BLACK PLASTIC CONTAINERS

Examples: Takeout and ready-to-serve containers, nursery pots and trays

RECOMMENDATIONS	
DESIGN	Where possible, avoid black and use alternative coloured materials to facilitate optical sorters capturing more materials for mixed plastic bales
CAPTURE	Continue exploring potential optical sorting technologies
RECOVERY	Work with the re-processor to identify if they are willing to accept the mixed black plastics for reprocessing. If not, identify opportunities for capture and use as an alternative fuel

DESIGN

- **Current state:**

- Black packaging is used for foodservice takeout and other food applications to hide unpleasant attributes, such as grease and condensation. It is also used for nursery packaging to avoid sun exposure to plant roots.
- It should be noted that grey/black nursery containers have a tendency to be made from recycled plastic that may be comprised of multiple resins, further complicating effective recycling. However, for food tray applications made of PET or PP, recycled content is not typically used and alternative colors would be a viable option.

- **Opportunities:**

- Encourage Packaging decision makers to avoid black where possible while still maintaining the high recycled content typical in much of this packaging, particularly in nursery applications (pots and trays). For PET packaging using black degrades the highly recyclable material to a residual.
- Takeout containers could be made in other colours to increase their overall potential for diversion, as traditional optical sorters could capture the colours.
- If colour change is not an option, use polyethylene (PE) and polypropylene (PP) for black plastic applications to improve recovery since there are viable end market options for these materials.

CAPTURE

- **Current state:**

- This packaging is variably accepted at curbside. Many municipalities accept black plastic e.g. all of BC, many in ON but not currently Toronto.
- Traditionally, it was not identifiable by optical sorters because it was indistinguishable from the black conveyor belt and therefore needed to be manually sorted. If not manually sorted, it ends up as residue for landfill or energy-from-waste.
- Black PE and PP plastics can be effectively sorted from other resin types using sink/float separation technology.

- New optical sorters are available to effectively identify and sort black plastics; these include NRT ColorPlus, Steinert UniSort BlackEye, MSS PurePlasticMax, and TOMRA Autosort Laser.[1]
    - NRT ColorPlus and MSS PurePlasticMax use in-flight recognition rather than viewing the belt, which mitigates the problem of finding black on black. Steinert UniSort BlackEye, MSS PurePlasticMax, and TOMRA Autosort Laser also all use near infrared (NIR) technology.
- New optical sorters may be more costly than traditional ones, but it is believed that their cost will decline with economies of scale as they are introduced to more MRFs.

- **Opportunities:**

- Other optical sorting technologies are also being explored that would require the use of an additive that can be detected by Near Infrared (NIR) technology.[2]
- Terahertz sensor technology is being developed to identify and sort black plastics.[3]
- Tracer and digital watermark technology is being explored to facilitate improved sorting and to assess how it can be introduced and standardized across the plastics industry[4]. This technology has been piloted in EU (project Holy Grail).

RECOVERY

- **Current state:**

- Mixed Black plastics (marked #7 Other) have limited applications and typically end-up in residuals or lower-grade mixed plastics.
- Black PE and PP are commercially recoverable because they have viable end use markets (automotive, household goods e.g. containers and shelving) whereas black post-consumer PET currently does not.

- **Opportunities:**

- For those facilities that cannot afford new optical sorting equipment, the materials can be taken to a recycler who can use sink-float technology to separate ("float" out) the polyolefins, which could be converted into a black pellet of mixed PE and PP, which could then be used in low-end applications. Generally, the "sink" materials could be flaked and used as an alternative fuel, providing they are scanned to ensure there is no PVC in the mix.

ADDITIONAL RESOURCES

Canadian Plastics Industry Association. (2018, May 15). Emerging technologies for the management of black plastics.
https://www.plastics.ca/?f=Recycling/CPIA%20Black%20Plastics%20Recycling%20Technology.pdf&n=CPIA+Black+Plastics+Recycling+Technology.pdf

Lorandos, Hera. Letsrecycle.com (2017, July 25). EU funding for black plastic sorting technology.
http://www.letsrecycle.com/news/latest-news/eu-funding-for-black-plastic-sorting-technology/

[1] https://www.plastics.ca/?f=Recycling/CPIA%20Black%20Plastics%20Recycling%20Technology.pdf&n=CPIA+Black+Plastics+Recycling+Technology.pdf
[2] http://www.letsrecycle.com/news/latest-news/eu-funding-for-black-plastic-sorting-technology/
[3] https://resource-recycling.com/plastics/2016/06/30/german-group-develops-black-plastic-sorting-technology/
[4] http://www.plasticsnews.com/article/20170404/NEWS/304049998/pg-led-workshop-to-review-tracing-plastics-for-recycling

