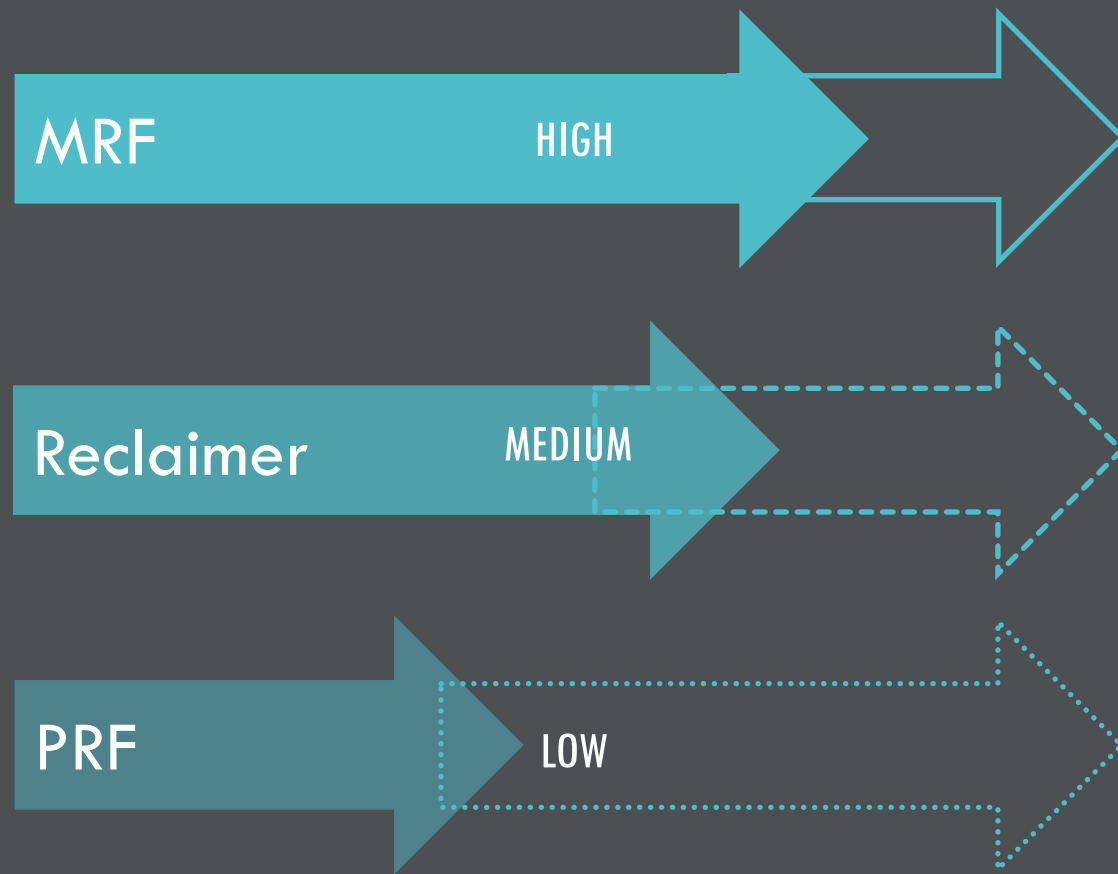
OPTION 5: The MRF sorts PET thermoforms in a mixed plastic bale. The mixed plastics bale is sent to a PRF or mixed plastic recycler. The PRF / mixed plastic recycler sorts and bales a PET thermoform-only stream and sends to reclaimer for further processing or PET thermoform-only recycling markets.

COMPARATIVE MARGINAL SORTING AND HANDLING COSTS FOR SEPARATE THERMOFORM POTENTIAL PATHWAYS



Note: This chart only represents the marginal costs of sorting, baling / handling and transporting a separate material stream, such as PET thermoforms; it does not reflect capital costs, overhead or other fixed or operational costs of MRFs or reclaimers. Option 1 is not shown as it is the status quo.

PET THERMOFORM CHANNEL IMPLEMENTATION READINESS SCALE



FACTORS IMPACTING READINESS

PET already optically sorted in MRFs representing 70% of capacity. Could separate thermoforms with an additional manual sorter; efficiency gains with advanced sorting. Direct gateway to increased access. Survey indicates willingness to consider with stable market and price.

Current pathway for most recovered thermoforms, though not preferred. Technical limitations constrain using more thermoforms. Separate sort and/or wash line needed to process thermoforms separately. Survey suggests low enthusiasm for sorting.

Historically unsuccessful business model with renewed interest. Highest capital investment and marginal system cost. Can leverage interest in other resins. Can expand access broadly within a region with one large targeted investment.

BARRIERS IN THE PET THERMOFORM RECOVERY SUPPLY CHAIN

Barriers:

Limited MRF sorting capacity for segregated PET thermoform or low value (+ colored bottle) stream

MRFs may not be ready to handle volume increase. Concerns include markets, storage, volumes, price.

Barriers:

Inconsistent messages about sortability/desirability of non-bottle PET are a challenge to increasing recycling collection

Barriers:

Technical and market constraints at PET reclaimer facilities

RECLAMATION



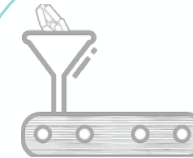
RESIN PRODUCTION



Barriers:

Low virgin resin price creates competitive challenge

DESIGN & CONVERSION



Barriers:

Limited end markets; design challenges (e.g., labels, inks, adhesives, colorants, additives)

CONSUMER



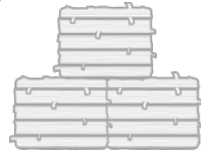
Barriers:

Inconsistent education about non-bottle PET is a challenge to increasing recovery volumes

COLLECTION



SORTATION





PROJECT FINDINGS

- PET thermoform generation is equivalent to natural HDPE bottles, therefore likely sufficient volume to target for increased recovery
- There is potential to increase the recovery of PET thermoforms, but barriers remain
- Key findings:
 - Inconsistent acceptance by PET reclaimer markets limits MRF openness to greater access / education efforts
 - Current acceptance at most reclaimers capped at ~10% of bale weight (combined with bottles) due to process and market constraints
 - Lower reclaimer interest in sorting PET thermoform-only stream compared to MRFs
 - Willingness to sort a new stream is highly dependent on consistent, reliable markets and sufficient market price



PROJECT CONCLUSIONS

- MRF flow has potential to demonstrate near term gains in PET thermoform recovery, assuming end markets or processing fees can support additional costs
- PET reclaimer pathways may have greatest optimization potential, but significant technical and operational questions remain
- PRF / mixed plastic reclaimer pathway has the least clear route to success



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UPDATED POLYETHYLENE TEREPHTHALATE RESIN LIFE CYCLE ANALYSIS AND CALCULATOR

November 5, 2020 (Charlotte, NC) – The National Association for PET Container Resources (NAPCOR) announced today the release of an updated Cradle-To-Resin Life Cycle Analysis (LCA) of Polyethylene Terephthalate Resin. This study, along with the Association of Plastic Recyclers' 2018 analysis of recycled resins (both conducted by Franklin Associates, a division of ERG) provides the data to compare energy requirements, solid waste generation, and environmental emissions for the processes involved in manufacturing virgin PET material and those required to collect, sort, and reprocess postconsumer PET packaging into clean recycled resin.

Using the comparative findings from these recent LCAs, an infographic and calculator tool were created by NAPCOR to illustrate the comparative impacts of virgin PET (VPET) and RPET. A reduction of 60% in greenhouse gas emissions may be achieved by replacing a unit of VPET with RPET. When using RPET in place of VPET, a 75% lower total energy demand may be achieved, and 40% less process and transportation energy is expended.

The NAPCOR infographic provides a high-level summary of environmental benefits resulting from PET recycling in the US and Canada, while the calculator allows the user to generate an environmental report for a user-specified weight of PET and percentage of recycled content.

The most recent LCA reports for both virgin and recycled PET along with the calculator and infographic may be accessed at <https://napcor.com/sustainability/> (<https://napcor.com/sustainability/>).

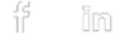
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Cleaning the rPET Stream: How we scale post-consumer recycled PET in the US

A new study by Closed Loop Partners

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- 2 RECENT TRENDS IN RPET CAPACITY IN NORTH AMERICA**
- 3 RPET VS. VIRGIN PRODUCTION PROCESSES**
- 4 WHAT DRIVES COSTS?**
- 5 INTERVENTIONS THAT WORK**
- 6 WHAT'S NEXT**



Less than 30% of the PET used in bottles and jars is recovered in the US, and just 6% is re-used as rPET in new bottles . Yet PET is the most common resin type used in plastic packaging and the most universally accepted plastic in US municipal recycling programs. Recycling infrastructure for post-consumer PET is also the most mature. How can we address the stark under-performance of PET recycling through investment in solutions that provide long-term benefits to the system overall?

Ideally, demand pull from end users would encourage the recovery and reprocessing of post-consumer recycled PET; yet the market is constrained by the ability of suppliers to offer rPET at prices that can compete with virgin PET resin. If we are ever going to be able to grow the rPET market, we need better solutions that drive efficiencies throughout the process, improve the cost structure of producing rPET, and enhance the material's overall value.

We could increase the recycling rate of PET by 6% and close the loop on nearly 80 million pounds of PET bottles each year – *without putting a single new cart on the street.*

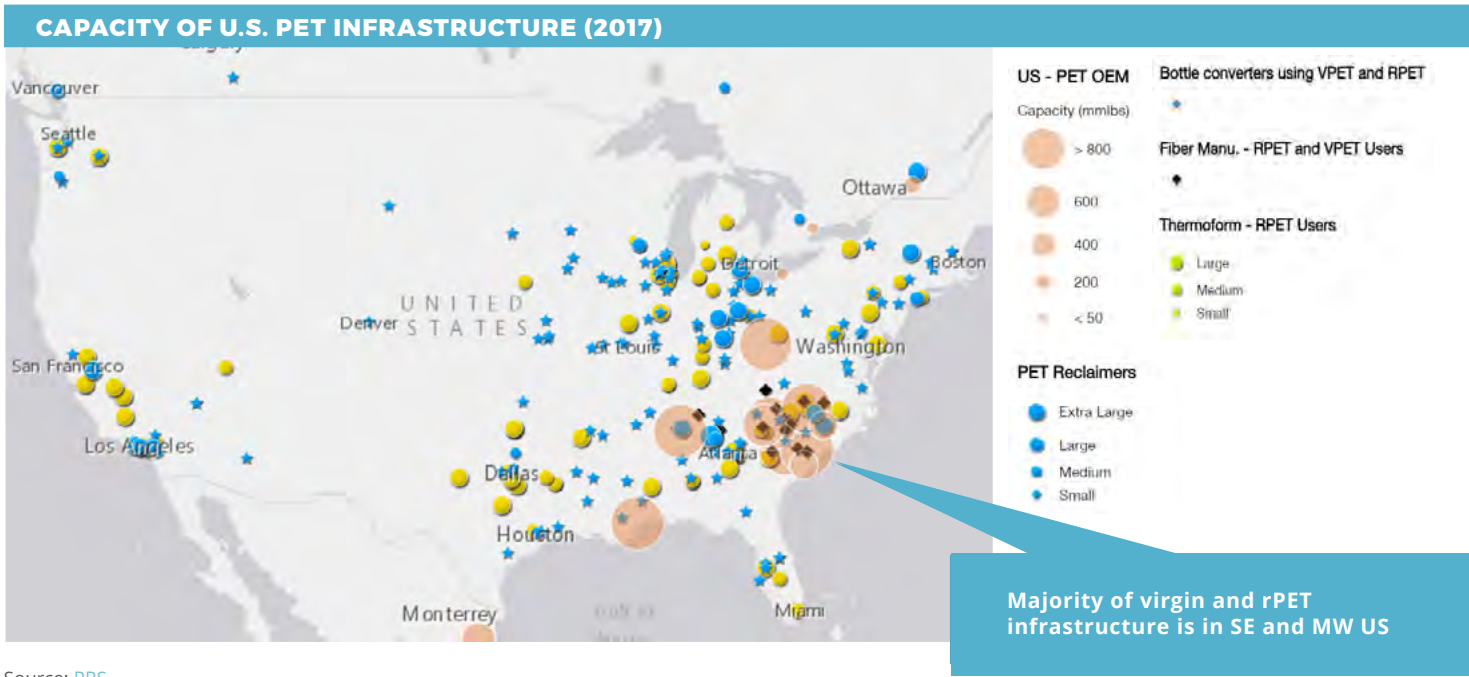
In an analysis conducted by Closed Loop Partners with RRS, we have identified a suite of interventions that would greatly improve the cost structure of rPET and benefit MRFs, reprocessors, and end-users. If implemented nationally, **we could increase the recycling rate of PET by 6% and close the loop on nearly 80 million pounds of PET bottles each year – without putting a single new cart on the street.**

Focusing on bottle-to-bottle processes, we identified several interventions that effectively improve yield from residential curbside collection by more than 20% and lower costs of rPET processing by 10%. By targeting action and investment, MRFs, reclaimers, reprocessors, and end-users could realize value for themselves and across the system.

Recent trends in rPET capacity in North America

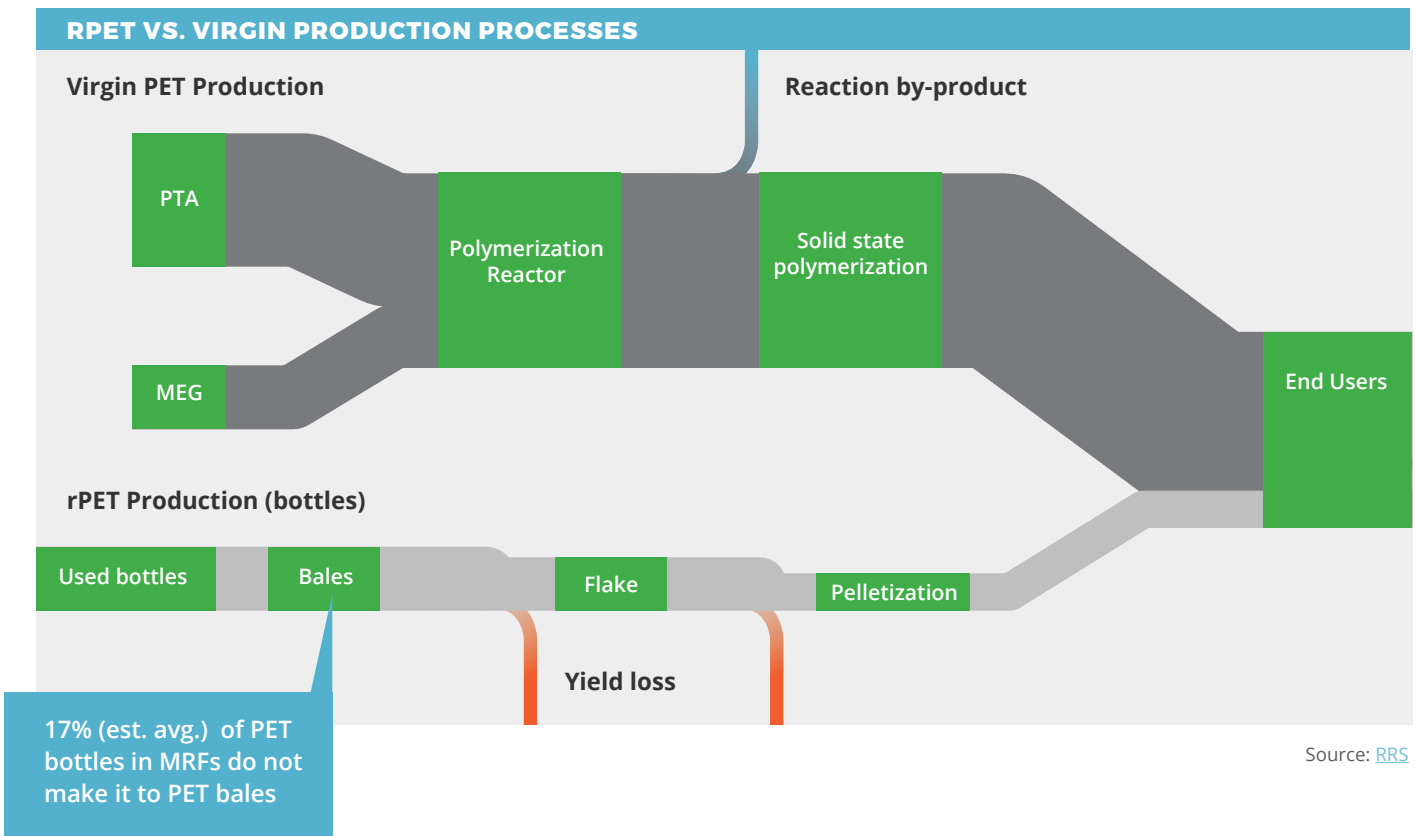
In the past decade, virgin PET consumption has grown, though production has been increasingly consolidated among a few market players (i.e., DAK, Indorama), all privately held companies. The price of rPET closely follows the price of virgin PET, which has seen considerable volatility - as with global oil prices - over the past 10 years. Meanwhile, the national recycling rate for PET has hovered around 30% - largely reflecting an inelastic supply. During this time, capacity for processing post-consumer recycled PET (rPET) has had its ups and downs. The industry recently lost 400 mm lbs of capacity with the closure of some facilities. Capacity is expected to return to roughly 2 billion lbs/year by 2018, with at least 350 million lbs. of new PET processing capacity coming online in the next few years.

Existing facilities that reprocess rPET are operating at ~ 75% capacity. For bottles and containers, end-users can increase the amount of rPET they use, if that material is price-competitive with virgin, and at the appropriate quality specifications. In 2016, just 370 million lbs of rPET was reused for food and beverage bottles, although 1,753 million lbs of PET was recovered for recycling.



rPET vs. Virgin Production Processes

Virgin material is produced at scale by combining raw material inputs (PTA, MEG) in a polymerization process. In contrast, post-consumer recycled PET must travel from consumer to MRF to reclaimer/ reprocessor to end user – at each stage there is potential for yield loss and inefficiency. Two very different processes result in very different cost structures. At the time of the study, the estimated average cost to produce virgin PET was \$0.52-0.56 per pound, while the cost to process and produce rPET was estimated at \$0.60-0.65 per pound. It is no wonder that end users have chosen virgin PET. **If rPET is ever going to be competitive with virgin at scale, we have to find ways to make improvements across the system.**



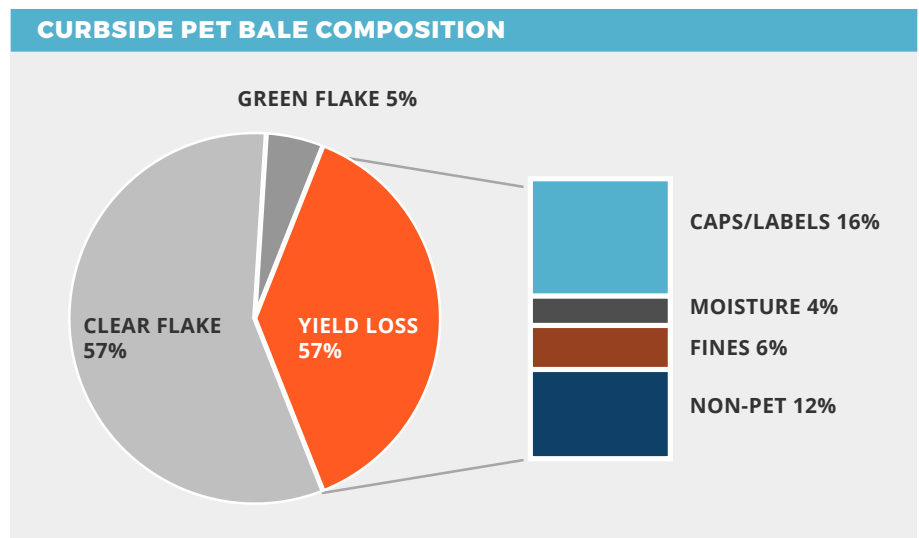
If rPET is ever going to be competitive with virgin at scale, we have to find ways to make improvements across the system.

QUANTITY (VOLUME)

Consumer access to, and participation in, convenient recycling determines supply of PET. Supply is not influenced by price or demand; rather, supply is a function of municipal and state policies that determine material recovery, and consumer behavior. Collections infrastructure and policies influence how much material is available for reprocessing.

QUALITY AND YIELD OF PET BALES

In non-Bottle Bill states where PET is generally recovered through curbside collection, PET bales out of MRFs have sold for, on average, ~ \$0.17 per pound, national average (picked up). Bottle Bill bales typically command a premium of \$.05 to \$.15 per pound over curbside. **The estimated average yield of PET in a curbside bale is 62%; there is potential to recover more PET than is collected today.** Furthermore, it is estimated that another 17% of PET that travels through a MRF is not captured in the PET bale. For the reclaimer, the adjusted yield price is \$0.31 per pound – a difference of at least \$0.07 per pound (not including transportation). Contributors to yield loss include caps and labels, non-PET material, fines and moisture, as illustrated.



Source: [RRS](#)

CLEANING AND SORTING

Mechanical processing of the PET bale, and the subsequent conversion to flake, drives costs by an estimated average of \$0.19 per pound. The many contamination / yield issues are partly a result of MRF inefficiencies in sorting, but also partly result from design decisions made by brand owners that are counter-productive to the recycling process.

CONVERSION OF FLAKE TO PELLET

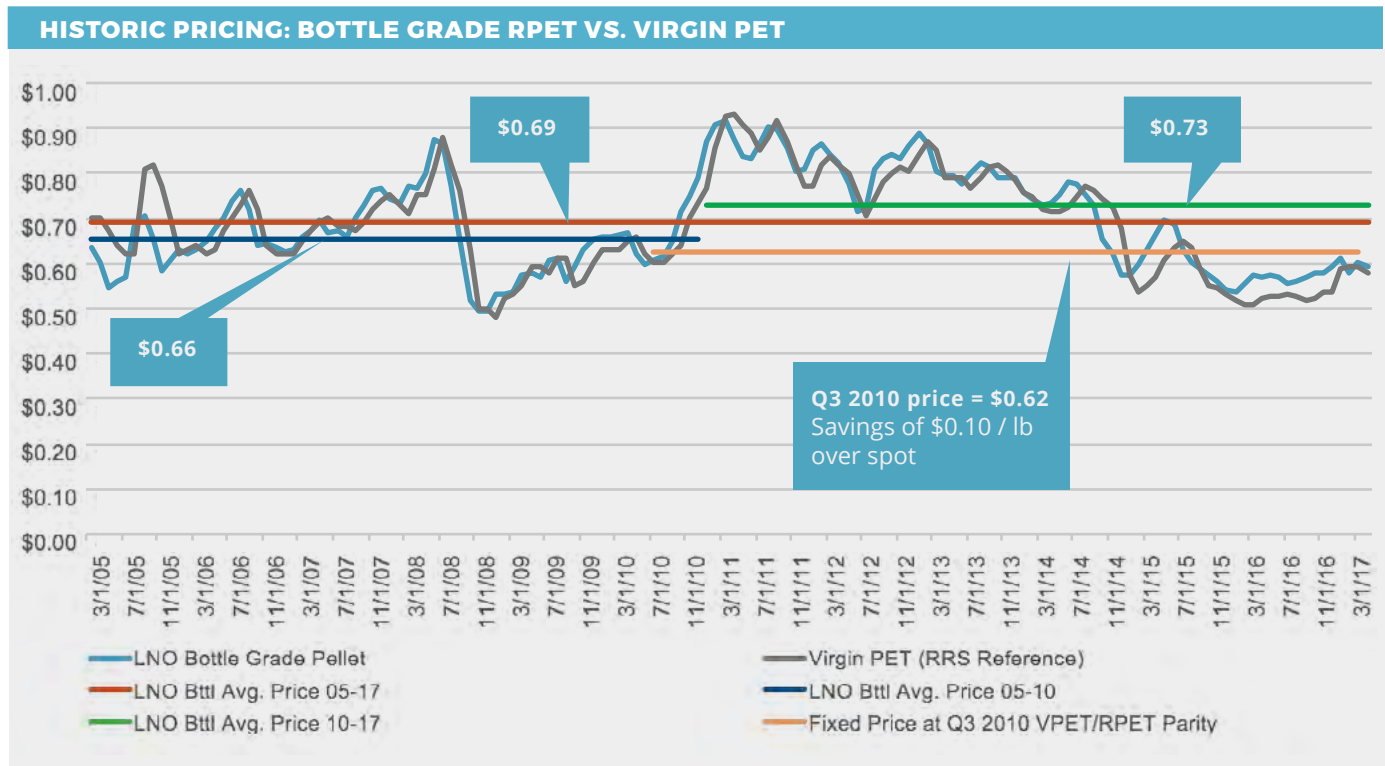
The estimated average cost of this process is \$0.10 per pound.

INCONSISTENCY OF SUPPLY

In addition to inelastic (i.e., not effected by pricing) volume of material collected, the quality of rPET can vary with little warning. The variability can make it difficult for end users to maintain a consistent quality specification without adapting the process or blend of materials being used.

VOLATILITY OF COMMODITY PRICES

RPET is typically purchased on the spot market. Price volatility prevents suppliers from being able to invest in capital expense to keep up with the latest technology or expand capacity. Were long-term contracts more common in the industry, buyers and suppliers would have benefitted from pricing at roughly \$0.62-0.73 per pound over certain periods, based on historic pricing data.



(1) Price of VPET increased in Q3; Source: [RRS](#)



What interventions would have the greatest impact on the cost structure of producing rPET? We looked at a wide range of investments, policies, and actions across the system, with an eye toward impacting a bottle-to-bottle process.

We prioritized interventions based on the following criteria:

1. Impact on the system
2. Feasibility to implement
3. History of commercialization/proof of concept
4. Level of investment required
5. Impact on cost reduction/value enhancement.

Although we did not focus on the effect of improving collections infrastructure on increasing supply, this study showed the impact of interventions led by MRFs, reclaimers, reprocessors, producers and end-users. Key interventions are summarized on the following page.

Interventions that work

INTERVENTION	IMPACT ON rPET SYSTEM	CAPITAL EXPENDITURE (Type of Capital)	PROOF OF CONCEPT	TIMELINE
MRF sorting and quality control , incl. installing optical sorters and robotics equipment, and implementing best management practices	10+% capture rate increase at MRF; 5% yield increase at reprocessor; 10% savings from lower operating & disposal costs	\$0.5MM, avg. per MRF (Equipment loan)	Widely deployed	1-5 years
Flake to Resin , i.e., installing equipment that would bypass the pellet stage, going from flake directly to blend with virgin resin.	15% cost savings vs. PCR pellet; 10% flake content to reactor would increase rPET to bottle markets from ~23% to 30%; better quality product (less discoloration)	\$2-3MM per 25MM lbs. (Equipment loan)	In production at both DAK & Indorama	1-5 years
Flake to Preform , i.e., installing equipment that can bypass the pellet stage, going from flake directly to preform.	15% cost savings vs. PCR pellet; allows high % of food grade recycled flake (up to 100%); better quality product (less discoloration)	\$1.3MM per 80 mm lbs. (Equipment loan)	8 locations worldwide; 1 in development in CA	1-3 years
Brand Commitment to APR Design Guidelines , implemented by end users/brand owners	5% yield increase at reprocessor	NA	Already in the market	1-3 years
Brand Procurement Strategies , incl. pricing to minimize volatility and long-term purchase agreements, negotiated between the end-user and reprocessor	Increased stability, access to financing for reprocessor; potential stabilizing effects further upstream	NA (Contract)	Already exists in the market for virgin and other PCR commodities (e.g., paper); less so for rPET	1-3 years
Chemical Depolymerization , i.e., installing / operating a new plant to produce like-virgin PTA and MEG monomers	Minimal cost savings (est.)	NOT MODELED (Incl. venture capital, equipment loans)	Very early; Loop Industries pilot completed and first commercial scale facility in development	2-5 years
Byproduct Market Development , for non-PET materials (e.g., PP, PE) would incentivize MRFs to improve quality of PET bales, and other commodities	Reduces yield loss; improves and diversifies MRF revenues	NOT MODELED (Could include contracts, venture capital, equipment loans)	Recent example: APR Demand Champions initiative	1-5 years

Where APR's Design Guides Can Have the Greatest Impact



DESIGN GUIDE TOPIC

APR GUIDANCE

Metal closures and lidding	Avoid using metal with PET packaging.
Pressure sensitive film labels	Employ labels that meet APR Critical Guidance Test Criteria, including use of conforming substrates, adhesives, and inks.
Shrink sleeve labels	Employ labels that meet APR Critical Guidance Test Criteria, or which have been evaluated within APR's Responsible Innovation Program.
Paper labels	Avoid use of paper labels. If used, conduct lab testing to select paper labels that have negligible impact on color and haze of recycled PET.
Blow molded PETG containers	Avoid using PETG in packaging.

Based on our criteria, we saw the greatest potential in implementing a suite of interventions all together, including those implemented by MRFs, reclaimers/reprocessors, brand owners or end users, and producers. Investments made at each stage in the process can also generate value throughout the system.

FOR MRFS

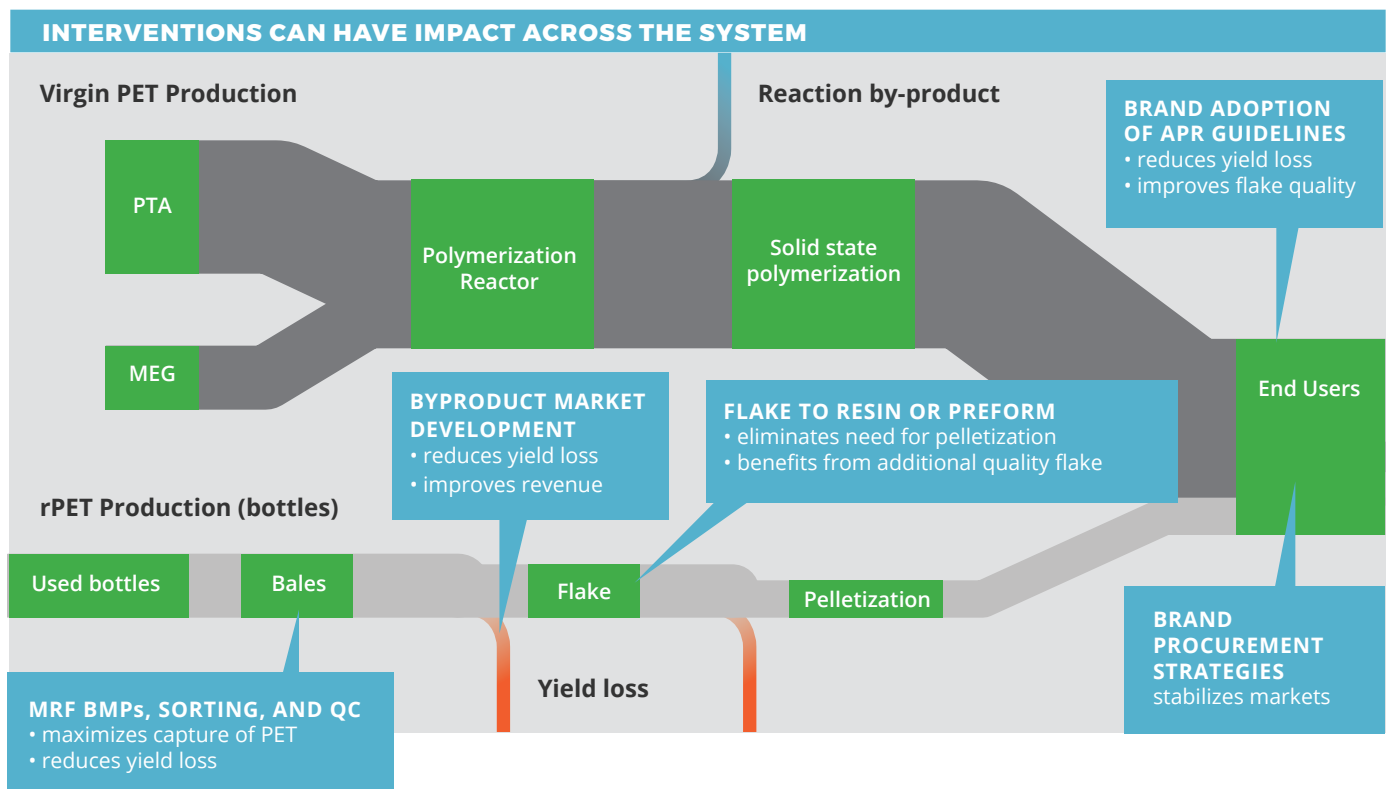
Yield improvement (10+%) and additional capture/yield improvements for other material types; increased cost savings and revenue opportunities

FOR REPROCESSORS

Yield improvement (21+%, incl. yield improvement at MRF); cost savings (10+%); reduced exposure to price volatility and commodity risks

FOR BRAND OWNERS/END-USERS

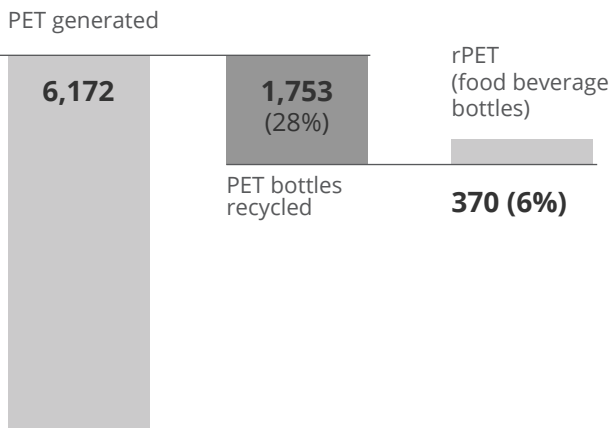
Increased volume of higher quality of RPET at lower cost; greater flexibility in end uses of material; less volatility in price



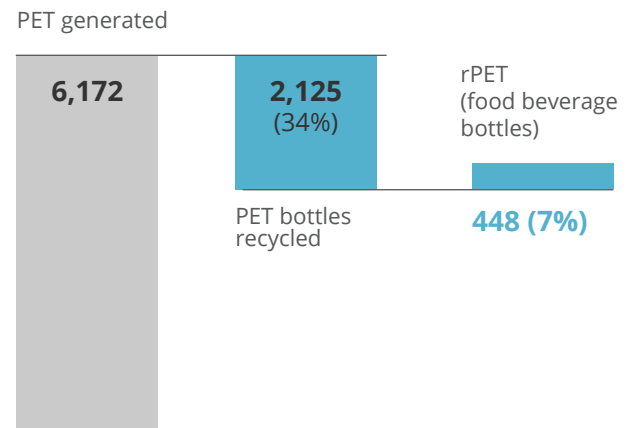


With more than 6 billion pound of PET bottles and containers generated each year, *these interventions have the potential to increase the domestic supply of rPET for bottles and other uses by 6% or more over time.*

BASELINE YIELD FOR CONTAINERS (2016)
million lbs



YIELD WITH INTERVENTIONS
million lbs



ABOUT US

Research and analysis for Cleaning the rPET Stream was provided by RRS, with input from the Association of Plastics Recyclers (APR) and NAPCOR.

Closed Loop Partners invests in sustainable consumer goods, advanced recycling technologies, and the development of the circular economy using a variety of investment approaches. The business was launched in 2014 with the creation of our unique project finance vehicle, Closed Loop Fund, which was later complemented by both philanthropic and growth equity funds on the Closed Loop platform.

Offering below market rate loans to municipalities and private recycling companies in North America, Closed Loop Fund plans to invest \$100 million by 2025 to scale recycling infrastructure and create more circular supply chains for consumer products and packaging, focusing on recyclable commodities in plastics, glass, paper and metal. As of June 2017, the Fund's initial investments have diverted more than 80 million pounds of post-consumer plastics, including PET. The Fund's investors include the world's largest retailer and consumer brands: Walmart Foundation, 3M, Coca-Cola, Colgate-Palmolive, Dr. Pepper Snapple Group, Johnson & Johnson, Keurig Green Mountain, Nestlé Waters North America, Pepsi, Procter & Gamble, and Unilever. For more information, visit closedlooppartners.com.

From an investor's point of view, there are opportunities to strengthen the rPET market through project financing and venture capital, but other supports are needed (e.g., adoption of APR design guidelines, negotiation of long-term contracts) too. We are seeing investors come to the table (e.g., recent investments in new capacity under companies such as rPlanetEarth and Carbonlite), but more capital is needed if we are to close the loop on post-consumer recycled PET bottles and containers. For example, an additional \$125 million in capital investment could support the upgrade of 250 MRFs across the continental US. If this investment were made, the system would see an additional 80 million lbs. of PET per year.

Improving infrastructure for rPET production can benefit PET end uses beyond packaging, as well as other resin types. HDPE, PP are growing PCR materials. The interventions recommended here for PET – in particular at the MRF – would have a “halo” effect on other materials. Post-consumer recycled production of these other resin types should be studied further to understand the cost implications and impact potential in detail.

See below for all source references.

1. NAPCOR, and The Association of Plastics Recyclers. “2005-2015 Reports on Postconsumer PET Container Recycling Activity.” Recycling Rate Reports. N.p., n.d. Web. Apr. 2017.
2. “CPI News Releases.” U.S. Bureau of Labor Statistics. U.S. Bureau of Labor Statistics, n.d. Web. Apr. 2017.
3. NAPET Conference, 2015
4. OESA Conference, 2016
5. The Packaging Conference, 2015
6. Americas Polyester Industry Conference, 2015
7. Confidential interviews with industry experts, 2017
8. All data from RRS, unless otherwise noted.

Contact

All inquiries regarding this report can be directed to Ellen Martin, admin@closedlooppartners.com

March 17, 2022

OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY

Re: Request for Information on Oregon Statewide Recycling Collection List

Dear DEQ Technical Workgroup and Rules Advisory Committee,

Eastman would like to register support for the inclusion of certain foodservice packaging items on the “Uniform Statewide Collection List”. Eastman is in Kingsport, Tennessee, and we are an end market for post-consumer materials sourced from Material Recovery Facilities (MRFs). We currently source PET based articles to produce virgin-like quality polyesters and copolyesters via our molecular recycling technology. Our facility is starting up early 2023 and will have capacity of 100,000 metric tons to produce polyester material. Eastman’s Methanolysis technology has a polyester yield rate of 93% and overall material to material conversion of 87% for our targeted feedstock mix. We are currently in the process of procuring material now for start-up in 2023.

We procure the following MRF grades

- PET Thermoform Bales (including any percentage of colored PET)
- Additionally, we are open to accept any colored/opaque PET bales (bottles or thermoforms)

The following foodservice packaging items are acceptable in these incoming bales:

- **Polyethylene Terephthalate (PET) Cups and Containers**, including drink cups, clamshells, bowls, trays and other thermoformed containers

As an end market for these materials with expanding demand from our customers Eastman wants to encourage the inclusion of these items in the statewide list to ensure an adequate supply to feed our growing operation.

Thanks very much for your consideration. We are happy to provide follow-up information upon request.

Best Regards,

Kierstin Turnock
State Government Affairs – Circular Economy
Eastman
Kierstinm.Turnock@eastman.com

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President & CEO
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March 18, 2022

OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY

Re: Request for Information on Oregon Statewide Recycling Collection List

Dear DEQ Technical Workgroup and Rules Advisory Committee,

EFS-plastics Inc. would like to register support for the inclusion of certain foodservice packaging items on the "Uniform Statewide Collection List". EFS-plastics Inc. has three facilities in North America, including a new facility in Lethbridge, Alberta, and we are an end market for post-consumer materials sourced from Material Recovery Facilities (MRFs). We have been purchasing #3-7 mixed plastic from Oregon MRFs since 2019 to process at our facility in Listowel, Ontario, as our throughput capacity has grown rapidly in recent years. At our new Lethbridge facility, we are sourcing post-consumer olefins (mostly in the form of #3-7 or #1-7 commodity bales) to produce various grades of 100% PCR PP and PE pellets. We currently have a total capacity to process 55,000 metric tonnes post-consumer material annually.

We would like to take this opportunity to highlight how important it is to us to grow the supply of polyolefins (in particular PP) collected from households. As a recycler, we are seeing demand grow for PCR PP and PE over the next few years, and we are looking far and wide to get access to more material. We know there is a large volume of PP and PE that is not being appropriately collected or sorted in the Pacific Northwest and is unfortunately ending up in landfill. EFS-plastics is very eager to continue working with communities and MRFs in Oregon to incentivize them to keep these materials in circulation.

We procure the following MRF grades:

- 25,000 tonnes of #3-7 or #1-7 mixed rigid plastic
- 20,000 tones of Grade A-C and MRF-grade film
- 5,000 tonnes of PP/Tubs & Lids
- 5,000 tonnes of HDPE

The following foodservice packaging items are desirable in these incoming bales:

- Polyethylene Terephthalate (PET) Cups and Containers, including drink cups, clamshells, bowls, trays and other thermoformed containers
- Polypropylene (PP) cups and containers, including drink cups, deli tubs, clamshells, takeout dishes and lids and other PP thermoformed or injection molded containers

The following foodservice packaging items are acceptable in these incoming bales (i.e., we are happy to accept them because we can easily sort them from other materials, and it makes it easier for MRFs to recover more material that we do want.)

- Rigid Polystyrene (PS) cups and containers, including drink cups, clamshells, sandwich boxes and other thermoformed containers
- Expanded Polystyrene (EPS or Styrofoam) cups and containers, including drink cups and clamshells

As an end market for these materials with expanding demand from our customers, EFS-plastics wants to encourage the inclusion of these items in the statewide list to ensure an adequate supply to feed our growing operation.

Thanks very much for your consideration. We are happy to provide follow-up information upon request.

Best Regards,

A handwritten signature in blue ink, appearing to read 'Vogt', with a long horizontal stroke extending to the right.

Martin Vogt
President & CEO

Oregon Statewide Recycling Collection List and Producer-Collection Materials for Recycling

This information is submitted by the Foodservice Packaging Institute in response to the February 3, 2022 Request for Information: Oregon statewide recycling collection list and producer-collected materials (for recycling).

We welcome questions and can provide additional details upon request. Please contact:
Ashley Elzinga
571-407-1434
aelzinga@fpi.org

Background

The Oregon Department of Environmental Quality has requested technical information that can be used to evaluate materials against evaluation criteria set forth in statute. The Oregon Plastic Pollution and Recycling Modernization Act was passed into law in 2021 requiring numerous changes that are intended to modernize and stabilize recycling services in Oregon.

The Foodservice Packaging Institute (FPI) was founded in 1933 and is the leading authority for the North American foodservice packaging industry. FPI encourages the responsible use of all foodservice packaging through promotion of its benefits and members' products. FPI's core members are foodservice packaging manufacturers and their raw material and machinery suppliers. With over 75 members, FPI includes approximately 90% of converters and suppliers in the foodservice packaging industry in North America, and over 200 foodservice operators, distributors, and educational institutions.

FPI is committed to reducing the impact of its products on the environment and is dedicated to making sure these items recovered and diverted from the landfill. FPI has a separately funded recovery group with a focus on paper and plastic cups, containers, bags, and boxes. Since 2011, this group has been working with communities, recycling facilities, composters, and end markets to expand to find stable and sustainable recovery solutions for these valuable materials. This group receives technical support from Resource Recycling Systems (RRS).

Through the [Community Partnership program](#) that launched in 2017, FPI has partnered with 15 residential programs to add foodservice items to their accepted material lists. The specific items are determined through consultation with the individual program, the Material Recovery Facilities (MRF) and end markets that process the community's materials. Once FPI determines viability for inclusion of foodservice packaging materials into the prospective community recovery program, FPI works with the city and/or municipality to educate residents on best practices for recovery. This education campaign is a crucial component of every Community Partnership and helps elevate the whole community recovery program, not just the foodservice items. Because these efforts

are market-based, they have proven stable and sustainable without further assistance from FPI, and the partners report numerous benefits to their programs.

This RFI submission provides information regarding polypropylene cups and containers to support decisions around their inclusion in the uniform Statewide collection list (USCL). The data has been compiled with the assistance of technical consultant, RRS, who has conducted ongoing research on recycling and recyclability of these materials for FPI and other clients.