Messenger, Ben. Waste Management World. (2017, January 26). New NRT Optical Sorting System Allows Separation of Black Plastics for Recycling.
https://waste-management-world.com/a/new-nrt-optical-sorting-system-allows-separation-of-black-plastics-for-recycling

Resource Recycling. (2016, June 30). German group develops black plastic sorting technology.
https://resource-recycling.com/plastics/2016/06/30/german-group-develops-black-plastic-sorting-technology/

WRAP. (2015, October). Recyclability of Black Plastic Packaging.
http://www.wrap.org.uk/content/recyclability-black-plastic-packaging-0

Workman, Megan. Recycling Today. (2015, July 7). Shedding light on black plastics.
http://www.recyclingtoday.com/article/rtge0714-processing-black-plastics

BEVERAGE CUPS, ICE CREAM CONTAINERS, & OTHER POLYCOATED PACKAGING

Examples: Coffee or tea takeaway cups

RECOMMENDATIONS	
DESIGN	Add this packaging to a harmonized list of PPP that is collected and recycled**.**
CAPTURE	Continue to educate consumers to separate the lids from the rest of the package and to empty contents, according to their local recycling program's guidelines. All programs wishing to include this packaging in their gable/aseptic grade should work closely with their mill buyers or brokers to ensure they are within acceptable tolerance levels (if applicable). Those wishing to use optical sortation for the capture of hot beverage cups should work directly with their technology provider for a solution.

DESIGN

- **Current state:**
- This packaging is not accepted in most municipal and depot recycling programs, and it is not easily known or confirmed if this packaging is actually recycled in commercial recycling programs.
- **Opportunities:**
- This packaging is composed of valuable fiber materials that should be recovered, and the technology to recover this packaging is readily available and added to MRFs.

CAPTURE

- **Current state:**
- This packaging is accepted at curbside by some but not all municipalities. Some programs accept this material as part of their green bin program.
- Where it is accepted, there is a need to separate the lids from the rest of the packaging, and contents must be empty.
- In single stream collection, hot beverage cups will flow to the container side of the facility as long as they remain three-dimensional. If they are flattened, they will tend to flow with boxboard and end up in with mixed fibers or sorted out by quality control.
- In dual stream collection, or the container side of a single-stream, hot beverage cups are either manually sorted into the gable and aseptic grade or left for residue.
- Ideally, these cups would be captured by the optical sorters set up to capture the other polycoated materials (gable and aseptic); however, up until late 2015, technology was not set up to do this.

- Printing inks are applied directly on the fiber for cups, whereas ink is printed on the polymer layer for gable top and aseptic containers. North American mills have the ability to de-ink during the re-pulping process, but South Korean mills do not. PS lids typically end up in residue.

• **Opportunities:**

- In 2014, Stewardship Ontario, Tim Hortons, and The Carton Council of Canada began a project to determine the ability to manage hot and cold beverage cups as part of the PSI-52 (gable and aseptic) grade. The project group did extensive material pulping trials at a North American mill. Testing went well, and it was determined that hot and cold beverage cups were not a detriment to the tissue pulp at mills that de-ink.
- In 2015, Stewardship Ontario and Tim Hortons worked with Ti-Tech on optical sorter programming modifications. Testing completed in November of 2015 showed a 60% capture rate of all hot and cold beverage cups on a dual eject optical (mixed plastics and gable/aseptic). This was a sharp contrast to previous MRF flow studies performed in 2014 that had a minimal capture rate. Subsequent phases of the project focused on improving sorting results by reprogramming Ti-Tech optical sorting equipment to more precisely identify the cups. Refinements to the equipment programming showed that 90% of the hot beverage cups were correctly captured to the polycoat stream. Notably, the reprogramming of the equipment did not significantly affect the purity rate of the sorted polycoat material, with 92% of the total composition consisting of polycoat materials.[1]
- Ink saturation levels continue to be an issue depending on what mill the materials are being sent to. Programs wishing to include hot/cold beverage cups in their gable/aseptic pack need to work with their buyers or brokers to ensure they are being shipped to a mill that de-inks.

RECOVERY

• **Current state:**

- The multi-stakeholder project continues to see success in both the ability to capture and re-process hot beverage cups. At present, North American mills can accept these cups as part of the gable and aseptic grade. However, the number of mills that process gable and aseptic grade is somewhat limited. To our knowledge, South Korean mills are not equipped to handle cups due to their lack of de-inking capabilities.