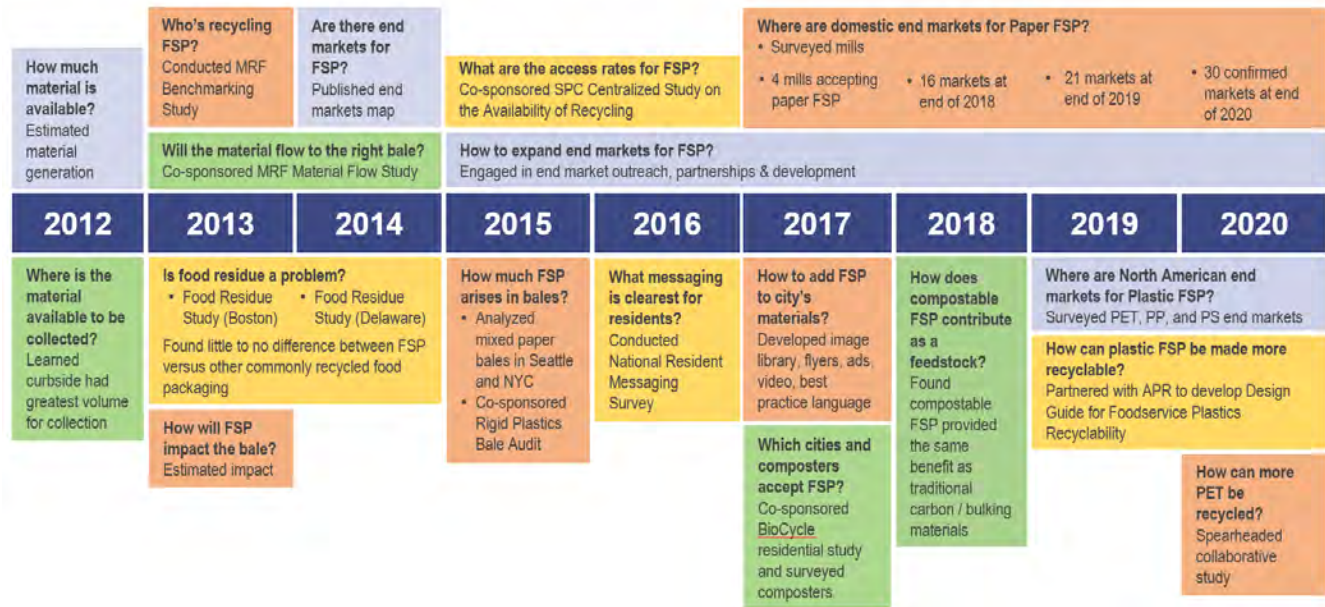
Plastics: PP Cups and Containers

Polypropylene (PP) resin, designated with the #5 resin identification code, is one of the most common resins in foodservice packaging applications, used for foodservice packaging including drink cups, deli tubs, takeout dishes, and thermoformed containers.

FPI Research

Since the inception of the FPI's recovery efforts over ten years ago, FPI has been conducting research on recyclability of foodservice packaging in order to understand and overcome potential barriers to its recovery. This research has provided the foundation for FPI's successful Community Partnership program. Many of these studies have been collaborations with other industry stakeholders including the Association of Plastic Recyclers and the Sustainable Packaging Coalition, and since 2012, much of this research has been conducted with technical support from RRS and other technical experts including Cascadia Consulting, DSM, Stina (formerly More Recycling), and Moore and Associates. Below is an overview of these research efforts and the questions they were designed to address.

Overview of FPI's Foundational Research



Overviews of studies are available at www.recycleFSP.org

Studies of particular relevance for PP cups and containers can be found in the appendix. They include research in the following areas:

- [Food Residue Studies](#)
- [MRF Flow Studies](#)
- Mixed Plastic Bale Sorts ([2015](#) and [2021](#))
- Reclaimer Surveys (reflected in FPI's [End Markets Map](#))
-

The Stability, Maturity, Accessibility and Viability of Responsible End Markets

The following map shows North American end markets for PP (yellow diamond) and mixed plastic (red diamond) bales. The list is a result of a bi-annual survey of plastics reclaimers, last conducted in 2020, supplemented with more recent market information and announcements. FPI maintains an interactive map of end markets by commodity at <https://www.recyclefsp.org/end-markets-map>. These markets source from a wide geographic region with Oregon-based materials known to travel to the eastern part of North America (see letter of support from EFS). End markets do not distinguish between PP cups / foodservice containers and other types of widely recycled PP such as dairy tubs. ISRI / APR specifications include these items in the specification for 1-7 and 3-7 bales. This is a growing market with increasing demand from reclaimers and manufacturers. See attached

letters of support in Appendix from Denton, EFS and Green Rhino. Generally speaking, this is representative of overall end markets.

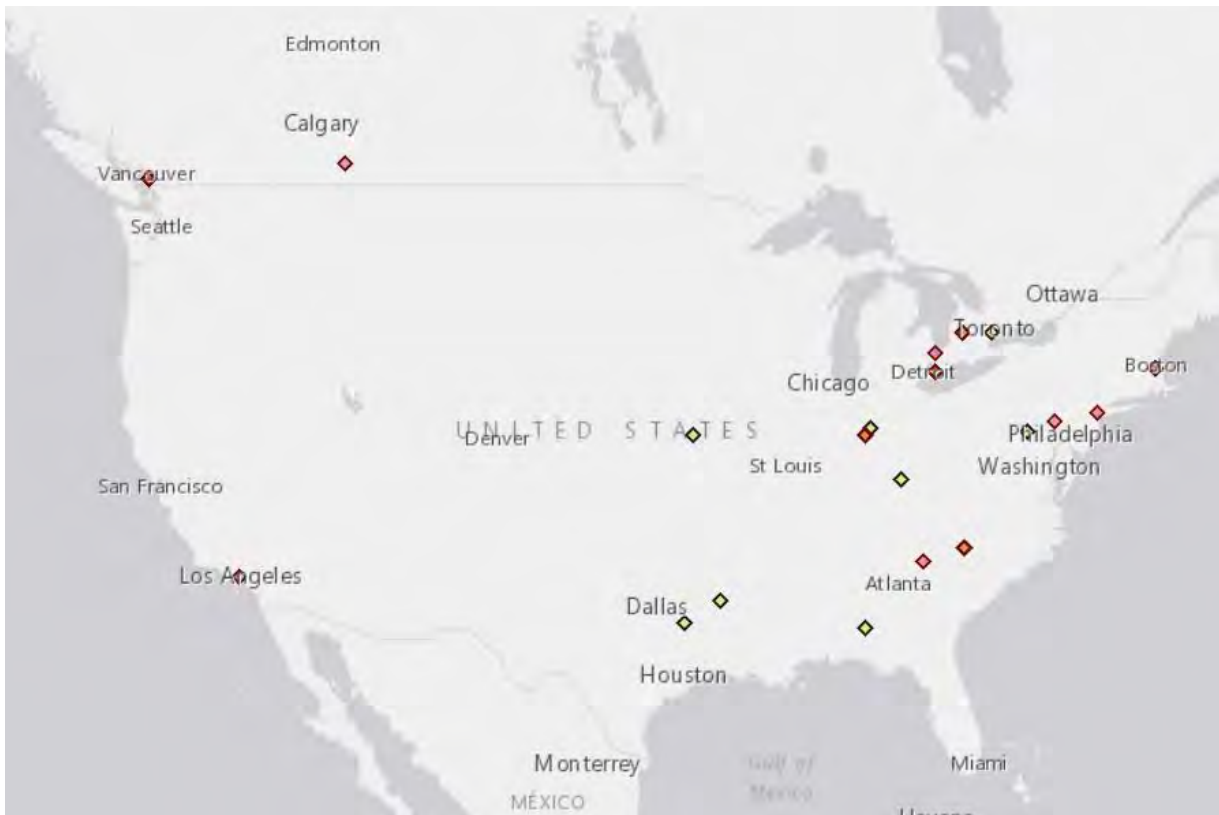


Figure 1. End Markets that Accept PP cups and containers. Source: <https://www.recyclefsp.org/end-markets-map>

This includes the following reclaimers:

- Merlin Plastics – Delta, British Columbia: All Rigids #1-7
- EFS Plastics – Lethbridge, Alberta: All Rigids #1-7
- St Joseph Plastics – St. Joseph, Missouri: PP bales
- Nursery Supplies – Jacksonville, TX: PP Bales
- IntegriCo – Sarepta, Louisiana: PP Bales
- KW Plastics – Troy, Alabama: PP Bales
- Pre-Zero Polymers – Westminster, South Carolina: All Rigids #1-7
- Custom Polymers - Charlotte, North Carolina: All Rigids #1-7
- Champion Polymer Recycling – Winchester, Kentucky: PP Bales
- East Terra Plastic – Indianapolis, Indiana: PP Bales

- Sirmax – Anderson, Indiana: PP Bales
- Mel Tech Plastics – Tilbury, Ontario: PP Bales
- Revital Polymers – Sarnia, Ontario: All Rigids #1-7
- EFS Plastics – Listowel, Ontario: All Rigids #1-7 & PP Bales
- Urban Polymers – North York, Ontario: PP bales
- Nursery Supplies – Chambersburg, PA: PP bales
- Trigon – Newmanstown PA: All Rigids #1-7

In addition, there are two emerging local markets in Oregon interested in sourcing PP Bales:

- Denton Plastics, located in Portland, accepts PP cups and containers in incoming bales. As described in their letter of support (located in the Appendix), Denton is experiencing expanding demand and wants to ensure an adequate supply to feed a growing operation.
- Similarly, a new plastic reclaimer, Green Rhino, is in the process of starting up in Tigard and would like to ensure an adequate supply of source separated PP for the plant. See letter of support in Appendix.

Regionally, PreZero US, located in Los Angeles, is an end market who sources mixed rigid plastics. PP cups and containers are acceptable in incoming bales (See Appendix for full letter of support). Additionally, EFS Plastics is eager to work with communities and MRFs in Oregon and keep PP in circulation. EFS Plastics has seen rapid growth in recent years and expects increased demand for PCR PP in the coming years. EFS has provided a letter of support, found in the Appendix.

The Anticipated Yield Loss for the Material During the Recycling Process

MRF Capture / Yield Loss

RRS data indicates that PP cups and containers typically have a high rate of capture / low level of loss in a MRF environment.

- According to a 2015 MRF flow study (see Appendix), PP cups flowed reliably to the container line (average loss rate to paper stream was 10%, and at the best-performing MRF, it was only 3% - note that this study represented a baseline where the MRFs had not undertaken any efforts to maximize capture of these items). The same study found the PP held its shape well and generally flowed to the container line. There are no specific studies conducted by FPI to document the flow of PP trays and other containers.
- More recent research undertaken by RRS found that more than 80% of PP cups and containers were properly directed to the container line in a typical single stream MRF environment, while less than 20% traveled with two dimensional materials to the paper line. These are likely lids or flattened containers. RRS research has also found that PP cups and containers that reach an optical sorter are captured nearly 90% of the time, and less than 10 percent of PP flows to residue. Capture in the MRF would be increased if quality control measures were implemented on the paper line.

Reclaimer Capture / Yield Loss

RRS research indicates that the reclaimer yield loss when recycling PP is approximately 30%. By comparison, this is lower than the yield in a typical curbside collected PET bale (38%) but higher than the yield loss of HDPE bottle bales (18%).

The Material's Compatibility with Existing (Oregon) Recycling Infrastructure

According to FPI research, most foodservice packaging is discarded at home or in the workplace. This means that residential curbside collection offers significant potential for capturing this material to achieve optimal diversion. Due to conditions spurred by the ongoing pandemic, takeout and delivery have likely prompted more opportunity for at home collection.

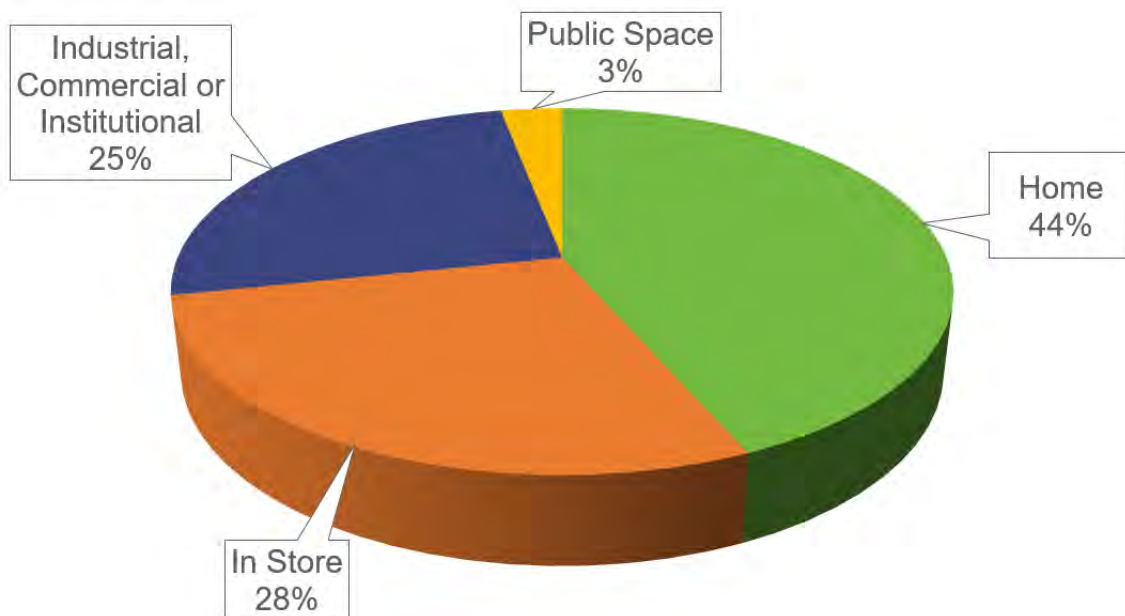


Chart showing breakdown of foodservice packaging by point of disposal

Round containers greater than 6 oz are currently accepted in a majority of households in Oregon. This would encompass some foodservice packaging PP containers, such as deli tubs. Drink cups, trays, lids, and other foodservice packaging containers are not yet generally accepted in Oregon's franchise collection programs. An FPI-sponsored study is currently underway which will provide more detailed insights into whether any Oregon communities accept these items cups in residential programs.

As noted above drink cups behave like "tubs" or "round plastic containers" through the recycling system. This is relevant because some recycling guidelines, such as those listed by [Metro Regional Government](#), accept "round plastic containers" but explicitly prohibit "plastic beverage cups". This is confusing and contradictory, as PP beverage cups are round containers typically greater than 6 oz., they flow through the MRF in the same way, and are just as valuable to end markets, yet are not currently collected.

The Amount of Material Available

There are varying estimates of the availability of PP Cups and Containers, ranging from 8.5 to over 20 million lbs generated in Oregon.

- 2016 Oregon Waste Characterization study indicated 3,712 tons (7.4 million lbs.) of 8oz and larger tubs and another 544 tons (1.09 million lbs.) 6oz tubs, for a total of 8.49 million lbs estimated PP availability.
- Based on national sales data from the American Chemistry Council in the 2020 Resin Review, in 2019 there were 789 million lbs. of PP cups and containers sold into the US market. When looked at on a per capita basis this amounts to 2.3 lbs. per year or about 9.9 million lbs. per year available material.
- According to The Recycling Partnership's *2020 State of Curbside Recycling report*, some limited data from capture studies suggest there may be as much as 17 pounds of polypropylene available per year from a single-family household. This would place polypropylene at higher generation rates than both natural and colored HDPE. Total annual polypropylene tonnage by U.S. single-family households would be an estimated 827,000 tons or 1.65 billion pounds. Extrapolated per capita into Oregon this could represent over 20 million lbs of material.

The Practicalities of Sorting and Storing the Material

It is RRS' understanding that most Metro MRFs would sort PP into mixed plastic 3-7 bales. However, growing demand for #5 bale and support for MRF upgrades through the PP Coalition has the potential to shift the market away from mixed bales toward PP specific bales. Nationally, the trend among MRFs operated by the enterprise companies (WM, Republic, Waste Connections) and regional entities is also to move away from mixed plastic and toward PP specific bales.

When considering mixed bales in relation to PP cups, a 2020-2021 bale audit was conducted by FPI and RRS to evaluate prevalence in bales marketed by MRFs¹. The study consisted of nine bales, classified into either *pre-picked rigids plastics: with bulky* or *pre-picked rigids: no bulky*. Within the *pre-picked rigids: no bulky* category, cups made up a small portion of all the bales sorted, averaging just over 6% of the total bale weight. This bale sort study shows that plastic cups are still successfully reaching plastic reclaimers, where they can be recycled into new products. By including cups and other non-bottle plastic containers in residential recycling programs, communities can provide a pathway for these cups and containers to be recycled. See Appendix for full study.

See additional notes on material flows in the anticipated yield loss section above.

Contamination

There are multiple aspects of contamination to consider. One issue is food residue on the packaging. According to a series of studies looking at food residue in foodservice packaging conducted by FPI in 2013 and 2014 the amount of residue in foodservice packaging was similar to any other type of food contact packaging and

¹ RRS was unable to source bales for this study from the west coast; bales audited were sourced from CO, NE, IN, OH, VA, SC, GA and NY. The results were similar to those of an earlier [study](#) that did include west coast bales.

determined to be consistent with what markets are accepting. Cups are used to contain liquids, and generally, residual liquid drains out of the cup by the time it reaches the MRF.

Another issue is related to cross contamination, when the material flows to the non-target material stream. As noted above. PP cups and containers are correctly captured 80% of the time. Cross contamination is primarily a result of two-dimensional lids flowing to the mixed paper line. Additional quality control on the paper line can reduce cross contamination and yield loss.

The real-world experiences of communities and MRF accepting PP cups and containers indicate that with good resident education, PP cups and containers other foodservice packaging can be added successfully while reducing overall contamination. The communities and MRFs that have participated in FPI's Community Partnership program have not reported any problems with quality or marketability of bales as a result of adding PP cups and containers, and the foodservice items added via the partnerships remain in their programs.

The Ability for Waste Generators to Easily Identify and Properly Prepare the Material

PP cups and containers are easily identifiable by waste generators by looking at the #5 resin identification code. Alternatively, residents of programs that use broader language such as "plastic cups and containers" can usually identify the accepted items intuitively.

The only preparation needed is to empty the cup/container and remove the lid or any other ancillary items.

FPI inventoried the messaging used in leading recycling programs, the terminology recommended by several industry groups, and conducted a resident messaging survey specific to foodservice packaging in order to develop best practices. FPI employs these findings in every Community Partnership program and resident communications for each program addition. These best practices include recommended terminology, effective graphics, and simple preparation instructions aimed at promoting recycling of clean and empty items and minimizing contamination ([the resident education kit, including the study results, is available for download](#)). The graphics feature clean, empty cups, with no lids or straws attached. This messaging strategy has proven effective, and our partner communities have reported reductions in residue following the communications campaign.

Economic Factors

Historically, PP items have been marketed in mixed plastic bales. However, there is increasing demand for a single resin PP bale. The demand for polypropylene bales is strong currently with an average national price over the past 12 months of \$.29/lb. This is higher than the price of curbside PET bottles (based on data from recyclingmarkets.net). Mixed plastic 3-7 bales have a 12-month average price of about \$.01/lb (based on data from recyclingmarkets.net).



FOODSERVICE PACKAGING
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OREGON DEQ RFI RESPONSE: PP CUPS & CONTAINERS

A key economic factor for capture of PP is related to volume. In recent years, a number of foodservice brands have begun using polypropylene cups. PP cups and containers have an increasing market share and can be expected to bring added value into the recycling system whether it is sorted into PP bales or increases PP content in mixed bales, which could result in higher prices. If more PP were to enter the curbside stream there is greater incentive and logistical rationale to sort into a PP bale, which has higher market value and increasing demand.

Appendices

- FPI: Food Residue Study Overview
- RRS, Reclay StewardEdge, and Moore Recycling: MRF Material Flow Study Summary
- FPI: Plastic Cups Bale Sort Findings
- Denton Plastics Letter of Support
- Green Rhino Letter of Support
- PreZero US Letter of Support
- EFS Plastics Letter of Support



Food Residue Overview

FOOD RESIDUE IN FOODSERVICE PACKAGING RECYCLING: Overview of FPI Food Residue Studies

Background

The Foodservice Packaging Institute's Paper Recovery Alliance and Plastics Recovery Group have been working on overcoming barriers to recovery of foodservice packaging, and one of the often-cited reasons foodservice packaging is not accepted for recycling is the concern about increased levels of food contamination.

The Studies

To address this concern, two studies were conducted, to learn whether foodservice packaging (such as take-out containers or pizza boxes) set out for recycling were more contaminated than food contact packaging (such as peanut butter jars or pasta boxes) that has traditionally been accepted at single stream material recovery facilities (MRFs). DSM Environmental Services, Inc., conducted the studies in Boston, MA (Sept-Oct 2013) and Delaware (July 2014).

The process for each study included a sampling of materials between approximately 2,600 and 4,700 pounds of randomly selected residential curbside recyclables collected in different areas of the selected locations. For all recycling samples, corrugated, mixed paper, plastic tubs and lids, aluminum cans and foils/pans, were sorted into two categories, foodservice packaging or other packaging in contact with food (e.g. jars, tubs, cans, and boxes from prepackaged grocery items). The sort team then used a visual rating system to assess and record how much food residue was present on the selected categories, ranking all materials from 1 (clean) to 5 (highly contaminated, containing uneaten food remnants in addition to residue).

The Results

In both Boston and Delaware, the majority of the samples of foodservice packaging was rated as low-residue (1-2). In the Boston study, there was no appreciable difference in contamination rates between foodservice and food contact packaging. The overwhelming



majority of the samples were extremely clean. In the Delaware study, the proportion of foodservice packaging in high residue levels (4-5) was small and virtually identical to that of food contact packaging. Accordingly, the total proportion of items rated low and middle residue levels (1-3) was essentially the same among foodservice and food contact packaging and formed the majority, however some of the foodservice packaging material types showed a slight shift from the low (1-2) to the middle rating (3) when compared to the food contact packaging. While tolerance for food residue will vary by material and market, the levels ranked 1-3 are believed to be consistent with what markets are generally accepting today as part of the mix of commodities process by MRFs.

The studies yielded some additional observations that help to place this analysis in perspective.

1. Recyclables at the Boston study were exceptionally clean overall, which led the sort team to conclude that while the study was representative of the Boston area, it may not be representative of recycling set outs in other cities. In contrast, the Delaware study samples contained a higher proportion of commingled refuse and appeared to have more soiling from compaction and cross-contamination with refuse in the trucks. As a result, it was challenging in some cases to determine if the surface contamination on the items originated in the recycling truck or if it was food residue from the original packaging contents. (For the purposes of the sort, residue on the exterior was assumed to be contamination from the truck, and residue on the interior was assumed to be food residue.)
2. The most meaningful comparison associated with both sorts was probably the plastic tubs, cups and clamshells category. The sample size in both studies was robust, and covered a broad range of contamination levels for both food contact and foodservice packaging. Neither the Boston nor the Delaware study found an appreciable difference between food residue levels in foodservice and food contact packaging in this category.



Contractor's Conclusions

Based on the findings of these two studies, it appears that overall, the mix of foodservice packaging items recycled at curbside has comparable levels of food residue to that found in food contact packaging. Commingling with refuse seems to have a significant impact on the cleanliness of recyclables, regardless of how clean the recyclables were the consumer placed them in the recycling cart.

The studies at Boston and Delaware presented great opportunities to gather useful data on the issue of adding foodservice packaging to recycling programs. FPI would like to thank the City of Boston, Casella, the Delaware Solid Waste Authority, and ReCommunity for participating in the study. *More information on FPI's recovery projects may be found at www.fpi.org/stewardship.*





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MRF MATERIAL FLOW STUDY

FINAL REPORT | APRIL 2015

COMMISSIONED BY



PREPARED BY RRS IN CONJUNCTION WITH:



INTRODUCTION

The famous Greek philosopher Heraclitus captured the essence of the recycling industry over 2,500 years ago when he penned the phrase, “Nothing endures but change.” The march of packaging innovation and technology, and the persistently changing habits of consumers continue to dictate the changing mix of materials that enters a material recovery facility (MRF). Over the past decade, there has been a continual decline in the once dominant materials including newspaper, glass and metal cans. At the same time, a host of other packaging types have emerged, presenting new recovery opportunities. Recycling programs throughout the country have responded by expanding the list of materials accepted for recycling, notably including a wide range of plastics and cartons. For the MRFs that receive the material, it is not always easy to keep sorting technologies and techniques on pace with this expanding mix.

STUDY OVERVIEW

Packaging companies have an interest in ensuring that the packages they produce or sell their products in have the opportunity to be recycled. The ability to recycle the package can be a consumer’s deciding factor in the purchase of a particular product. This, and the desire to minimize environmental footprints, are the drivers behind the recently completed MRF Material Flow Study.

MRFs are the intersection between consumers, residents and the industrial infrastructure that creates the products and packaging we use every day. To better understand the recyclability of their packaging, five diverse associations – the Carton Council, Foodservice Packaging Institute (FPI), American Chemistry Council (ACC), National Association for PET Container Resources (NAPCOR) and the Association of Postconsumer Plastics Reprocessors (APR) – joined together to study how numerous materials flowed through the MRF. They contracted with RRS, Reclay StewardEdge (RSE) and Moore Recycling Associates to develop a standard methodology and execute it at five MRFs.

KEY CONCLUSIONS

In studying the performance of specific materials through different MRF environments, a number of general takeaways became clear. These conclusions could help to serve as guidelines to improve recovery across the recovery value chain – from residents and municipalities to packaging designers and MRF operators and engineers, and everyone else in between.

AUDIENCE	KEY TAKEAWAYS
Packaging Designers	<ul style="list-style-type: none"> Form, material and rigidity have a significant effect on a product’s “sortability” in the MRF Light-weighting of plastics can decrease recovery in a single stream MRF due to loss to the paper streams
MRF Operators	<ul style="list-style-type: none"> More equipment steps (disc screen decks or other separation equipment) can improve accuracy of splitting two-dimensional from three-dimensional materials Properly maintaining the disc screens (cleaning and replacing discs) can significantly reduce loss of containers to the paper stream Minimizing compaction to maintain the form/shape of incoming material improves separation Continually training sorters to recognize a wide range of acceptable packaging is of growing importance
MRF Equipment Designers	<ul style="list-style-type: none"> Further research and development is needed to improve consistency of behavior of non-bottle plastics in the MRF Further testing and refining of optical sorter programming is needed to effectively optically sort a wider range of packaging
Municipalities	<ul style="list-style-type: none"> Regular communications with local MRFs is critical to understanding behavior of materials currently accepted and identifying additional materials that could be added As the list of acceptable materials grows, continual education for residents is essential to keeping contamination to a minimum For single stream programs, education to the consumer to not crush materials can improve their recovery
Recycling Industry	<ul style="list-style-type: none"> Continually evaluate and match MRF product quality and end market capabilities to ensure true recovery

ABOUT THIS REPORT

This study examined the behavior of numerous individual products in the MRF, yielding data on cups, clamshells, containers, domes/trays, bottles, tubs, lids, gable-top and aseptic cartons, and other materials. Funders of this study have gained a greater awareness of the opportunities and obstacles regarding the recovery of each of these materials and will apply this new knowledge to increase recovery.

While the detailed data on each material are not presented within this report, key findings regarding material flows, sorting technologies, and other sorting and design related considerations are explained, along with the study's methodology.

STUDY METHODOLOGY

There were three stated goals of the study:

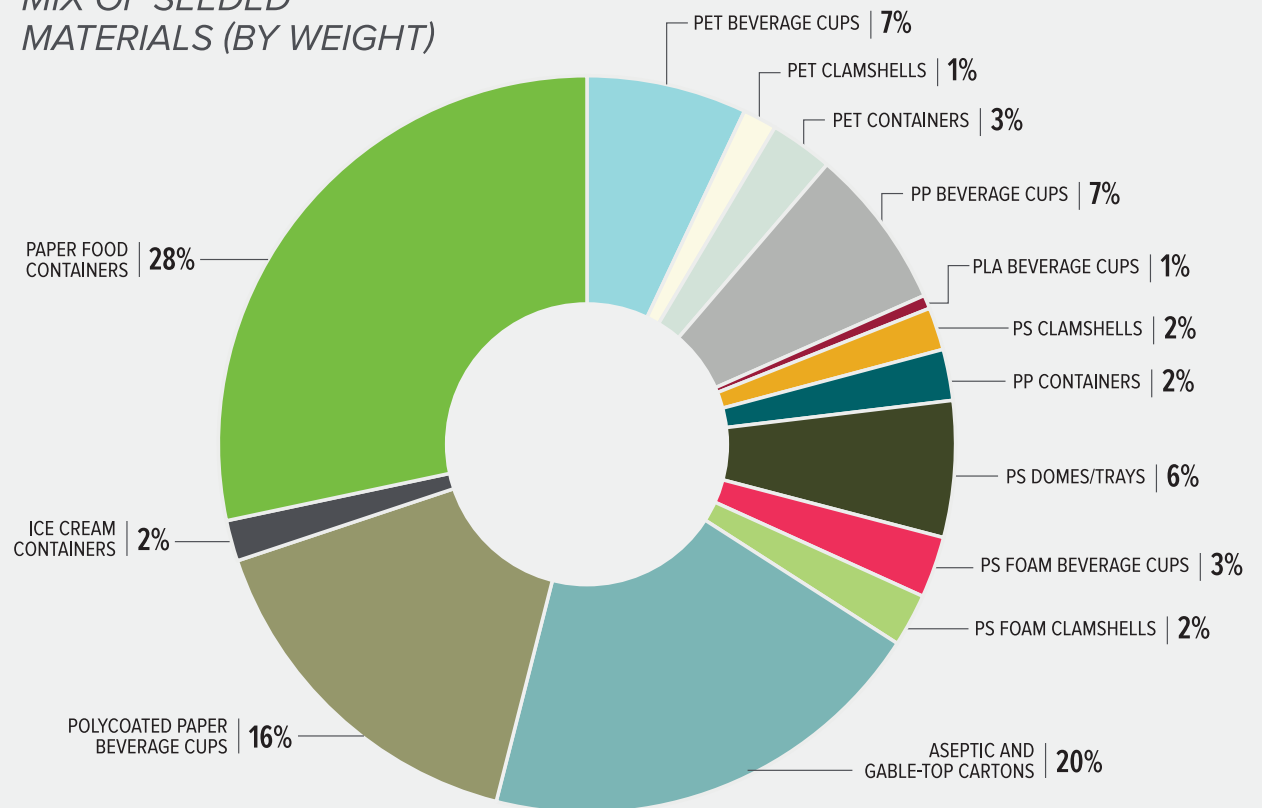
1. Learn how materials similar to the test samples and other study materials would flow through typical MRF environments;
2. Determine which of the study materials, not currently accepted by MRFs, could potentially be recycled using existing MRF infrastructure; and
3. Start to develop an understanding of what sort processes could be modified to allow effective recovery of sample materials

The study focused on a broad range of materials, many that are currently widely

accepted and some that are very rarely included in recycling programs. Materials that are not commonly accepted for recycling were brought in and added, or “seeded”, to the normal stream received by the MRF. To simulate a realistic recovery scenario, care was taken to add materials at levels that corresponded to their relative prevalence in the marketplace. In other words, more common materials were seeded in larger amounts (by weight) than less common ones.

The plastic materials studied included cups, clamshells, domes/trays, bottles, tubs, lids and other containers. Each was classified by resin identification code and in some categories including containers and tubs, by size as well. The paper products studied included cups, ice cream containers, gable-top and aseptic cartons, and take-out food containers. Figure 1 shows the representative mix of materials that was seeded.

FIGURE 1
MIX OF SEEDED MATERIALS (BY WEIGHT)



In each of the five MRFs that served as test sites for this study, a standard methodology was applied to analyze the flow of materials. This methodology was, in essence, quite simple and could be replicated for other materials or repeated in other MRFs.

- The MRF set aside enough inbound recyclable material to run their facility for 3 hours (between 30 and 100 tons). This represented the average material that the facility processes on a day to day basis.
- The study team worked with the MRF staff to mix the seeded packaging into the inbound material. In each facility, the seeded materials represented about 1% of the incoming stream by weight.
- Sort staff was trained on how to handle the seeded materials. In general, the materials were allowed to flow where they naturally did within the facility and sorters were instructed to not pick and dispose of the seeded materials as residue. However, each seeded package was given one or more target commodity streams and if, for example paper beverage cups flowed to the container line, the sorters were directed to positively sort them to the carton bale and if they flowed to the paper line they were allowed to stay in the mixed paper bale. Seeded materials therefore flowed to existing MRF products – new product grades were not produced for the seeded materials.
- The facility processed the material for 3 hours. During the processing, video cameras were set up to monitor the flow of materials and the actions of the sorters.
- Random samples of the main products were taken either as loose samples or from random bales. The target sample weight was about 600 pounds for each of the products and, where possible, multiple samples were taken of each product or the majority of the product was sorted.
- Each of the samples was sorted into 104 categories. The plastic sort categories were chosen to match other studies commissioned by ACC, APR, NAPCOR, and others.

Ideally, tests were run during a time that the facility was not planning to operate, so as not to hinder normal operations. MRFs operate on extremely tight timelines, and without careful scheduling a study could easily create problematic disruptions.

DATA ANALYSIS

Based on the data collected, two analyses were performed. The first was characterizations of each of the product streams. These were completed for each of the samples of a single product and then averaged to get the product characterization. Product characterizations showed how much of that stream was composed of each sort category. An example is shown in Figure 2. The product characterizations are important for end

The MRFs at which this study was conducted were chosen to represent the wide diversity of facilities that currently process recyclables nationwide. Here are some of their key descriptors and differentiators:

- 1 dual stream and 4 single stream facilities
- Throughput range (tons per hour): 10 tph – 35 tph
- Four different equipment manufacturers
- Number of optical sorters ranged from 0 – 5
- Varying combinations of disc screens and other mechanical separation equipment

PRODUCT CHARACTERIZATIONS WERE CALCULATED FOR THE FOLLOWING STREAMS:

Mixed Paper	Mixed Paper/ Newspaper ¹	cHDPE
Newspaper	PET	nHDPE
Cartons	Mixed Plastics ²	Residue

¹ Some facilities only marketed one grade of paper

² Also included a HDPE/PP Tubs and Lids grade

markets to understand the quality and composition of a MRFs products. For this study, it was important to see if the addition of seeded materials would increase contamination of existing product streams.

The second analysis used the characterizations to determine the destination of each of the study materials. For example, if 10,000 paper beverage cups were introduced into

the MRF, how many would end up in the mixed paper, how many in the carton bale and how many in the residue and other categories. This analysis was the key to understanding how the materials flowed in the MRF environment. Examples of this analysis are shown in the Results section.

RESULTS

While a diverse set of MRFs was chosen for the study, the results presented here are specific to the MRFs studied, as different results can be achieved by modifying equipment layouts, operating protocols and material streams.

Key findings are grouped by type of MRF, type of sortation equipment and material form and prevalence.

DUAL STREAM SYSTEMS

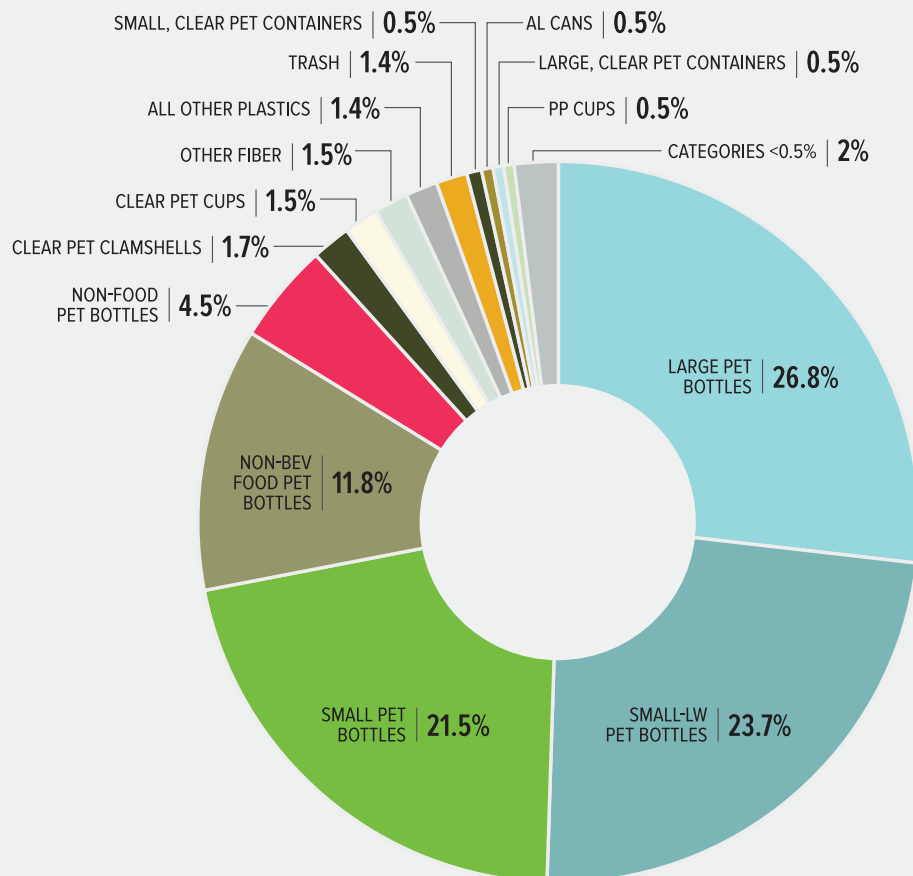
Two types of MRFs were included in the study: one dual stream and four single stream. While only one MRF was dual stream, one comparison about the difference between dual and single stream systems can be made.

Dual stream systems, which are declining nationally in favor of single stream systems, require residents to separate paper materials from metal, glass and plastic containers. As will be highlighted in the next section, dual stream systems offer the advantage of reducing loss of plastics and other containers to the paper streams. On the other hand, as the material mix has expanded to new packaging types, it isn't always well understood to by residents in which stream they should be included. For MRFs, it is more difficult to sort these containers from the paper stream than it is from the container stream, making this a real obstacle.

SINGLE STREAM SYSTEMS

While single stream systems allow for easier communication to consumers about how to recycle (and simplify collection systems), the difficulty in separating the materials is passed

FIGURE 2
*EXAMPLE PRODUCT STREAM CHARACTERIZATION:
PET, AVERAGED ACROSS ALL 5 MRFs*



onto the MRF. One of the key observations in this study is that there are wide variations in how effective single stream facilities are in separating paper from the containers. To accomplish this separation, single stream facilities use a series of disc screens and other equipment that all utilize the difference in shape between paper and containers. Flat materials (generally 2-dimensional) will travel to the top of the screen and to one series of conveyors, while bottles and other containers (generally 3-dimensional) will either fall through the screens or tumble to the bottom to a different series of conveyors.

There are numerous factors that affect the ability of single stream equipment to accurately separate the 2D and 3D materials. They include equipment design factors (such as screen design and angle), operation issues (such as overloading the screens, cleaning the screens, and wet material), maintenance issues (such as wear to discs) and collection issues (such as excessive compaction of the material by residents or collection vehicles). Further, the packaging design itself can also affect the flow of individual materials. All of these variables cannot be evaluated in one study, but general conclusions are possible.

BEST PRACTICES FOR ACCURATE 2D/3D SEPARATION IN SINGLE STREAM MRFs:

- Avoid loading screens past their design throughput
- Clean screens of material that are wrapped around the shafts
- Replace worn and damaged discs
- Minimize compaction of material by residents and collection trucks
- Keep material dry

SCREENS

In this study, plastics separation by screens was examined in depth and the analysis can act as a surrogate for other container material types, such as aluminum and steel. The amount of plastics (including bottles, containers, clamshells and cups) lost to the paper stream varied from 3% to 12%. The two MRFs that experienced a 12% loss of plastics to the paper

stream were both medium sized single stream facilities (25-30 rated tons per hour (tph)) that had fewer screens than the larger two (35 tph). After seeing the screening effectiveness data from this study, both replaced worn discs in their disc screens and reported a significant improvement in the 2D/3D separation. The facility that experienced a 3% loss of plastic to the paper stream was a large MRF with an adequate number of screens for the incoming volume and material type (note: this facility was the top performer across the entire study). Interestingly, the facility with 8% loss was similar to the 3% facility, but it had two distinct operational issues that were not normal for their facilities: material was wetter than normal due to heavy snow storms, and space constraints on the tip floor caused by equipment failures resulted in handling of the material significantly more than normal (including driving over it with a loader). These results suggest that a well maintained facility with an adequate number of screens for the incoming volume and material mix, operating under normal conditions can achieve very low losses of containers to paper products.

Note: Both large single stream MRFs, which had better success than the medium single stream MRFs at separating the plastic containers from the paper, were equipped with 4 sets of disc screens: an OCC screen for separating cardboard or “old corrugated containers”; 2 ONP screens for separating “old newspapers” and a polishing screen for cleaning up the mixed paper stream. The two medium MRFs had 1 less paper screen each. Depending on the facility, this study indicates that the extra screens can help improve the accuracy of the 2D/3D separation in single stream MRFs.

FORM

The form of a package had a strong influence on the loss of packaging to the paper streams. As can be seen in Table 1, the plastic clamshells had a much higher likelihood of flattening and moving with the paper streams. The rounder materials (including bottles, cups and containers) all had much lower loss rates, and less than 5% was lost at the top performing MRFs, Small, lightweight water bottles were more likely than other bottles to move with the paper with a loss rate of 15%. The cups, containers and clamshells still enter the MRFs in much lower quantities than bottles. They made up 11% of the plastics stream, even with the seeded materials. Aseptic and gable-top cartons had a higher average loss rate to the paper

streams, although it is interesting to note it was the only packaging type to have one facility with no loss to the paper stream. In all five MRFs, they marketed a Grade 52 for cartons and pulled them from the container line.

OPTICAL SORTERS

Another piece of equipment in MRFs that can help improve separation of materials are optical sorters. Optical sorters can recognize materials based on what they are made of along with their size and shape. All four single stream facilities had at least one optical sorter, and the two large facilities had 3–4. Optical sorter efficiency was difficult to determine from this study because for each optically sorted commodity there were one or more manual sorters for quality control, both on the material that was positively sorted and what was missed. Therefore a manual sorter could remove a PET cup that was positively sorted by the optical sorter into the PET bale or another could mistakenly sort a PP cup that resembled one from PET into the PET bale. However, there were two interesting cases that are worth noting with the optical sorters.

Many of the materials that were tested as part of this study are light weight, meaning a sorter (either human or optical) needs to handle more pieces in order to sort a ton. At the only single stream facility without an optical sorter for the cartons, the manual sorter who normally sorts cartons was asked to positively sort any paper beverage cups and ice cream containers. With the volume of cups and ice cream containers, the sorter was overwhelmed and the manager chose to add a second sorter to that station. This implies that as more lightweight materials are added to the MRF, either more manual sorters will need to be added or optical sorters may be able to help increase the sorting throughput.

Even for a trained manual sorter, recognizing the resin type for each item as it goes by on a conveyor is very difficult. The PP and PET cups that were seeded for the test were both clear plastic and very similar in style. Averaged across all five facilities, approximately 20% of the PP cups were found in the PET bales. This is likely due to manual sorters positively sorting them to the PET stream because they so closely resembled PET cups. As more diverse packaging, including different sizes, shapes, colors, materials and purposes, continues to enter the MRF, improvements in technology and training to keep bale quality high will likely be necessary.

Similarly at one MRF, the optical sorter was set to sort all HDPE and PP and manual sorters then sorted that stream into nHDPE, cHDPE and a HDPE/PP Tubs and Lids grade. The cHDPE bale at that MRF had a much higher percentage of PP (8%) than the other MRFs (less than 2%). This further emphasizes the sorting challenges facing MRFs.