ADDITIONAL RESOURCES

Stewardship Ontario. (November 2016). Hot Beverage Cup Acceptability & Recyclability in the Ontario Blue Box Program.
http://stewardshipontario.ca/wp-content/uploads/2016/12/Hot-beverage-cup-recycling_December-2016.pdf

Stewardship Ontario. (2014). Tim Hortons and recycling team tests curbside collection of beverage cups.
http://www.stewardshipontario.ca/case-study/tim-hortons-and-recycling-team-tests-curbside-collection-of-beverage-cups/

Foodservice Packaging Institute (2015, February). Foodservice Packaging in Mixed Paper Bales: Audit Results.
http://www.fpi.org/fpi/files/ccLibraryFiles/Filename/000000000847/Mixed%20Paper%20Bale%20Audit%20Overview.pdf

[1] http://stewardshipontario.ca/wp-content/uploads/2016/12/Hot-beverage-cup-recycling_December-2016.pdf

COLOURED OPAQUE PET

Examples: Household and personal care bottles, energy drink bottles

RECOMMENDATIONS	
DESIGN	Choose clear and/or translucent PET over opaque colours, since clear PET has a valuable end market and encourages economical recovery. Better understand end-use applications and preference for this packaging.

DESIGN

- **Current state:**
- Coloured, opaque PET packaging is chosen for brand marketing purposes.
- **Opportunity:**
- Use of full-wrap labels on clear PET could still produce a colorful effect, but this approach can also present issues in the recycling process (refer to *Full-Wrap Labels on Plastic Bottles*).

CAPTURE

- **Current state:**
- An optical sorter positively sorts all PET, regardless of whether it is clear or opaque.
- If manual sorting is used, coloured, opaque PET bottles are often mistaken for HDPE bottles.
- **Opportunity:**
- Tracer and digital watermark technology is being explored to facilitate improved sorting[1]

RECOVERY

- **Current state:**
- Opaque, coloured PET in significant quantities is a problem for the re-processor as it limits the yield from the bale of clear PET.
- Clear PET can be made into any new colour, whereas coloured PET, unless colour-separated into specific colours, is generally limited to grey or black recycled PET applications.
- Opaque, coloured PET is also problematic for many recycled PET end uses because of contamination. In particular, TiO_2 is detrimental to PET recycling for bottle-to-bottle and engineered resin uses.
- Opaque, coloured PET has limited end-market applications and therefore has significantly less value than clear PET.[2]

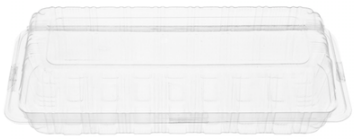
ADDITIONAL RESOURCES

Caliendo, Heather. Plastics Technology. (2015, May 28). Colored PET: Pretty To Look At; Headache For Recyclers.http://www.ptonline.com/blog/post/colored-pet-pretty-to-look-at-headache-for-recyclers-

[1] http://www.plasticsnews.com/article/20170404/NEWS/304049998/pg-led-workshop-to-review-tracing-plastics-for-recycling
[2] http://www.plasticsrecycling.org/images/pdf/design-guide/PET_APR_Design_Guide.pdf

COMPOSTABLE PLASTIC

Examples: Takeout and single-serve containers, trays, cups, and cutlery



RECOMMENDATIONS	
DESIGN	Use life cycle assessment (LCA) tools to evaluate your options and support your packaging design decisions. If designing for recycling, consider controlled methods of collection to capture the material and consult with local MRFs to understand its impacts to the recycling stream. If designing for composting, use BPI certification to validate the packaging's compostability[1] and consult with local composting facilities to understand its impacts to the organics stream.
CAPTURE	Encourage education of proper disposal of this material (either recycling or composting) where appropriate
RECOVERY	Support initiatives that are working to increase recovery and build end markets for this material

DESIGN

- **Current state:**

- This plastic resin is predominately polylactic acid (PLA) and is considered for viable option when considering bio-based and renewable material sourcing.
- Using compostable plastics for targeted 'nutrient-contaminated' applications can help recover nutrients of packaging contents[2]
- Note that 'oxo-degradable' or 'oxo-biodegradable' additives to conventional plastic resins do not qualify as compostable plastic. The Association of Plastic Recyclers (APR) and the Plastics Industry Association (SPI) have issued position papers concerning these additives.[3,4]