MATERIAL PREVALENCE

MRFs have been designed to separate bottles and cans from magazines and newspaper. During this study, extensive data was collected on the behavior of specific packaging types in the MRF environment. It shows that MRFs are doing quite well with these prevalent materials, although even these materials are not being correctly sorted at 100%. At best, the study showed a recovery of 93% of an individual package type, with much of the loss to other products and not to residue alone. Similarly for small (<1L), regular weight

TABLE 1
LOSS RATE OF PACKAGING MATERIALS TO THE PAPER STREAMS

FORM	AVERAGE LOSS RATE TO PAPER STREAM	LOSS RATE AT BEST PERFORMING SINGLE STREAM MRF
Plastic Bottles	5%	2%
Plastic Cups	10%	3%
Plastic Containers	12%	2%
Plastic Clamshells	29%	12%
Aseptic and Gable-top Cartons	18%	0%

PET bottles and all size cHDPE bottles, results are shown in Figure 3. Compare those figures to results for small (<10") PET non-bottle containers and cHDPE non-bottle containers as shown in Figure 4. Note that for all results, the data from each of the five MRFs was averaged to form a composite of the behavior across all facilities. According to RRS's database, approximately 50% of the material nationally is processed through the largest 20% of MRFs. Therefore, the larger MRFs were weighted more heavily than the smaller facilities when combining the data.

Why do bottles flow more consistently to the proper bale than tubs and other non-bottle containers? There are many likely reasons for these results. The first, and likely most important, is relative amount of material. During the tests, there were greater than 20 times more regular weight PET bottles than small PET containers (by weight). Including all types of PET bottles and both large and small containers, there were greater than 30 times more bottles (by weight). Although not as pronounced, there were still 8 times as many colored HDPE bottles as containers and tubs. Package types that are more prevalent in the stream are more likely to be targeted by manual sorters if they are missed or misdirected by the optical sorters or disc screens, thereby increasing their recovery. In addition, the equipment is tuned to increase the recovery of the

FIGURE 3
DESTINATION OF SMALL, REGULAR WEIGHT (< 1L) PET BEVERAGE BOTTLES (TOP) AND ALL CHDPE BOTTLES

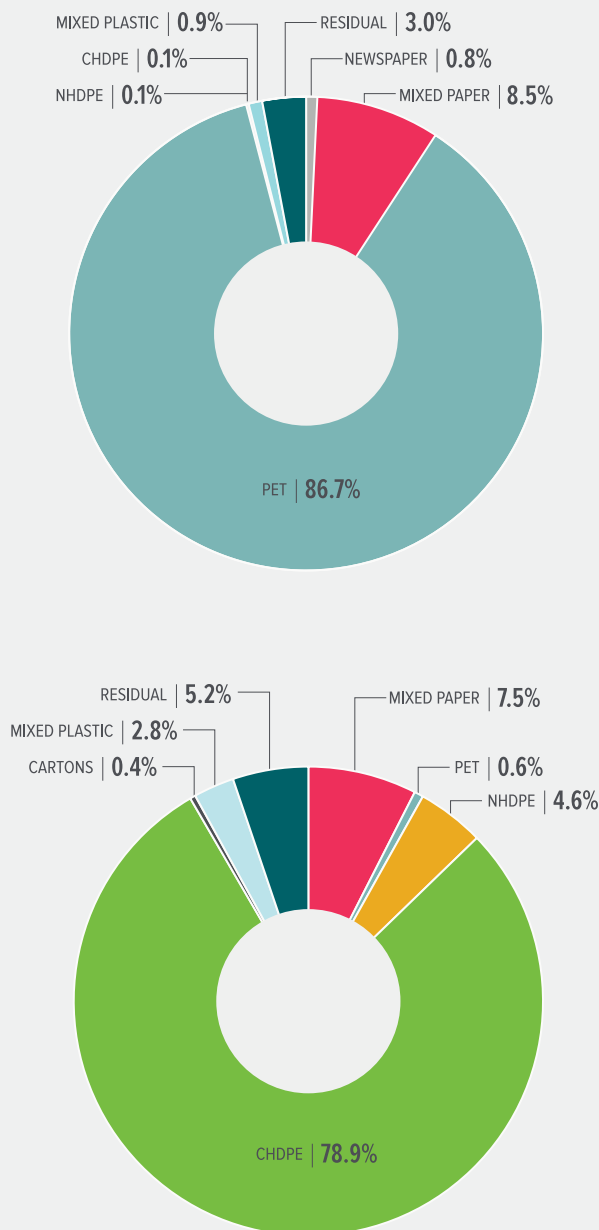


FIGURE 4
DESTINATION OF SMALL PET CONTAINERS (TOP) AND CHDPE CONTAINERS (ALL NON-BOTTLE CONTAINERS & TUBS, < 10" DIAMETER)

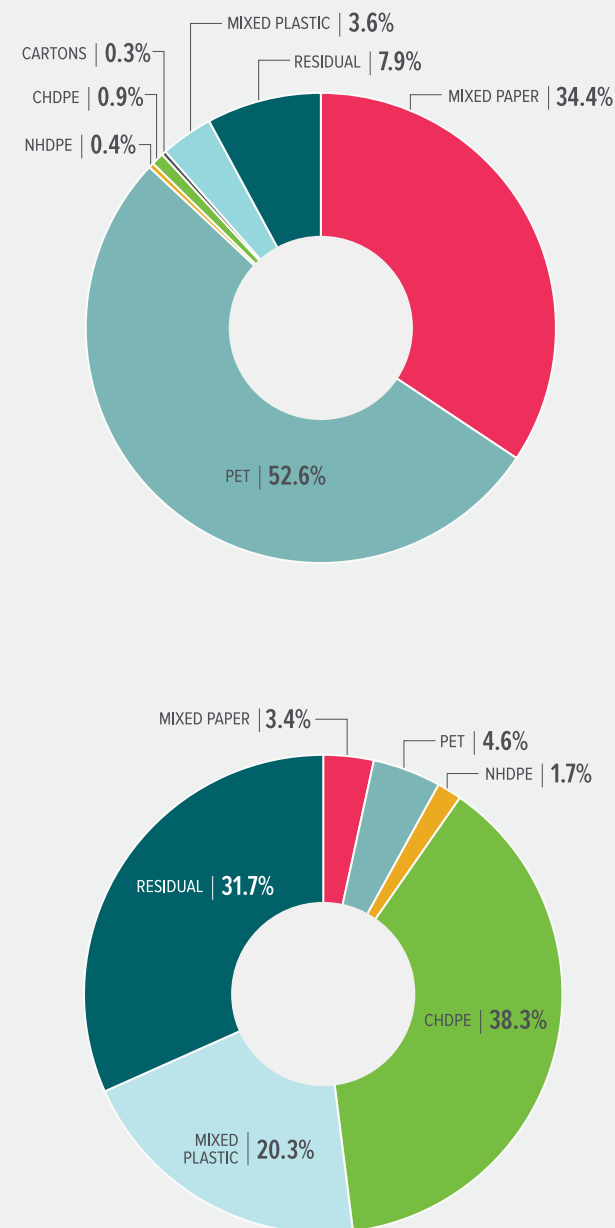
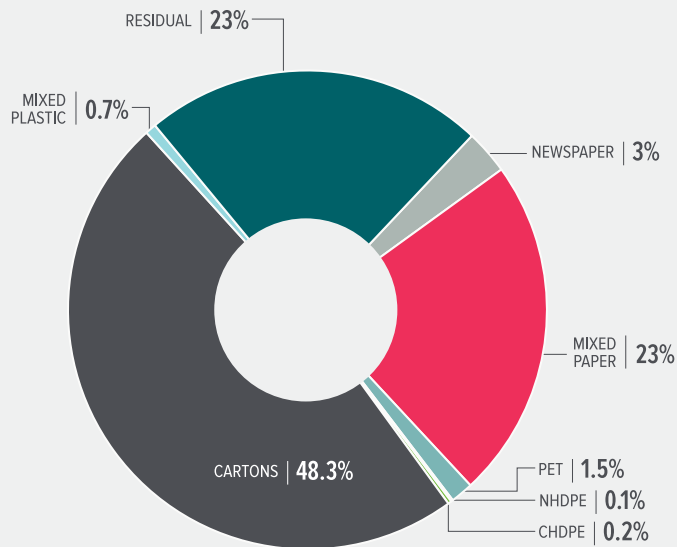
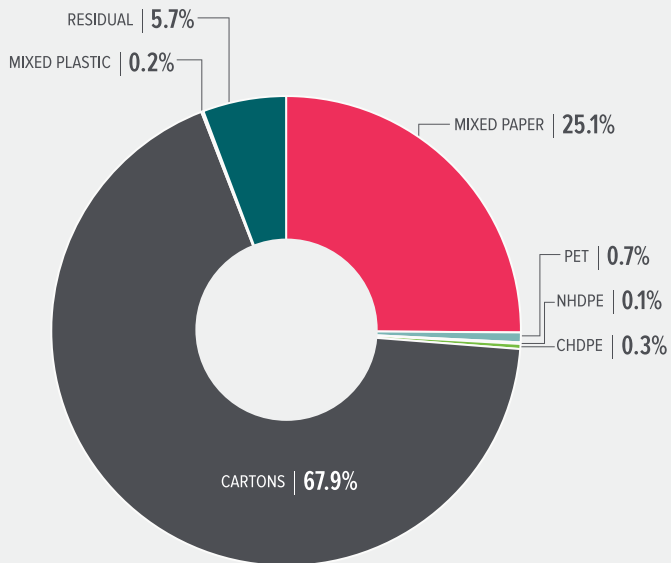


FIGURE 5
DESTINATION OF CARTONS
(TOP) AND PAPER BEVERAGE CUPS



most common materials and may not perform as consistently on less common package types.

Secondly, to target the PET and cHDPE non-bottle containers would take two different strategies. The majority of the PET containers not in the PET bale are lost to the paper stream. However, very little of the cHDPE containers were in the paper stream, but most of the loss was to the residue stream, likely because they were not captured from the container line either by the optical or manual sorters. Finally, the size and shape of the containers can be quite varied in comparison to the bottles, with many containers being flatter and having open tops, which reduces the ability to hold the shape during handling and sorting. This will continue to cause less consistency on the disc screens and other equipment.

ADDING NEW MATERIALS

The study also specifically assessed the MRF “sortability” of some packaging materials that are not currently accepted extensively by recycling programs nationwide but are in fact growing in many communities, including: paper beverage cups, ice cream containers and polystyrene foam cups and clamshells. Figure 5 compares the behavior of aseptic and gable-top cartons to paper beverage cups.

As one example, the paper beverage cups had a strong tendency to flow to the container line (similar to cartons and plastic cups). A higher percentage were lost to residue which, based on review of the test setup and sorter training, was most likely from the container line. This could be due to manual sorters being less familiar seeing them or being overwhelmed when the optical sorter didn’t catch them. Further study could be done to better understand the effectiveness of optical sorters on different types of cups and if programming could be improved to recognize them.

CONCLUSIONS

This study demonstrates the power of examining a material’s inherent behavior in a MRF environment. Understanding how that material will flow allows for informed, operational actions to maximize recovery of that material. It is a useful exercise, as was done here, to look at not only new materials (that aren’t currently accepted) to see which MRF end-products they can be a part of, but also to see how currently accepted materials, both prevalent and not, are being recovered. Recycling is a complicated system of consumer behavior, collection programs, sorting at MRFs and end markets. All stages of the value chain need to be similarly examined to create a full picture of recyclability. As shown in this study, examining and solving material processing challenges at the modern MRF is a necessary step in achieving success for the recycling industry of the future.



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Background

The composition of bales of recycled materials is constantly evolving as the mix of packaging in the market changes. It is particularly important to understand how our products are captured and recovered through the residential stream and their prevalence in bales marketed by material recovery facilities. To build on knowledge gained during prior studies, between November 2020 and February 2021, FPI participated in an audit of #3-#7 bales to obtain a current snapshot of bale composition.

The RRS-led audit was conducted at Michigan State University's Recycling Center. During the audit, RRS sorted by resin and format. To better enable comparison with previous studies, the methodology was reviewed by the Association of Plastic Recyclers (APR) and other project funders and efforts were made to align with the bale audit methodology utilized by Stina, Inc. (formerly More Recycling) to facilitate comparison with past studies. This paper summarizes findings related to PP, PS and PET cups in mixed plastics bales.

The Study

FPI's goal in participating in the study was to get a better understanding of the prevalence of plastic cups in the mixed plastics bales, as well as breakdown by plastic resin type of the cups in the bales. Note that the study focused on cups rather than other foodservice containers, since other container types are used in multiple applications and distinguishing between foodservice and non-foodservice applications (such as pre-packaged food) is not feasible in the context of a bale sort.

The bale sort included a total of nine #3-#7 (pre-picked) bales from nine North American material recovery facilities located in the Northeast, Southeast, Midwest and Western regions of the US. The sampled bales were further classified into two bale types:

- Pre-picked Rigids Plastics: With Bulky (two of the nine bales)
- Pre-Picked Rigids Plastic: No Bulky (seven of the nine bales)

The Results

Resulting data showed that cups made up a small portion of all the bales sorted, with the *Pre-picked Rigids Plastics: No Bulky* bales averaging just over 6 percent of the total bale weight. The *Pre-picked Rigids Plastics: With Bulky* contained a lower proportion of cups.

The cups were further sorted by resin: polystyrene (PS), polypropylene (PP), and polyethylene terephthalate (PET). The majority (over 60%) of plastic cups found in all #3-7 bales were made of PP. The balance of cups in the bales split between PS and PET.

In comparison to the 2015 data, overall cup prevalence in the pre-picked/no bulky (#3-7) bales was unchanged at just over 6 percent.

In the pre-picked/with bulky (#3-#7) bales, the proportions of cup resins had shifted considerably, with PP the dominant cup resin in the bale rather than PS per the 2015 results. However, due to the small number of pre-

picked/with bulky (#3-#7) bales sorted, it is unclear whether this is representative of a broader trend in that bale type.

This bale sort study shows that plastic cups are still successfully reaching plastic reclaimers, where they can be recycled into new products. By including cups and other non-bottle plastic containers in residential recycling programs, communities can provide a pathway for these cups and containers to be recycled.

Complete results from the Mixed Plastics Bale Sort Study are available to PRG members. More information on recycling of foodservice packaging may be found at www.recyclefsp.org.



MARCH 17, 2022

OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY

Re: Request for Information on Oregon Statewide Recycling Collection List

Dear DEQ Technical Workgroup and Rules Advisory Committee,

Denton Plastics, Inc. would like to register support for the inclusion of certain foodservice packaging items on the "Uniform Statewide Collection List". Denton Plastics, Inc. is located in Portland, Oregon and we are an end market for post-consumer materials sourced from Material Recovery Facilities (MRFs). We currently source post-consumer olefins to produce PCR Resin with a capacity of 2 million pounds post-consumer material annually.

We will begin procuring the following MRF grades

- -0- lbs of Mixed Plastic Bales [add detail as needed – e.g. 1-7, 3-7, other...]
- -0- lbs of PET Thermoform Bales
- 600,000 pounds of Polypropylene Bales
- 1,400,000 pounds of Polyethylene Bales

The following foodservice packaging items are acceptable in these incoming bales:

- **Polypropylene (PP) cups and containers**, including drink cups, deli tubs, clamshells, takeout dishes and lids and other PP thermoformed or injection molded containers
- **Rigid Polystyrene (PS) cups and containers**, including drink cups, clamshells, sandwich boxes and other thermoformed containers
- **Expanded Polystyrene (EPS or Styrofoam) cups and containers**, including drink cups and clamshells

As an end market for these materials with expanding demand from our customers Denton Plastics, Inc. wants to encourage the inclusion of these items in the statewide list to ensure an adequate supply to feed our growing operation.

Thanks very much for your consideration. We are happy to provide follow-up information upon request.

Best Regards,

A handwritten signature in black ink that reads "Nicole Janssen".

Nicole Janssen,

President,

Denton Plastics, Inc.



3.17.22

OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY

Re: Request for Information on Oregon Statewide Recycling Collection List

Dear DEQ Technical Workgroup and Rules Advisory Committee,

Green Rhino Recycling would like to register support for the inclusion of certain foodservice packaging items on the "Uniform Statewide Collection List". Green Rhino Recycling is located in Tigard and we are an end market for post-consumer materials sourced from Material Recovery Facilities (MRFs). We currently to produce PCR PP Pellets with a capacity of 3600 tons post-consumer material annually and a yield rate of 90%. The plant was installed in March of 2022.

We procure the following MRF grades beginning April 2022

- 600,000 lbs per month Polypropylene bales

The following items are acceptable in these incoming bales:

- **Polypropylene (PP) cups and containers**, including drink cups, deli tubs, clamshells, takeout dishes and lids and other PP thermoformed or injection molded containers

As an end market for these materials with expanding demand from our customers Green Rhino Recycling wants to encourage the inclusion of these items in the statewide list to ensure an adequate supply to feed our growing operation.

Thanks very much for your consideration. We are happy to provide follow-up information upon request.

Best Regards,

Steven Green
253-285-8880
Green Rhino Recycling
12700 SW Hall Blvd unit E
Tigard OR 97223



MARCH 20, 2022

OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY

Re: Request for Information on Oregon Statewide Recycling Collection List

Dear DEQ Technical Workgroup and Rules Advisory Committee,

PreZero US would like to register support for the inclusion of certain foodservice packaging **items on the "Uniform Statewide Collection List"**. **PreZero US is located in Los Angeles, CA** and we are an end market for post-consumer materials sourced from Material Recovery Facilities (MRFs). We currently source grades A & B of plastic film (LDPE/LLDPE) and mixed rigid plastics (HDPE, PP) to produce the following output: LDPE, PP and PE resins (all 100% certified post-consumer) with a capacity of 60,000 tons annually and a yield rate of at average 80% across the 3 grades.

We are currently procuring the following MRF grades

- **7mm lbs. of Mixed Rigid Plastic Bales (#'s 2-7)**
- 5mm lbs. of Mixed Rigid Plastic **Bales (#'s 3-7)**
- 12mm lbs. of A Grade Plastic Film Bales (#4)
- 12mm lbs. of B Grade Plastic Film Bales (#4)

The following food service packaging items are acceptable in these incoming bales:

- Polypropylene (PP) cups and containers, including drink cups, deli tubs, clamshells, takeout dishes and lids and other PP thermoformed or injection molded containers

As an end market for these materials with expanding demand from our customers PreZero US wants to encourage the inclusion of these items in the statewide list to ensure an adequate supply to feed our growing operation.

Thanks very much for your consideration. We are happy to provide follow-up information upon request.

Best Regards,

Hendik Dullinger
VP – Business Development
Hendrik.dullinger@prezero.us
(703) 424-6295

Martin Vogt
President & CEO
EFS-plastics Inc.
5788 Line 84, Listowel, ON, Canada N4W 3G9
519-418-3377 ext. 3101
Martin.vogt@efs-plastics.ca

March 18, 2022

OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY

Re: Request for Information on Oregon Statewide Recycling Collection List

Dear DEQ Technical Workgroup and Rules Advisory Committee,

EFS-plastics Inc. would like to register support for the inclusion of certain foodservice packaging items on the "Uniform Statewide Collection List". EFS-plastics Inc. has three facilities in North America, including a new facility in Lethbridge, Alberta, and we are an end market for post-consumer materials sourced from Material Recovery Facilities (MRFs). We have been purchasing #3-7 mixed plastic from Oregon MRFs since 2019 to process at our facility in Listowel, Ontario, as our throughput capacity has grown rapidly in recent years. At our new Lethbridge facility, we are sourcing post-consumer olefins (mostly in the form of #3-7 or #1-7 commodity bales) to produce various grades of 100% PCR PP and PE pellets. We currently have a total capacity to process 55,000 metric tonnes post-consumer material annually.

We would like to take this opportunity to highlight how important it is to us to grow the supply of polyolefins (in particular PP) collected from households. As a recycler, we are seeing demand grow for PCR PP and PE over the next few years, and we are looking far and wide to get access to more material. We know there is a large volume of PP and PE that is not being appropriately collected or sorted in the Pacific Northwest and is unfortunately ending up in landfill. EFS-plastics is very eager to continue working with communities and MRFs in Oregon to incentivize them to keep these materials in circulation.

We procure the following MRF grades:

- 25,000 tonnes of #3-7 or #1-7 mixed rigid plastic
- 20,000 tones of Grade A-C and MRF-grade film
- 5,000 tonnes of PP/Tubs & Lids
- 5,000 tonnes of HDPE

The following foodservice packaging items are desirable in these incoming bales:

- Polyethylene Terephthalate (PET) Cups and Containers, including drink cups, clamshells, bowls, trays and other thermoformed containers
- Polypropylene (PP) cups and containers, including drink cups, deli tubs, clamshells, takeout dishes and lids and other PP thermoformed or injection molded containers

The following foodservice packaging items are acceptable in these incoming bales (i.e., we are happy to accept them because we can easily sort them from other materials, and it makes it easier for MRFs to recover more material that we do want.)

- Rigid Polystyrene (PS) cups and containers, including drink cups, clamshells, sandwich boxes and other thermoformed containers
- Expanded Polystyrene (EPS or Styrofoam) cups and containers, including drink cups and clamshells

As an end market for these materials with expanding demand from our customers, EFS-plastics wants to encourage the inclusion of these items in the statewide list to ensure an adequate supply to feed our growing operation.

Thanks very much for your consideration. We are happy to provide follow-up information upon request.

Best Regards,

A handwritten signature in blue ink, appearing to read 'Vogt', with a long horizontal stroke extending to the right.

Martin Vogt
President & CEO



March 20, 2022

State of Oregon
Materials Management Division
Department of Environmental Quality
700 NE Multnomah St., Suite 600
Portland, OR 97232

Comments for Section 22 - Oregon Statewide Recycling Collection List (Oregon Plastic Pollution and Recycling Modernization Act)

On behalf of the Glass Packaging Institute (GPI), I offer the following comments and perspective on the benefits recycled glass brings to Oregon, as the Department considers packaging and materials for inclusion on the statewide commingled recyclables collection list. This information is background for our continuing engagement with the Department and other stakeholders on the list, and how the EPR program is shaped in the coming months and years.

When glass container plants increase the amount of recycled glass added to the raw materials used to make glass (sand, soda ash and limestone), furnace temperatures can be reduced, resulting in less energy use and lower greenhouse gas emissions. This is a win for the glass companies with respect to energy costs, as well a win for consumers and Oregon's goals to reduce greenhouse gas emissions.

As long recognized by the Department, the environmental benefits of reusing recycled glass in Oregon (in contrast to landfill disposal), outweigh the impacts associated with raw materials extraction. By weight, glass containers on average comprise 25% of a curbside recycling program's volume. Consumer surveys conducted by the [Glass Recycling Coalition](#) over the past several years have also demonstrated that residents overwhelmingly expect to be able to recycle glass containers.

Section 22 Statutory Criteria

As GPI reviewed the statutory criteria to be considered for the commingled collection list, we noted a number of key markers that glass in Oregon meets to be included in the primary list of materials to be recycled, including: the environmental and health benefits, viable, stable and mature end markets, the compatibility of the state's infrastructure, the ability of waste generators to easily identify the material, environmental factors from a life cycle perspective, the amount of material available for markets and the value of properly sorted recycled glass.

While a majority of Oregon's glass is collected in the states beverage container deposit program, the remaining glass only presents an issue in commingled single-stream recycling destined to materials recovery facilities (MRFs) lacking proper investment and/or sorting technologies. Through the Glass Recycling Foundation (GRF), GPI is actively engaged with MRFs through certification and educational outreach to improve the quality of glass being collected and sorted.

Glass enjoys a strong manufacturing base in domestic marketplaces, for many Oregon recycling companies, and throughout the country. As the Department may know, GPI member company, O-I Glass operates a bottle manufacturing plant in Portland, servicing beer and wine brands, and is a partner in a glass sorting and processing company called Glass to Glass, which provides high-quality recycled glass to the O-I plant.

O-I Glass purchases nearly 100,000 tons of recycled glass collected through a variety of programs throughout the state of Oregon. These programs include the Oregon Beverage Recycling Cooperative and its bottle bill program, dual-bin collection programs in many parts of the state, and importantly, glass collected through single-stream (commingled) collection.

O-I estimates that roughly 50,000 tons of recycled glass is collected in a residential, curbside manner, including commingled collection and glass on the side. Both O-I and Glass to Glass have significantly invested in sorting and other cleaning equipment to help ensure commingled glass can be re-melted in their furnace to make new bottles.

The viability of this important facility, which is a key cog in the beer and food industry, depends on quality recycled glass purchased from Oregon's recycling programs. Importantly, a portion of the commingled recycled glass used at the O-I plant comes from outside of the Portland/metro region.

Glass from Oregon that is processed through the state's processing facilities has circular end markets in Oregon, as well as plants in neighboring Washington and California. Increasing the amount of glass collected helps meet diversion goals for the State, improves feedstock desired by industry and increases recycled content levels for food and beverage packaging, helping them meet their sustainability goals.

Maintaining a viable non-deposit glass recovery and recycling program is necessary, given the state's allowance for the wine and spirits industry to consider its options to become a part of the deposit program, or participate in the new EPR PRO. It also will help capture food jars and other glass packaging not covered within the deposit program.

The Glass Packaging Institute and its members have an interest in seeing the glass recovery and recycling system in Oregon remain strong and set the standard for other states considering extended producer responsibility packaging laws.

GPI points to the expansion of the Glass Recycling Coalition's www.glassrecycles.org MRF Glass Certification program, for best practices related to glass recycling in single-stream MRFs.

The nearly dozen MRFs that have been recognized for that program are evidence that glass can be handled well in commingled single-stream programs. The state PRO could determine that glass can be included in the commingled list.

At a minimum, glass needs to be included in the statewide recycling list and uniform collection lists and should be studied as a part of the commingled program.

Commingled are not necessarily limited to a single commingled stream. Virtually no European or Canadian EPR programs rely on single stream commingled recycling for their collection systems, and since Oregon already has one of the stronger state recycling systems in the US, it seems possible the PRO may conclude that an additional collection bin could provide more efficient incremental improvement to achieve the state's recycling goals.

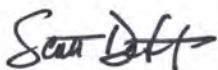
There could be two "technically" commingled collections – one for paper, cardboard and fiber products, and another for rigid containers that are not under deposit. It is possible that glass could work in that system.

It is also possible that glass may be best served in a hybrid of separate "glass on the side" programs in more densely populated areas of the state, with an extensive drop-off or hub and spoke recovery programs in the Southern and Eastern parts of Oregon.

The GPI and industry have been studying a set of similar solutions for Eastern Washington and related rural "wine country" collection programs as a part of policy stakeholder meetings in Washington and California. The industry asks to remain an active participant in further dialogue, as the DEQ moves along to the next stage of the EPR rulemaking and stakeholder dialogue.

Thank you for your thoughtful consideration of our comments. Please reach out with any questions or comments you may have.

Sincerely,



Scott DeFife
President

March 18, 2022

Oregon Department of Environmental Quality

PET thermoform recycling. The National Association for PET Container Resources (NAPCOR) appreciates the opportunity to provide data that may assist the Oregon Department of Environmental Quality (DEQ) evaluate materials for inclusion in statewide recycling lists, which are being developed in accordance with Section 22 of Oregon’s Plastic Pollution and Recycling Modernization Act (Senate Bill 582). We can share proprietary data that may assist the Department’s implementation of the new regulations, particularly regarding PET thermoforms. PET thermoform recovery continues to grow as demonstrated by our annual PET Recycling Report (Figure A below). This annual report utilizes survey data directly reported by all PET reclaimers operating in the US and Canada. Our work to increase recovery of thermoforms dates back over a decade, yielding in recent years a substantial increase in PET thermoform recovery with reclamation of these packages doubling since 2016.

Oregon’s contribution. Although we do not collect state-specific data (we survey all reclaimers in the US and Canada but do not ask feedstock origin in our questionnaire), we have been able to estimate PET thermoform recovery in California (a bottle deposit state collecting PET thermoforms in curbside programs) using CalRecycle sort analysis of their Grade B PET bale (curbside mixed collection). Incorporating CalRecycle sort data applied to total PET shipped to reclaimers from Grade B bales we estimated 9.5 million pounds of PET thermoforms were recycled, or about 10% of all PET thermoforms recycled nationally in 2019. Although population differences would impact the quantity of PET thermoforms recovered in Oregon, we can anticipate an Oregon program similar to California (bottle deposits plus curbside collection of PET thermoforms) would yield a notable stream of PET thermoforms for reclaimers searching for additional supplies.

Recycled PET short supply. Recycled PET supply to final markets is short throughout North America illustrated by sharply elevated PET bale prices. Although Oregon does an excellent job collecting PET bottles through its deposit program, it is the exception and not the rule in post-consumer bottle recovery. Only ten states have deposit laws, resulting in a US bottle collection rate of only 27% (2020 data). End-markets for recycled PET are diverse with applications in carpet, textile, strapping and packaging applications. Weak post-consumer bottle collection coupled with sharply growing recycled PET end-markets amplifies the need to collect all PET packaging formats.

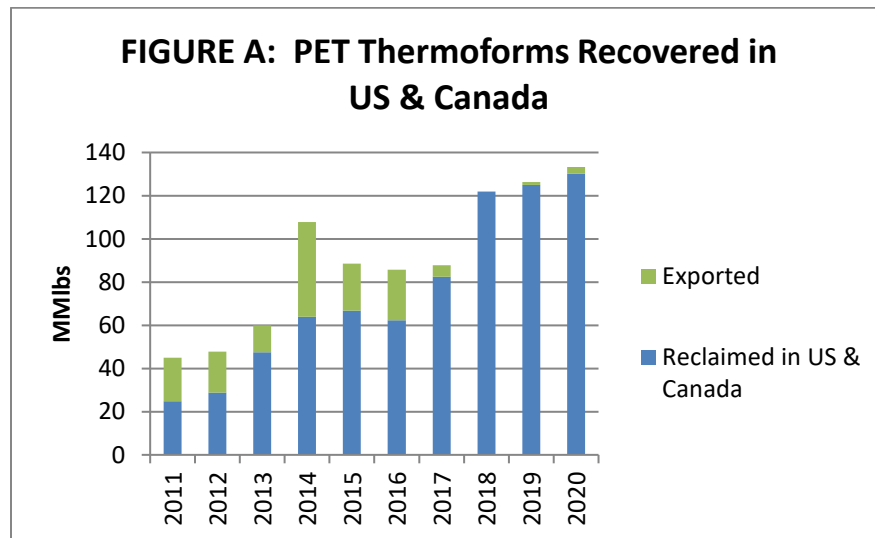
Advances in thermoform recycling. Although PET thermoforms are more difficult to recycle than bottles, particularly for reclaimers focusing on “bottle-to-bottle” markets, short supply plus process improvements and technical advances in reclamation equipment have stimulated recyclers to make significant increases in thermoform recycling in recent years. On average, PET reclaimers in the US accept thermoforms at levels up to 10-15% with baled bottles for processing into a variety of end-use markets. More recently, markets for postconsumer PET thermoform-only material have emerged, with multiple buyers on the west coast seeking PET thermoform-only bales, including supplies from Ridwell in Portland. With more consumer education around PET thermoform recyclability and a deliberate push to include in curbside bins, the potential recovery increase is even greater. Total annual generation of PET thermoforms available for recycling in the US is estimated at 1.8 billion pounds.

Thermoform to thermoform recycling. We are also encouraged that several producers of PET thermoform packages have introduced new specifications requiring postconsumer PET thermoform content in their packages. Data from our recent 2020 PET Thermoform Market Analysis yielded a total of

14.5 million pounds of post-consumer thermoform recycled PET used by the sheet and thermoform community in 2020.

NAPCOR is a non-profit trade association representing the polyethylene terephthalate (PET) plastic packaging industry. PET is the most recycled plastic and identified by the number 1 resin identification code. Common applications using PET material include beverage bottles, thermoforms, cups and trays. Our membership encompasses the PET supply chain, including raw material suppliers, container producers, PET reclaimers and equipment suppliers.

Thank you for the opportunity to provide input on this important decision and please feel free to ask additional questions.



Best regards,



Darrel Collier
Executive Director NAPCOR
Phone: (704) 241-1631 | Email: dcollier@napcor.com

Inclusion of Fiber Cups on Oregon's Recycling List

Request for Information: Section 22 of Oregon's Plastic Pollution and Recycling Modernization Act (Senate Bill 582)

3.18.2022

Introduction

This letter is a submission to a Request for Information (dated February 3, 2022) issued by the Oregon Department of Environmental Quality to solicit information to evaluate the inclusion (or exclusion) of new materials on statewide Oregon recycling lists. These lists are being developed in accordance with Section 22 of Oregon's Plastic Pollution and Recycling Modernization Act (Senate Bill 582).

The [NextGen Consortium](#), a program of the Center for the Circular Economy at Closed Loop Partners with founding partners Starbucks and McDonald's, offers this letter to provide evidence that supports the inclusion of fiber cups on Oregon's recycling lists – which we understand will be revised on July 1, 2025. Fiber cups generally contain a thin polyethylene barrier – on the inside for hot cups and on both sides for cold cups. As we write below, the liner is increasingly not an impediment to recycling fiber cups and accessing the high-quality fiber contained in them.

Support for Including Fiber Cups

Formed in 2018, the NextGen Consortium is a multi-year, global consortium that aims to address single-use foodservice packaging waste by advancing the design, commercialization, and recovery of packaging alternatives. The Consortium works across the value chain – with brands, municipalities, material recovery facilities (MRFs), and manufacturers – to ensure we provide viable market solutions that scale throughout the supply chain and bring value to recovery systems. More information about the Consortium can be found here: www.closedlooppartners.com/nextgen.

Since the Consortium's inception, we have been working to increase the number of cities, MRFs, and paper mills that accept and process cups. Through this, we have spoken with dozens of subject matter experts across the recycling value chain and can offer the following perspectives:

- **A growing number of US cities and counties are adding cups to their lists of acceptable recycling items.** A number of major US cities [Atlanta](#), [Detroit](#), [Seattle](#), [San Francisco](#), [Denver](#), [New York](#), [Louisville](#), and [Washington, DC](#), among others, accept cups, and this list will continue to grow as cities see that MRFs and mills want and can process cups. As an example, in February 2022, Rumpke, one of the nation's largest privately-owned recycling firms, [announced](#) it would accept fiber cups in its curbside and drop box programs across Indiana, Kentucky, and Ohio.
- **The fiber in cups is high quality.** From our discussions with paper mills, and in public statements, we know that the fiber in cups is [high quality](#) and can help offset declining volumes of other paper types.
- **A growing number of paper mills can [process fiber cups](#).** According to the Foodservice Packaging Institute (FPI), as of January 2022, [there were 28 mills that](#) accept cups in bales of mixed paper (mills that represent more than [75% of mixed paper demand](#)) and five that accept cups in bales of aseptic and gable top cartons. These mills can separate the polyethylene liner so that the valuable fiber can be captured at high rates (above 85% of the fiber). As one can see on the [FPI map](#), there are no mills in Oregon or on the West coast that currently accept cups. However, based on recent conversations, we anticipate that there will be mills/end markets on the West coast that accept cups in the near future (well before July 2025).
- **Cups can be effectively captured by MRFs.** The Consortium has partnered with several MRFs to conduct flow studies to better understand how cups flow through a MRF environment. Based on this work, we know that cups can be diverted to mixed paper or polycoated bales through technology (e.g. optical sorters, robotic sorters, etc.) or manual effort.
- **Contamination is generally not an issue.** While some stakeholders have voiced concerns about fiber cups introducing contamination such as liquids and food into MRFs and mills, our discussions and tests with MRFs and mills indicate that contamination is not a significant challenge. Liquids typically drain from cups along the journey from consumer to MRF, and while some consumers might put waste into a cup (e.g. plastic wrappers), this does not cause an issue for reprocessing at the mills. This issue was raised in a recent [report](#) on cup recycling by FPI.

- **Fiber cups are a relatively small percentage of waste and recycling streams in the United States and Oregon.** According to a 2014 waste characterization [study](#) in Seattle and New York, food service packaging (including hot and cold cups) represented less than 0.5% of mixed paper bales in each city. Cups alone (hot and cold) were roughly 0.25% of the stream in Seattle and 0.04% in New York. According to a 2016/17 waste characterization [study](#) in Oregon, “other polycoated paper”, which includes cups along with other formats including foodservice packaging and frozen food boxes, represented 1.08% of the total waste stream.

Recommendation on Fiber Cups

Based on our experience, which we have summarized above, we recommend that fiber cups are considered for inclusion on Oregon’s uniform statewide collection list.

While cups will remain a small percentage of waste overall, they are a visible sign of waste for consumers. There are also a growing number of food and beverage brands and retailers that are motivated to find recycling solutions for the single use cup.

We would be happy to speak with the DEQ to answer any questions you might have about our experience. Contact information follows.

Contact Information

Daniel Liswood

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Inclusion of Polypropylene Cups on Oregon's Recycling List

Request for Information: Section 22 of Oregon's Plastic Pollution and Recycling Modernization Act (Senate Bill 582)

3.18.2022

Introduction

This letter is a submission to a Request for Information (dated February 3, 2022) issued by the Oregon Department of Environmental Quality to solicit information to evaluate the inclusion (or exclusion) of new materials on statewide Oregon recycling lists. These lists are being developed in accordance with Section 22 of Oregon's Plastic Pollution and Recycling Modernization Act (Senate Bill 582).

The [NextGen Consortium](#), a program of Closed Loop Partners with founding partners Starbucks and McDonald's, offers this letter to provide evidence that supports the inclusion of polypropylene (PP) cups on Oregon's recycling lists – which we understand will be revised on July 1, 2025.

Polypropylene (PP), also referred to as #5 plastic, is a commonly used plastic in packaging, including drink and yogurt cups.

As we outline below, there has been a lot of activity in the last several years to increase recycling of and improve outcomes for polypropylene packaging, including cups. Notably, there are the activities of the Recycling Partnership's [Polypropylene Recycling Coalition](#), of which the NextGen Consortium is a Steering Member.

Support for Including Polypropylene Cups

Formed in 2018, the NextGen Consortium is a multi-year, global consortium that aims to address single-use foodservice packaging waste by advancing the design, commercialization, and recovery of packaging. The Consortium works across the value chain – with brands, municipalities, material recovery facilities (MRFs), and manufacturers – to ensure we provide viable market solutions that scale throughout

the supply chain and bring value to recovery systems. More information about the Consortium can be found here: <https://www.closedlooppartners.com/nextgen>.

Over the last few years, we have been working to help improve the recycling opportunities for PP packaging, including cups. In addition to our [Steering-level membership](#) of the Polypropylene Recycling Coalition, we have engaged several subject matter experts across the recycling value chain and can offer the following perspectives:

- **A growing number of US cities and counties are adding PP packaging, including PP cups, to their lists of acceptable recycling items.** According to the Sustainability Packaging Coalition's [2020-21 Centralized Study of Availability of Recycling](#), 59 percent of the US population has recycling access for PP tubs and other containers (including cups).¹ This access number is also likely to increase in the coming months as a result of activities taking place in late 2021 and early 2022. As an example, in its first year, the Polypropylene Recycling Coalition's [grants to 13 recycling facilities](#) will help increase recycling access by nearly 6%.
- **Reclaimers that purchase PP and mixed plastic bales accept the PP cup.** According to a recent [study from RRS](#), as part of the [2020-21 Centralized Study of Availability of Recycling](#), reclaimers that represent 90 percent of known PP reclamation capacity, “recover and process all tubs, lids, cups and thermoforms of the same resin type together” and “did not report any formats as “prohibitive” in their systems when recovering PP” (Source: [SPC/RRS 2021/22](#)).
- **There is growing demand for recycled PP and material recycling facilities (MRFs) are investing in necessary infrastructure to help meet demand.** There has been [broad interest from domestic MRFs](#) to improve and increase capacity to collect and sort polypropylene. To date, the Polypropylene Recycling Coalition has [awarded](#) more than \$4 million in grants to 13 recycling facilities to increase capture of polypropylene packaging, which will impact roughly 15 million people nation-wide.
- **Demand for recycled plastics far outweighs supply.** According to a [report](#) from Closed Loop Partners, “Demand for plastics is strong and growing, yet the supply of recycled plastics available to meet demand is stuck at

¹ In March 2022, SPC added the [following guidance](#) regarding PP Cups: “Note of clarification added 3/2022: additional research using both expert interview and bale audits was conducted in 2021 to examine acceptance of PP Cups, Tub, and Containers. The findings of this research support the hypothesis that a false construct was responsible for a lack of clarity around acceptance of PP Cups in the 2020-21 Centralized Study of Availability of Recycling. The executive summary of the report can be found [here](#).” (Source: SPC's [2020-21 Centralized Study of Availability of Recycling](#))

6%”(Source: [CLP](#) 2019). Initiatives, like the ones described above, are helping to address this gap.

Recommendation on Polypropylene Cups

Based on our experience, which we have summarized above, we recommend that polypropylene packaging, including cups, are considered for inclusion on Oregon’s uniform statewide collection list. We would be happy to speak with the DEQ to answer any questions you might have about our experience. Contact information follows.

Contact Information

Daniel Liswood

Senior Project Director – NextGen Consortium

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Date: 03/18/2022

Subject: **Statewide collection recycling list** [per Section 22(1)(a)]
Producer-collected materials list [per Section 22(1)(b)]

In 2021, the Oregon Legislature adopted, and Governor Kate Brown signed into law, Senate Bill 582, the Oregon Plastic Pollution and Recycling Modernization Act. The Act requires numerous changes that are intended to modernize and stabilize recycling services in Oregon and further reduce the environmental impacts of certain materials across their full life cycle.

PakTech - An Oregon Based Company

PakTech is an Oregon Corporation focused on manufacturing market demanded products made from 100% recycled materials (rHDPE) and ending up with a product that itself is 100% recyclable. In 2020 alone, we utilized over 22 million pounds of rHDPE (equivalent of over 165 million milk containers) used to create the next generation of recycled products. Since PakTech elected to begin utilizing rHDPE in 2012, we have repurposed over 800 million milk containers in the production of our products, which have been shipped around the globe.

In 1998 PakTech had just over 50 employees and now has 360, fully benefited employees. We pride ourselves on providing our employees a living wage with a benefits package that is top tier for our industry. We truly believe in being a positive influence in our community and in our State.

Through extensive work PakTech has learned how to create the logistics required to locate and assemble the base recycled materials to support our manufacturing process. Unfortunately, these sources are in Vancouver, British Columbia and Los Angeles, California – not in Oregon. This means that we resort to sourcing recycled material that should be readily available in Oregon from areas that have already made the investment in infrastructure necessary to modernize their recycling programs.

PakTech's intent is to have our products materials used in conjunction with DEQ's recommendations for material to include on the uniform statewide collection list, other materials that local governments are obligated to collect for recycling as part of providing the opportunity to recycle, and the list of materials that producer responsibility organizations are required to provide recycling services for.

The following information is provided to aid in the evaluation of our product materials for consideration of inclusion for recycling, as part of the evaluation of materials against the criteria listed in Section 22(3) of the Recycling Modernization Act.

PakTech products are made from Recycled High Density Polyethylene (rHDPE)

- Statewide collection and recycling of PakTech products, be it curbside or established collection programs, already aligns with meeting the goals set forth in the Recycling Modernization Act (Senate Bill 582)
- Collection and recycling of PakTech products align with the State of Oregon's statewide recycling rate for plastic packaging goals set for 2028, 2040 and 2050 (Section 27)
- PakTech products are SCS Global Certified 100% Recycled HDPE #2 (High Density Polyethylene)
- Made from 100% Recycled Thermoplastic Polyethylene from Milk, Water, Juice and Other Un-pigmented Household Containers
- HDPE Bottle Grade fractional Melt Resin with a .955 to .965 g/cm³ Density
- Can be combined with HDPE bottles (detergent and shampoo bottles) in collections to maximize recovery efficiency.
- Can also be combined with other rigid HDPE collections for recovery efficiency
- Made of a MONO plastic being 100% HDPE with no restrictive additives or layers to hinder recyclability
- Free of toxic chemicals
- Clean and free of foreign contamination, which could cause deterioration of HDPE properties through the recycling process
- Product shape is more 3D than 2D as well as being a rigid plastic. Meets criteria established by APR for recyclability.
- Compatible with existing Oregon recycling infrastructure (Does not hinder the recycling process)
- Will not cause problems of entanglement in the sorting equipment like the flexible LDPE rings made by HiCone have been known for
- Recycled HDPE material is very well established as a viable plastic for use in many product categories and end markets such as; Pipe Industry, Building Materials, Flower Pots, Park Benches, HDPE Bottles, PakTech Handles, just to name a few...
- High demand exists for recycled HDPE plastic due to mandates and commitments across organizations and industries to incorporate 25-30% recycled content into packaging products by 2025
- PakTech alone can provide and an end-market here in Oregon for the use of 1,000 to 2,000 tons annually of recycled Mixed Color HDPE and 10,000+ tons of Natural HDPE
- Reprocessors of plastics locally in Oregon are already acquiring HDPE from Oregon's recycling stream and have additional end-markets for collected PakTech products (Denton Plastics, Northwest Polymers, Green Rhino Recycling, Merlin Plastics, etc.)
- Promotes recycling of plastics to reduce fossil fuel consumption and keep out of the environment
- Promotes circularity by keeping the material in use over and over again

We believe that realizing a sustainable world means that we all must accelerate the transition to a safe, equitable, and circular economy where people, the planet, and businesses thrive. However, reaching a circular economy for any resource, especially plastics, is a large and complex global challenge.