EXAMPLE

Ingeo™ Polylactide Production
A peer-reviewed and published Eco-Profile shows Ingeo PLA has significant GHG and fossil-fuel usage benefits when compared to traditional plastic polymers when measured from field (farm or oil) through pellet production. According to the study, Ingeo PLA produces approximately 80% less GHG emissions and uses approximately 52% non-renewable energy in the growing, harvesting and conversion of feedstock into plastic pellets than traditional polymers.[5]

1 http://www.bpiworld.org/Resources/Documents/BPI Cert Decision Tree v1.pdf

2 https://www.ellenmacarthurfoundation.org/assets/downloads/New-Plastics-Economy_Catalysing-Action_13-1-17.pdf

3 https://www.plasticsrecycling.org/images/pdf/resources/Position_Statements/APR_Position_Degradable_Additives.pdf

4 http://www.plasticsindustry.org/sites/plastics.dev/files/Degradable%20Additives.pdf

5 Erwin T.H. Vink, Steve Davies. (June 2015). Life Cycle Inventory and Impact Assessment Data for 2014 Ingeo™ Polylactide Production. *Industrial Biotechnology*. Vol. 11, No. 3: 167-180.

CAPTURE

- **Current state:**

- Compostable plastic packaging is currently not accepted in most curbside organics collection programs in Canada.
- Due to its similar physical appearance to clear PET and PS, PLA does end up in the recycling box, although it is currently not accepted in curbside recycling programs.
- As PLA has its own unique light reflection characteristics, near-infrared (NIR) optical sortation technology can be used to identify and sort PLA from other resins. Where a facility uses manual sorting, much like PS and PVC, PLA may be confused with PET. This could result in it being inadvertently sorted into the PET stream. However, as most MRFs do a negative sort of mixed plastics, which includes PS, the PLA will typically end up in that mix.
- All coloured PLA would most likely end up in mixed plastics, as PET thermoforms are typically only clear.
- Currently, not enough PLA is being generated to significantly contaminate PET bales (less than 0.1% of any PET bale), though, as described above, PLA can be sorted with optical sorters if volumes of it increase.
- PLA resin is no longer sold into the beverage bottle market in North America, so there is little chance of any significant PET contamination.

- **Opportunities:**

- As residential and commercial organics collection programs grow, the number of industrial composting facilities will also likely grow. PLA compostable food serviceware can be a helpful vehicle to divert food waste to such facilities. Industrial composting facilities may be able to process PLA food serviceware depending on their operational parameters (e.g., temperature, moisture, residence time).
- Like other unique resins, PLA is technically recyclable. Nascent efforts are currently underway by some in the PLA industry, including customers and some recyclers, to develop and grow PLA collection and recycling strategies. This includes end-market development efforts for the recycled PLA.

RECOVERY

- **Current state:**

- Re-processors can separate the PLA from PET bales using optical sorters. They cannot use the sink-float separation technology, as both PET and PLA (and PS) sink in water. (They would have to use different liquids with tight, specific gravities in order to separate PET from PLA in a sink float system.)
- Some end markets are currently being developed for PLA, but they are limited. Typically, PLA ends up in mixed plastic bales that either get used as fuel, energy-from-waste or go to landfill.

- **Opportunities:**

- Given that there are insufficient quantities of PLA currently in the waste stream, and that PLA recycling infrastructure is in its infancy, the cost of sorting PLA as a separate stream at a MRF cannot be justified in the short term. As PLA applications grow in the marketplace, attention should be placed on sorting and re-processing this material, as well as growing the market for recycled PLA in various applications. However, it will take time and it will be important to understand the conditions for growth and future opportunities. Note that it took PET bottles 25 to 30 years to reach viable levels for effective recovery and there is still much room to improve the recovery rate of this material.

ADDITIONAL RESOURCES

Sustainable Packaging Coalition. (June 2017). Value of Compostable Packaging.
https://s3.amazonaws.com/gb.assets/Value+of+Compostable+Packaging+Report.pdf

Foodservice Packaging Institute. (December 2016). Literature Review on the Impacts to the Composting Value Chain When Introducing Compostable Foodservice Packaging.
http://docs.wixstatic.com/ugd/1f2d68_16ea25634d674abf99eff73d8ee62b2a.pdf

NatureWorks. (2017). Case studies where compostable food serviceware has been used in closed loop or quick service restaurant situations.
http://www.natureworksllc.com/Ingeo-in-Use/CaseStudies

CORRUGATED TRAY WITH PLASTIC FILM

Examples: Beverage bottle and can cases (12-count and higher)

RECOMMENDATIONS	
DESIGN	Where possible, use perforations to make the separation of trays and films easier. Consider design executions using only corrugated, boxboard, or plastic film where it is logical and feasible.
CAPTURE	Educate consumers to a greater degree to separate corrugated trays and plastic films (e.g., provide clear instructions to put tray into recycling bin and to take film to retail store depot collection)

DESIGN

- **Opportunities:**
- There are design options available for multi-packs and cases that use only one material while still providing stability and stackability.