Google teamed up with AFARA and IHS Markit to bring big data analytics to the plastic pollution crisis. Data suggest that the circularity gap is likely going to grow significantly over the next two decades. Under a business as usual scenario, it is projected that 7.7 billion metric tons of plastics will be mismanaged—landfilled, incinerated or leaked into the environment—between now and 2040. That volume of plastic is equivalent to roughly 16x the weight of the entire human population on earth today!

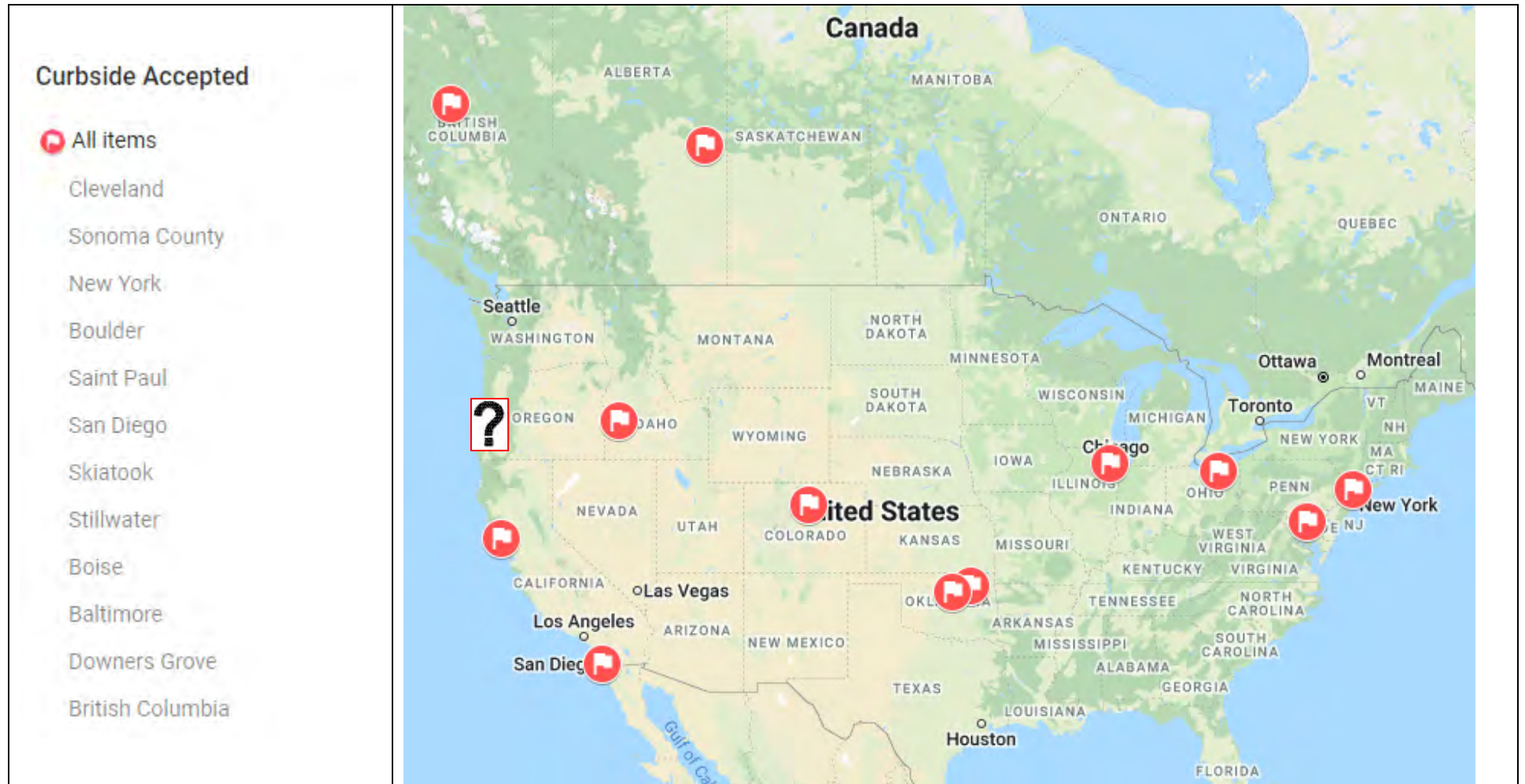
While there needs to be a portfolio approach that includes plastic reduction efforts, the biggest intervention we need to capitalize on is building better recycling infrastructure. As the world transitions from linear to circular, supply chains need to be rewired and the requisite infrastructure needs to be put in place to ensure these resources are kept in the economy and out of the environment.

We plea that you accept PakTech handles curbside. Sustainability truly underpins everything we do here at PakTech and this is the missing piece to our circular economy business model. It frustrates us that our clean HDPE product isn't accepted. Our commitment to sustainability led us to launch our own recycling program that has grown exponentially to ensure our products are properly recycled and repurposed as they should be. With that comes logistical hardships and roadblocks connecting recycling partners with Reprocessors along with the quantity of collections. We are optimistic as we see more states accepting our product curbside and this number continues to grow in the right direction. We take pride that Oregon claims to be one of the greenest states in the country but are frustrated by its limited recycling capacity. We ask that you make the right decision to accept our valuable PakTech products for the state of Oregon, our environment and for the future of a circular economy.



Current Curbside Recycling Activities with PakTech Products

Recyclers across the U.S. and Canada are realizing the benefits associated with the collections and recycling of PakTech Products and are currently being accepted in curbside collections in the following areas.



SCS Global Services does hereby certify that an independent assessment has been conducted on behalf of:

PakTech

1680 Irving Rd., Eugene, OR, US
230 Davidson Avenue, Cottage Grove, OR, US

For the following product(s):

Plastic Packaging:

Packaging Handles – Made With 100% Recycled HDPE

The product(s) meet(s) all of the necessary qualifications to be certified for the following claim(s):

SCS RECYCLED CONTENT CERTIFIED

Conforms to SCS Recycled Content Standard V7-0 for **100% Post-Consumer Recycled HDPE* Content**. The material quantification and mass-balance calculations are completed on a dry-weight basis.

**Made With 100% Recycled Plastic – High Density Polyethylene (HDPE)*

Registration # SCS-RC-06127

Valid from: May 14, 2021 to May 13, 2022



100% RECYCLED CONTENT
POST-CONSUMER HDPE

SCSglobal
SERVICES

A handwritten signature in black ink that reads "Stanley Mathuram".

Stanley Mathuram, PE, Vice President
2000 Powell Street, Ste. 600, Emeryville, CA 94608 USA

Addendum - Further Justification

We already know that plastics are replacing traditional materials, due in large part to their favorable strength-to-weight ratio that allows them to do more with less. We see that in numerous previous studies and market sectors.

Packaging – A study in the U.S. shows that if we were to replace plastic packaging with alternatives, we would dramatically increase the amount of packaging material. Alternatives would require four and a half times as much material by weight and increase the amount of packaging used by nearly 110 billion pounds annually.

Building Materials – Plastics can help save a whole lot of energy over the lives of our homes and buildings. The energy saved by using plastic materials compared to alternative materials is approximately 467.2 trillion BTU of energy a year – that’s enough to meet the average annual energy needs of 4.6 million U.S. households.

But despite measurable advances in these and other areas, the often-accepted narrative around plastics is: they are more wasteful and have greater environmental impacts than traditional materials. Is this true? While every material has environmental costs, how do plastics actually compare to alternatives?

In 2014 a study, commissioned by the United Nations Environment Program (UNEP) with Trucost, “Valuing Plastics: The Business Case for Measuring, Managing and Disclosing Plastic Use in the Consumer Goods Industry.” That study found that the “total natural capital cost of plastic used in the consumer goods industry is estimated to be more than \$75 billion per year.” The cost comes from a range of environmental impacts such as effects from marine litter and the loss of valuable resources when used plastics are sent to landfills rather than recycled.

In 2016 the American Chemistry Council commissioned an independent study by the same environmental consulting firm Trucost that looks at the broad environmental costs of using plastics in consumer goods compared to other materials. This new study, “Plastics and Sustainability: A Valuation of Environmental Benefits, Costs and Opportunities for Continuous Improvement,” provides that perspective. The report’s authors call it the largest natural capital cost study ever conducted for the plastics manufacturing sector.

The new study expands upon the initial study by including transportation as part of the life cycle of products and packaging. Most notably, it compares the environmental cost of using plastics in consumer products and packaging to the cost of replacing plastics with alternative materials.

The findings

When compared to alternatives, the new study found that the environmental cost of using plastics is four times less than the costs of other materials. Substituting plastics in consumer products and packaging with alternatives that perform the same function would increase environmental costs from \$139 billion to \$533 billion annually.

One of the likely reasons for these findings, as mentioned above, is the comparable strength-to-weight ratio of plastics. Alternative materials such as glass, tin, aluminum, and paper can be viable alternatives to plastics in many consumer goods applications. But a greater amount of these alternative materials typically is needed to accomplish the same objective. Similar to the findings in the packaging study above, this new study finds that alternatives require 4 times more material by mass on average.

In other words, using more material typically translates into higher environmental costs.

As it turns out, plastics are extremely efficient materials. Because they are both strong and lightweight, they allow us to do more with less in the 16 market sectors reviewed in the study... and in just about every aspect of modern living.

Even though plastics have significantly less impact on the environment than alternatives, the study identifies numerous opportunities to reduce that impact. These steps include increasing the use of lower-carbon sources of energy upstream, adopting lower-emission transport modes, developing even more efficient plastic packaging, and increasing recycling and energy recovery to help address ocean litter and conserve resources.

To help reduce plastics leakage into the marine environment, the study also highlighted the importance of expanding waste management infrastructure globally, particularly in Asia where other studies have determined 75 percent of marine litter originates.

The study also called for enhanced environmental leadership by the plastics industry, noting that the industry has “direct influence, or indirect influence via its supply chain management practices, over a significant share of the environmental costs of plastic use in consumer goods sector, and other sectors. Thus the industry is well positioned to play an enhanced leadership role in driving improvements in the environmental performance of the plastics value chain.”

This study represents the clearest and most comprehensive picture to date of the relative environmental costs and benefits of plastics compared to alternative materials. And by providing a path forward to further reduce these relative costs, the study provides insights for corporate decision makers, policy makers, and environmentally minded people into how plastic materials can further contribute to sustainability.

From the invention of plastic in the late 1800s to the introduction of Tupperware® in the 1940s to the latest innovations in easy-dipping ketchup packets, plastics have played an integral role in smart packaging solutions that help us do more with less. Whether it's your new electronic gadget, your favorite beauty product, or how you store lunch, plastic packaging helps protect your purchases until you're ready to use them, and that helps to reduce waste and save energy.



March 21, 2022

Mr. Dan Allaway
Project Manager
Department of Environmental Quality for Oregon

VIA EMAIL: rethinkrecycling@deq.oregon.gov

RE: Oregon Plastic Pollution and Recycling Modernization Act (Senate Bill 582)
Polypropylene – Material Technical Information Submission

Dear Mr. Allaway,

Thank you for the opportunity to provide input to the Oregon Department of Environmental Quality's (DEQ)'s request for technical information to be considered as part of the DEQ's responsibility for developing recommendations for inclusion (or exclusion) of materials from statewide recycling lists to be developed under Section 22 of Oregon's Plastic Pollution and Recycling Modernization Act (Senate Bill 582) ("SB 582"). We appreciate DEQ's interest in receiving input on an issue that will have significant impact on Oregon's efforts to develop a sustainable, meaningful recycling program designed to incentivize innovation, demands accountability, and will address plastic pollution. PureCycle Technologies is a pre-commercial operations company bringing innovative, disruptive polypropylene ("PP") recycling technology that will enable manufacturers to fabricate products using 100% recycled material.

PureCycle's patented solvent-based plastic purification process removes additives, colors, and odors from waste plastic resulting in an ultra-pure recycled (UPR) resin with nearly all the same applications as virgin plastic. Our UPR resin has a significantly broader application than mechanically recycled PP and does not require a chemical reaction to repurpose the waste plastic (as does pyrolysis and other chemical recycling processes). No one else is currently bringing a technology like ours to the market and we believe it will enable companies to design PP products that can be part of a circular economy.

We believe PP should be among the materials the DEQ recommends to the Environmental Quality Commission because market demand is solid and growing and our PP recycling technology will result in a substantially lower impact on the environment, including less greenhouse gas generation, than virgin production. PureCycle's commissioned independent, third party life cycle analysis ("LCA") of our UPR resin production process shows definite savings in both GHG emissions and fossil fuel consumption in comparison to prime PP. Currently we believe approximately 17 billion pounds of PP are produced today and based on our estimates we believe approximately 2.3 billion a year can be recycled and hope to create a market for half that. For example, PureCycle: has an anchor customer with Procter & Gamble ("P&G"), who invented this technology; has preprocessing that sorts and captures the other resins for resale, as opposed to ground and sorted in a wash process deeming them unrecoverable; has technology that can make a food grade recycled pellet; is interested in all forms of PP, not just packaging, including items like pill vials, hangers, super sacks and automotive residue – bringing new value opportunity to these post-use items.



After licensing the PP purification technology from P&G 2012, PureCycle continued its development and has spent the last four years proving the technology out through a pilot plant we built in 2019. After a series of raising capital, we are now developing a billion pounds of domestic capacity in the U.S. over the next three years, starting with our first commercial-scale operation in Ironton, Ohio. This plant is slated to be operational by the fourth quarter this year with over 100 million pounds of capacity. A second plant with two purification lines is breaking ground March 22, 2022, in Augusta, Georgia with an estimated 260 million pounds per year capacity. We have plans to keep building lines and plants as committed to our customers and investors through 2025 until we reach our billion pounds recycling capacity. Locations for these facilities, including locations in the western U.S., will be dependent on availability of supply. Our business model is extremely dependent on a growing PP recycling infrastructure, not a declining one.

Any efforts to decrease PP waste collection could undermine key domestic recycling technology innovation investments, like ours, in the U.S. and actually result in lower recycling rates. Polypropylene is the most versatile resin produced – with applications in almost every format of packaging, durable goods and fibers and fabrics. The fact it has not had a large stream of natural or clear consistent monotype packaging like PET has with beverage bottles as well HDPE with milk, water and juice bottles, has inhibited the growth of PP recycling until now. PureCycle's technology takes the colorants and additives out without breaking the molecular chain of the polymer. In other words, our technology allows the packaging industry to use our 100% recycled UPR resin nearly all the same products as virgin PP – regardless of whether the waste PP was from carpet, a car or a package.

PureCycle is committed to being a significant resource for recycled PP resin, but we need post-use, waste PP to produce UPR resin. To reach our billion pound per year goal, we need to procure approximately 2.5 times more waste PP from across the U.S. than what is currently being collected in MRF's (multi recovery facility) today. We need your help, to it. We would welcome the opportunity to discuss with the Oregon DEQ staff and the Environmental Quality Commission how PureCycle can be a part of, and support, Oregon's efforts to ensure an efficient and effective PP and other plastic recycling program. If you have any questions regarding our technology or expansions, I will be happy to facilitate a call through The Recycling Partnership and ourselves.

Sincerely,

Tamsin Etefagh
Chief Sustainability Officer



125 Rowell Court
Falls Church, VA 22046

RECYCLINGPARTNERSHIP.ORG

Response to Request for Information: Oregon Statewide Material Recycling Collection List

The Recycling Partnership
3/18/2022

The Recycling Partnership is pleased to submit this response to Oregon DEQ's Request for Information (<https://www.oregon.gov/deq/recycling/Documents/MaterialList-Rfl.pdf>) regarding a statewide material recycling collection list. This response provides detailed information on polypropylene packaging and additional general input on three other materials: PET thermoform packaging, pizza boxes, and paper cups.

Thank you for the opportunity to submit this information. Any questions or needed clarifications regarding The Recycling Partnership's input can be addressed to Scott Mouw at smouw@recyclingpartnership.org or Liz Bedard at ebedard@recyclingpartnership.org

Material Focus: Polypropylene

Based on the technical criteria submitted below, The Recycling Partnership urges Oregon DEQ to include polypropylene container packaging on its statewide recycling collection list. Polypropylene (PP) is an established and growing packaging material used in a variety of formats. PP containers are generated at levels comparable to other common recyclables and are proven to be sortable at MRFs. PP also has proven domestic markets, which will be further strengthened by the market dynamics of brand company content goals and state-level content requirements. Our technical input for Section 22 criteria is presented below:

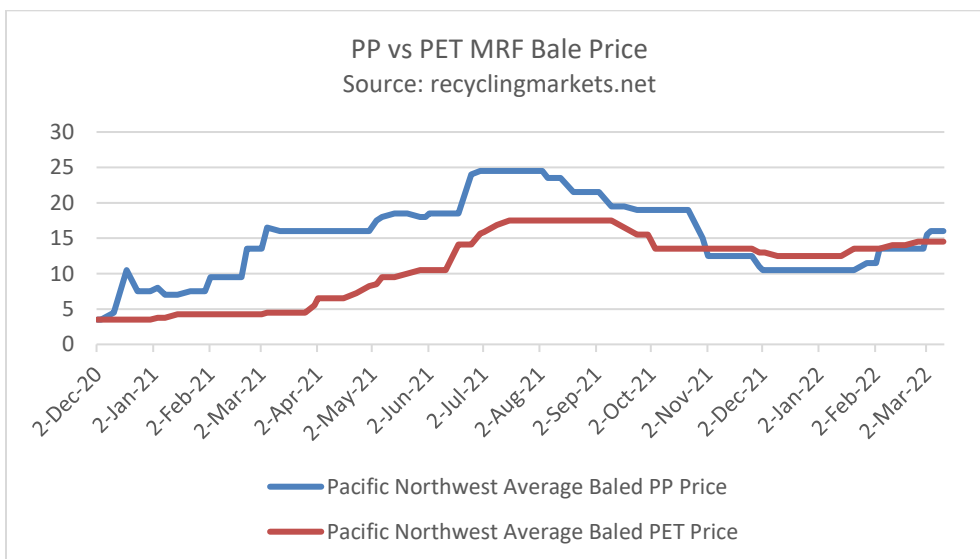
(a) The stability, maturity, accessibility, and viability of responsible end markets

Market price data is an important indicator of a material’s recyclability status. Price data from recyclingmarkets.net displays a notable and sustained rise in pricing for sorted and baled PP since December 2020. Although West Coast pricing lags stronger pricing for other regions, Pacific Northwest regional pricing provides solid evidence of market demand.

Figure 1 below compares PP pricing with PET for the Pacific Northwest. We recognize that much of PET is collected through deposit in Oregon, but for the PET that does go through MRF processing, PP prices track positively with this established commodity, in most months exceeding PET pricing. It is important to bear in mind that recyclingmarkets.net reports prices as “picked up” (freight-on-board at MRFs) so it encompasses the price effects of freight. PP has enjoyed an average market price \$300/ton over the last 14 months, well exceeding typical MRF processing costs of around \$90/ton and providing a robust return-on-investment case for the sortation of this material.

As with all recyclable commodities, PP could see price swings over the coming years. However, long-term market fundamentals, in particular regarding brand commitment to recycled content in PP packaging (discussed further below), provide a foundation of market value for PP.

Figure 1: Pacific Northwest PP vs PET MRF Bale Price



Oregon does not have in-state PP reclamation capacity and in general West Coast domestic recycling capacity for PP is not currently as well developed as it is in other parts of the U.S. However, that could change as PP becomes a mainstream acceptable plastic on par with PET and HDPE and as supply grows that in turn spurs and justifies PP reclamation investment. Some West Coast reclaimers for PP are indicating plans to add equipment to accommodate more PP feedstock and other recent developments demonstrate additions of reclamation capacity in Western states.¹ If PP feedstock is not available because of exclusion from Oregon or other West Coast collection lists, it could undermine potential reclamation development.

It is important to also note that PP is a commodity with established national market specifications. The Institute of Scrap Recycling Industries (ISRI) includes a marketable commodity standard for PP that incorporates quality considerations in its Scrap Specifications Circular: <http://www.scrap2.org/specs/40/>

(b) Environmental health and safety considerations

The Recycling Partnership has no technical input on this criteria.

(c) The anticipated yield loss for the material during the recycling process

As with any other material, PP can be lost in MRF processing when it is not targeted as a sortable commodity. However, applicant submittals to The Recycling Partnership’s Polypropylene Recycling Coalition grant program show that PP yield loss to residue or to lower value mixed plastics can be effectively addressed.² Figure 2 displays data on four of the first PP Recycling Coalition grant recipients that provides strong evidence of success in establishing PP as a specific sorted material.

Figure 2: Creation of Sorted PP Tonnage by Polypropylene Recycling Coalition Grant Recipients

MRF	PP Loss Pre-Grant Project	Technology/Approach Deployed to Address PP Loss	Annualized tonnage of new PP capture
MRF 1	PP not formally accepted; 40% of incidental PP sorted to low value mixed plastic and 60% lost to disposal	PP now formally accepted; Robotics applied on new plastic conveyor line	564 tons per year of sorted PP
MRF 2	PP sorted to low value mixed plastic	Optical sorter dedicated to PP sortation	563 tons per year of sorted PP
MRF 3	PP not formally accepted; incidental PP lost to disposal	PP formally accepted; Robotics applied on retrofitted conveyor	447 tons per year of sorted PP
MRF 5	PP treated as a contaminant and discarded in residue	Optical sorter dedicated to PP sortation	260 tons per year of sorted PP

¹ An indication of positive momentum in olefin reclamation investment in the West is found in the announcement of a Polymer Center by Republic Services, which also operates the MRF in Bend, OR: <https://resource-recycling.com/plastics/2022/03/01/republic-services-moves-to-vertically-integrate-in-plastics/>

² The Polypropylene Recycling Coalition is an industry collaboration bringing together stakeholders across the polypropylene (PP) value chain – resin suppliers, manufacturers, consumer packaged goods, and recycling processors – to improve polypropylene recovery and recycling in the United States and further develop the end-market of high-quality recycled polypropylene. The Coalition has released \$5.33 million in total funding committed to date in 17 grants covering 18 MRFs, with a projected increase in national PP recycling access rate of 6.4%.

The PP Recycling Coalition continues to offer grants to facilitate MRF PP sortation. To date, 18 facilities have received funding and projects are underway. We anticipate grantee reports will continue to demonstrate that investment in PP sortation equipment can effectively address MRF yield loss and deliver solid economic returns.

Little data is available on reclaimer yield loss. As with PET, reclaimers received commodity bales that contain materials that will not be converted to a final “pure” flake or pellet. Private estimates indicate reclamation bale yield loss for PP to be around 33%, which is comparable to PET. It must be noted that maximizing yield is in the business interest of reclaimers and even with this yield loss, the recycling of PP is economically proven.

(d) The material’s compatibility with existing (Oregon) recycling infrastructure

A review of Web-posted information by Oregon-based MRFs reveals mixed results for PP acceptability currently. One Portland area MRF accepts “plastic containers” that includes “#5 – Plastics – Dairy tubs.” Indirectly, community acceptance lists indicate MRF acceptance of PP in the Bend/Deschutes County area. Although most other Oregon-based MRFs focus acceptance on “bottles only” or “bottles and jugs,” acceptance by two MRFs indicates strong potential for broader PP acceptance, which is reinforced by PP acceptance at the MRF in West Vancouver, WA (significantly, 80% of Washington state MRFs show PP acceptance).

These data points demonstrate a baseline level of compatibility for PP with existing recycling infrastructure in Oregon and the Pacific Northwest. As The Recycling Partnership has found with its PP Recycling Coalition grant program, compatibility is dynamic and can be built through capital interventions in MRFs that did not previously have PP sortation capability. PP was largely incompatible with the State of Ohio’s recycling infrastructure until Coalition granting created a change in MRF sorting capacity that now makes PP accepted across the majority of households in the state.

The Recycling Partnership has created a Web-search platform that tracks and characterizes material acceptance in recycling programs across the U.S. A review of the information in this database indicates that PP is already accepted in geographic areas covering 60 percent of single family Oregon households. While there is little reference to PP or #5 plastics specifically, formats described in text and imagery demonstrate that main PP formats are accepted. This is another indicator of baseline compatibility for PP with Oregon’s recycling infrastructure. A review of the database for the State of Washington reveals 72 percent PP acceptance for single family homes, a clear sign of regional compatibility. With this level of baseline acceptance, failure to add PP to the state list will confuse consumers who are already enjoying access, potentially undermining public trust in the recycling system.

(e) The amount of the material available

The Recycling Partnership conducts capture studies examining parallel samples of waste and recycling streams that allow us to project commodity-specific household material generation. PP is a common consumer packaging material that is present in household generation at levels comparable to or exceeding other plastic materials commonly accepted for recycling.

Figure 3 provides the overall averages from capture study data ranking plastic containers in single family households on a per household basis. The Figure further uses this data to extrapolate tonnage for Oregon based on the state’s single family household numbers. It shows that PP packaging ranks second among common plastic recyclables in pounds/household and in projected tonnage for the State of Oregon. It ranks highest of materials

not typically covered by deposit and is generated at rates 69% higher than HDPE natural bottle and 26% higher than colored HDPE bottles.

Figure 3: National Average Single Family Household PP Generation Rates Compared to PET and HDPE

Material	Average Pounds/Household/Year	Extrapolated Tonnage for Oregon Single Family Households
PET Bottles	54.8	33,839
Polypropylene Packaging	19.8	12,226
HDPE Colored Bottles & Jars	15.7	9,695
Non-bottle PET packaging	11.7	7,225
HDPE Natural Bottles & Jars	11.7	7,225

If half of the estimated PP were captured and marketed as bales from Oregon MRFs, using 15 cents/pound a base price, it would equate to \$1.83 million in MRF commodity revenue per year.

In 2019, The Recycling Partnership supported a capture study for the Portland Metro area that included detailed sortation of PP packaging types. Figure 4 presents this data, showing a per household number smaller than indicated above but still within range, comparing favorably to HDPE bottle plastics and in line with PP and HDPE ratios in Figure 3.

Figure 4: PP Household Generation in Portland Metro Region

	Pounds/Household/Year	Extrapolated Tonnage for Oregon Single Family Households
PP (#5) Bottles & Jars (> 6 oz < 2 gals)	0.61	378
PP (#5) Bottles & Jars (<6 oz)	0.62	381
PP Tubs (> 6 oz < 2 gals)	3.20	1,977
PP Tubs (< 6 oz)	1.05	648
PP Other Rigid containers and packaging (< 2gals, >2")	8.93	5,516
PP rigid non-packaging (< 2gals, >2")	0.85	526
TOTAL – ALL PP	15.26	9,425
HDPE Natural Bottles	6.38	3,940
HDPE Colored Bottles	9.42	5,817

As the data shows, PP is available in quantities almost equal to natural and colored HDPE bottles combined in the Portland Metro region. Attachment A to this document show product examples of PP packaging use, indicating the materials widespread use across a variety of products. These images underscore the established presence of PP packaging in household consumption.

PP use in packaging appears to be growing and will likely benefit from resin replacement for other packaging, especially those that have been deemed problematic and unnecessary by the U.S. Plastics Pact.³ Moreover, PP has qualities that are not replicable by PET and HDPE, and so can be expected to continue filling key packaging categories for many common consumer products that those resins cannot.

(f) The practicalities of sorting and storing the material

As discussed in the example of PP Recycling Coalition grantees above and as can be found true for many other MRFs across the country, standard MRF optical and robotic equipment available on the market today successfully sorts PP. As a specified material, PP can be sorted into regular truckload quantities and moved quickly to market like any other established commodity at scale. For PP Recycling Coalition grantees to date, dedicated pre-baling storage capacity has been established to manage PP and all are moving baled material into outbound trucks in a manner similar to PET and HDPE.

(g) Contamination

There is no indication that PP packaged products are less cleanable for recycling preparation by households than other plastics packaging. PP packaging also tends not to have extraneous materials or any kind of composite makeup that is substantially different than many common PET and HDPE recyclable formats.

PP can certainly be perceived as an inbound contaminant from the perspective of a MRF with no capacity for PP sortation, but that capacity can be created. MRFs can expect market demand for spec PP bales will be consistent and further supported by the dynamic of brand and statutory content targets.

(h) The ability for waste generators to easily identify and properly prepare the material

In a section above and in Appendix A, we demonstrated the established nature of PP as packaging across a wide array of products and as present in household generation at levels facilitating collection and processing. As a recyclable material specified to households as a tub, cup or container, households and others waste generators can easily comprehend the material is recyclable (especially, as needed, if reference to the #5 Resin Identification Code is included in outreach information).

Basic recycling outreach can convey through words and imagery that PP is recyclable. Appendix B provides examples of outreach materials that describe clearly to households that PP is accepted in its main packaging formats. The examples include one community in the U.S. that recently added PP collection under a PP Coalition Grant, one from the Seattle area, and three from Oregon. The latter are further indication that PP is already a successfully accepted and sorted material in Oregon, which also further shows that MRF acceptance has an established baseline in the state. As we have discussed above, grant and technical interventions can also create sorting and acceptance capacity in MRFs where it is not already in place.

(i) Economic factors

Recycled content commitments by brand companies that package in PP, bolstered by recycled content mandate activity by states, can be expected to spur recycled domestic PP demand (a factor not previously in play when PP

³ <https://usplasticspact.org/problematic-materials/>

was typically sorted into mixed plastic bales often reliant on export markets). Commitments to recycled content in packaging is especially important when recognizing that most recycled PP is currently used in established non-packaging products such as automotive and construction products. Although market uses may shift, it is likely that recycled PP packaging demand will be *additive* on top of these current uses.

Activities within U.S. Plastics Pact provides insight into the potential market demand from recycled content commitments.⁴ Comparing current baseline content to the Pact's 30% content target by 2025, it is clear that a substantial supply gap needs be closed. Pact Activators with PP bottle and rigid container formats will need an estimated additional 200 million pounds per year of recycled PP to meet the recycled content target, which is equivalent to a 45 percent increase in the current national PP bottle and rigid container recycling rate.

It is important to remember two factors in this analysis: 1) not all brands packaging in PP are members of the Pact and additional r-PP demand will come from non-Pact members, and 2) assuming a 33% yield loss through MRF and reclaimer processing, the actual amount of PP needing to be collected to close the Pact Activator content gap would be 266 million pounds. At typical capture rates, this would be equivalent to the curbside collection of PP from 35 million single family homes, or about 35 percent of all U.S. single family households.

The Ocean Conservancy's recent Recommendations for Recycled Content report shows the interplay of recycled content scenarios and supply.⁵ From a baseline estimate of 0% for 2019/2020 in PP packaging recycled content, the report finds that 10% PCR by 2030 is only possible under significant growth in recycling collection and modest technological innovation. A content rate of 15% is feasible only when supply is boosted by national supply-side policy (EPR and Bottle Bill), technical intervention, and design-for-recycling improvements.

Brands are already subject to recycled content targets through publicly stated commitments (in part through the U.S. Plastics Pact) and to incipient State-level requirements. The Ocean Conservancy's report shows that supply side interventions are necessary to make those content levels achievable. This underscores the importance for PP to be included in universal collection. As noted in the report, "...one of the barriers to increased use of recycled plastics is the lack of available supply – there is not enough postconsumer plastic being collected in the recycling system to meet voluntary corporate commitments and industry demand."

(j) Environmental factors from a life cycle perspective

The Recycling Partnership has no technical input on this criteria.

(k) The policy expressed in Oregon Revised Statutes 459.015 (2)(a) to (c), as amended by Section 46 of the Recycling Modernization Act.

The Recycling Partnership has no technical input on this criteria.

Conclusion

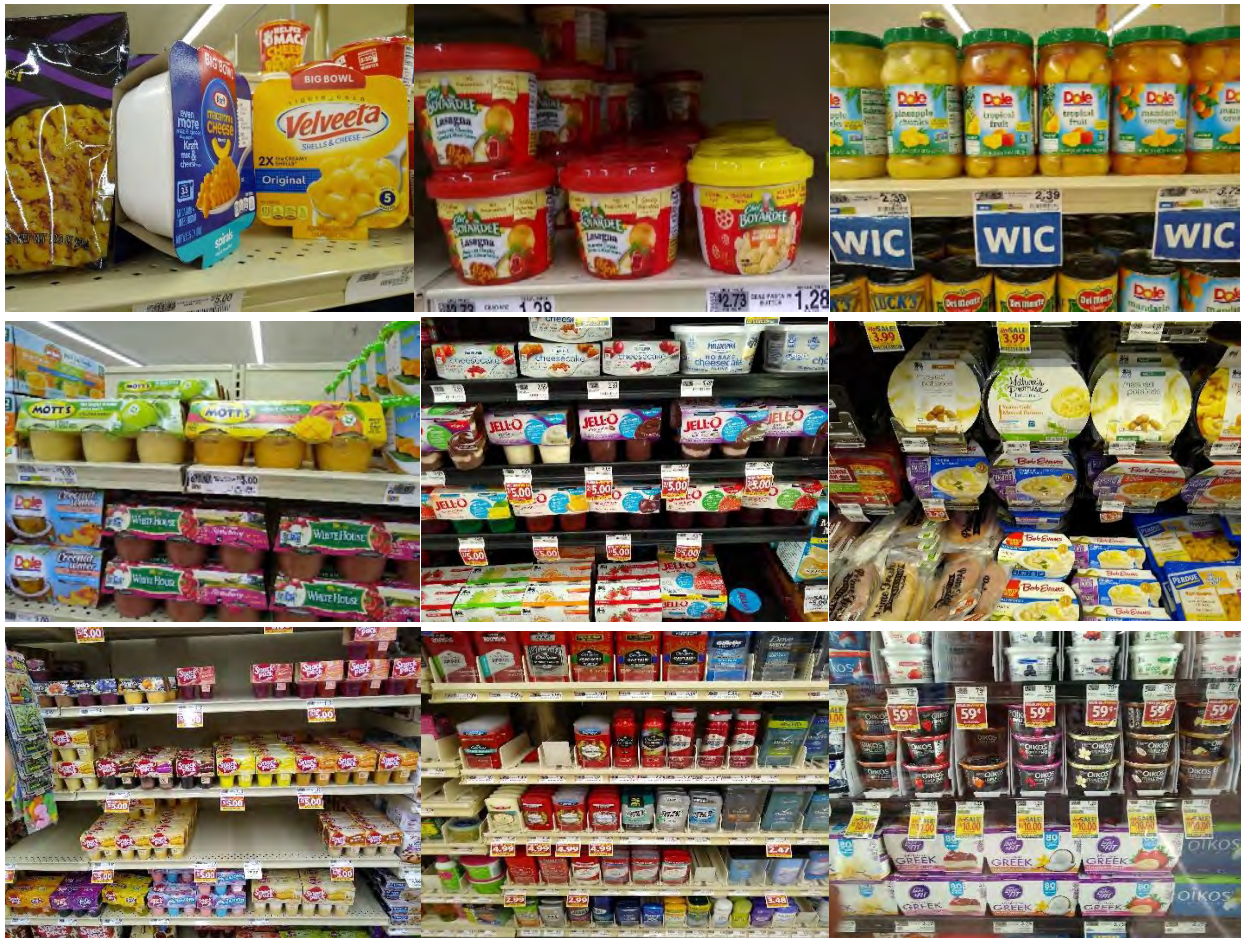
Thank you for the opportunity to submit this technical information. In summary, we believe it presents a compelling case for PP to be included in Oregon's statewide recycling collection list.

⁴ The U.S. Plastics Pact Baseline Report displays current levels of PP and other resin recycling content as reported by brand Pact Activators: <https://usplasticspact.org/baseline-reader/>

⁵ <https://oceanconservancy.org/blog/2022/02/16/recycled-content-standards/>

Appendix A: Imagery of PP Packaging on Store Shelves

PP is used in a wide variety of refrigerated, shelf-stable, microwavable and personal care products consumed in scaled quantities in U.S. households.



Appendix B: Imagery of Outreach Materials Conveying PP Recyclability

In response to the technical criteria regarding the ability for waste generators to easily identify and properly prepare the material, examples below show simple, effective imagery and communications that facilitate understanding of PP recyclability.

Example 1: Generic TRP mailer used in regions served by MRF recipients of PP Coalition Grants where PP was not originally accepted in collection programs



Example 2: WM imagery accessible on-line for areas served by the company’s MRFs (including State of Washington). Imagery accompanied by text directions to “Recycle plastics by shape: bottles, jars, jugs and tubs.”



Example 3: Imagery on Portland Metro material collection list, accompanied by text directions to recycle: “**Round plastic containers** that can hold 6 ounces or more, with a wider rim than base, and typically contain products such as salsa, margarine, cottage cheese, hummus, etc. (no drink cups)”



Example 4: Imagery on City of Gresham OR material collection list



Example 5: Imagery and wording from Republic Services City of Bend Recycling Guide



Plastic

(remove caps/lids & rinse clean)

- Plastic bottles & tubs (6 oz. or larger)
- Rigid plastic containers (such as yogurt & margarine tubs)
- Rigid plastic plant pots (4" or larger)
- Plastic buckets (5 gallons or less)
- Plastic milk jugs

Material Focus: PET Thermoforms

In lieu of providing detailed information in step with DEQ's technical criteria, The Recycling Partnership offers general input on PET thermoforms below.

Our National Database indicates a strong base level of acceptance in Oregon for "plastic clamshells," a common surrogate for PET thermoforms, with community collection lists covering 492,671 single family households (nationally, the number is 43.8 million). Many community programs and MRFs are ambiguous regarding their acceptance of thermoforms. In part, this reflects ambiguity in the PET reclamation sector toward thermoforms, with its much higher focus on bottles and a set of yield issues regarding thermoform processing.

However, recent thermoform-specific reclamation investments in the U.S. and Mexico demonstrate that the material has a growing market pathway that is separate from PET bottles (and alongside bottles, as well, in some instances). Secondary processors (often referred to as "PRFs") in some parts of the U.S. are also having success in extracting and marketing thermoforms from mixed MRF plastics. In addition, one entrepreneurial collector in Oregon is producing and marketing thermoform bales. We would further note that ISRI does have a PET thermoform bale specification in its Scrap Specifications Circular: <http://www.scrap2.org/specs/40/>. These are signs that thermoforms are emerging as a distinct recyclable commodity and that there is baseline return-on-investment in thermoform reclamation.

The broader context for these developments is the overall shortfall of recycled PET to meet brand and statutory content targets. Greater collection and processing acceptance of thermoforms is seen as one key strategy to address that shortfall.⁶

Relatedly, there is indication that thermoforms are growing faster than bottles in terms of generation. Current Recycling Partnership data indicates a 5:1 ratio of PET bottle to non-bottle PET generation in single family household but industry growth statistics and some key trends could push that ratio to 4:1 by 2030. A number of factors could encourage greater PET thermoform usage and generation, including resin substitution in products like cups, egg packaging, and other packaging that currently uses PS and PVC, which are identified as problematic and unnecessary by the U.S. Plastics Pact. Capture study data indicates non-bottle PET is already generated at levels equal to Natural HDPE (11.7 pounds per household per year) – under universal collection acceptance and strong capture rates, PET thermoforms could produce a quantity of MRF bales similar to HDPE.

In short, PET thermoforms are an established packaging format with recycling market demand that has grown and is expected to grow more. Many industry stakeholders are working to address technical and other issues that pose recycling challenges (e.g., detrimental labels). A pathway for PET thermoform acceptance could help catalyze conversion of non-PET clamshell packaging away other resins and thereby reduce contamination in the recycling system from look-alike materials. With these factors in mind, if PET thermoforms are not included in an initial material acceptance list, we encourage Oregon DEQ to be open to their inclusion in the future.

⁶ From NAPCOR 2020 PET Recycling Report, p.23, emphasis added by The Recycling Partnership: "As noted in a December 2020 report by Foodservice Packaging Institute (prepared by Resource Recycling Systems), some PET reclaimers will accept PET thermoforms as part of a curbside PET bale, but acceptance is capped at approximately 10 percent of bale weight. NAPCOR has found that this upper limit varies; *given the tight supply of RPET in the market, tolerance for thermoforms in bottle bales has increased by necessity in 2021.*"

Material Focus: Pizza Boxes

In lieu of providing detailed information in step with DEQ's technical criteria, The Recycling Partnership offers general input on Pizza Boxes.

Data from The Recycling Partnership's National Database of community program material acceptance indicates that pizza boxes are already included in program collection lists covering 76 percent of Oregon single family households. Pizza boxes are a readily identifiable discard for generators, who can be successfully instructed on how to prepare the boxes for recycling by excluding food or other extraneous materials. The Recycling Partnership provides resources to help communities communicate effectively about pizza boxes:

<https://recyclingpartnership.org/pizzaboxes/>

Pizza boxes sort effectively in MRFs into corrugated cardboard or mixed paper commodity bales. Paper industry acceptance of pizza boxes is well documented by industry sources (for example, see

<https://www.afandpa.org/news/2020/afpa-and-industry-partners-aim-set-record-straight-pizza-boxes-are-recyclable-grease-and>)

In sum, with no market or sortation barriers, and with the ability of recycling programs and haulers to effectively communicate about pizza box acceptance and how to avoid contamination, we urge Oregon DEQ to include the material on its statewide collection list.

Material Focus: Paper Cups

In lieu of providing detailed information in step with DEQ's technical criteria, The Recycling Partnership offers general input on Paper Cups.

Our review of publicly available MRF information and data from our National Database of community program material acceptance does not indicate a clear picture for paper cup acceptance in Oregon. However, industry sources show growing mill acceptance of paper cups and work continues to expand overall MRF and community program acceptance: <https://www.recyclefsp.org/paper-cup-alliance>. As documented in a recent white paper, paper cups are allowed in four different paper grades, all associated with substantial mill capacity and demand in the U.S.:

<https://static1.squarespace.com/static/5e8221dbc8b11929c3f7eef7/t/61fd9d504264206ae6406d4e/1644010833194/The+State+of+Paper+Cup+Recycling+-+Moore+and+Associates+2022.pdf>

As a sign of general regional acceptance and a demonstration of how generators can easily be instructed that paper cups are recyclable, see the City of Seattle's information: <http://www.seattle.gov/utilities/your-services/collection-and-disposal/where-does-it-go#/item/paper-cup> In similar regional vein and again, indicative of the status of regional market and mill acceptance, British Columbia's program also accepts paper cups and communicates clearly how generators should prepare the materials:

<https://www.crd.bc.ca/service/waste-recycling/recycle/myrecyclopedia/products/paper-cups#:~:text=Residential%20paper%20cups%20are%20accepted,accepted%20in%20the%20blue%20bag>

In short, paper cups are showing signs of steady progress in mill, MRF, and community acceptance, with the backing of industry stakeholders helping to improve cup recyclability. This progress provides compelling evidence that paper cups are beyond just "technical recyclability" and are now experiencing practical success as communities, MRFs, and mills find alignment and as perceived barriers to cup recycling are overcome. If paper cups are not included in an initial statewide acceptance list, we encourage Oregon DEQ to be open to their inclusion in the future. Paper cups contain valuable fiber which should ideally not be lost to landfill disposal.