CAPTURE

- **Current state:**
- Mixed materials entering the recycling stream must be manually separated and are cumbersome on the sorting line. If not captured during the sorting process, these materials end up in residue and in landfills.
- Corrugated trays and plastic films are recyclable materials. They should be separated before collection since separate end markets exist for both materials.
- **Opportunities:**
- There is continued investment in Promotion & Education (P&E) to educate consumers to remove plastic films from corrugated trays before recycling this type of packaging, stressing the importance of the separation of mixed recyclable packaging materials.

RECOVERY

- **Current state:**
- End markets exist for corrugated trays and mono-layer plastic films.

ADDITIONAL RESOURCES

Region of Peel. (2014, April). “Recycle Right.”
https://youtu.be/ayBv8GHeh0U

FULL-WRAP LABELS ON PLASTIC BOTTLES

Examples: Full-wrap labels or shrink sleeves on rigid bottles and containers

RECOMMENDATIONS	
DESIGN	Refer to the Association of Plastics Recyclers (APR) - Design for Recyclability guidelines. Where possible, add a perforation to the sleeve so that it is easier to remove (for consumers or manual sorters), or consider de-seaming adhesive solutions. Where possible, use partial sleeves to allow about 20% exposure of the PET bottle so that automatic MRF optical sorting equipment can properly identify a clear PET bottle beneath the label. Where possible, ensure ink does not stain rPET and use floatable sleeve materials on PET bottles (avoid materials that sink, e.g., PETG and PVC) to avoid contaminating rPET.
CAPTURE	Investigate opportunities for software enhancements for optical sorters.
RECOVERY	Consider investing in de-labeling equipment.

DESIGN

- **Current state:**
- Full shrink labels allow for high quality graphics around contoured bottles but can cause challenges in recycling plastic bottles with sleeves.
- **Opportunity:**
- There are a number of commercially available shrink label films that are listed on APR's website and meet their Critical Guidance Criteria for recyclability on bottles and containers[1]. Select film manufacturers have developed new high performing floatable films for sleeve labels that will easily and completely separate from bottles and containers during the sink/float tank process.

EXAMPLE

SunLam Deseaming Technology
In collaboration with Eastman Chemical, Sun Chemical launched a new deseaming adhesive (SunLam Deseaming Technology) for PETG sleeve label films that helps remove shrink labels from bottles during wet recycling. Removal of shrink sleeve labels takes place at the same point that other labels (e.g., wraparound, pressure sensitive, etc.) are removed with no additional equipment required by the recyclers. The SunLam Deseaming Technology is a recipient of APR's Responsible Innovation acknowledgment.[2]

[1] http://www.plasticsrecycling.org/images/pdf/PET-Resins/PET-Bottles/sleeve_label_on_pet_critical_guidance.pdf
[2] http://www.labelandnarrowweb.com/contents/view_online-exclusives/2017-04-24/awa-conference-explores-shrink-sleeve-recycling/51906

CAPTURE

- **Current state:**

- Bottles and containers with full shrink wrap labels are widely accepted at curbside.
- Full-wrap sleeves may confuse optical sorters if they cannot detect body material.
- A full-sleeved HDPE bottle may or may not end up in the HDPE bunker. As the sleeves are typically non-HDPE, the optical sorters may eject the HDPE bottle based on the resin of the sleeve, e.g., PETG. However, most equipment manufacturers report that optical sorters will detect the HDPE with a PETG label because the PETG is thin. If sorting issues occur, it may be possible to modify the settings on the optical sorter.
- In the event an HDPE bottle with PETG labels is mis-sorted, it would be up to the Quality Control (QC) sorter to redirect it back to the sort line where it could be manually sorted into the HDPE bunker. In a smaller facility where the containers are manually sorted, sorters could be trained to associate a specific brand with a specific resin and sort the container into the appropriate bunker. In this case, the full-sleeved HDPE bottle would end up in the HDPE bunker.
- A full-sleeved PET bottle may end up on the PET eject line where optical sorting is used, if the sleeve is PETG. If the sleeve is another resin, it may be missed and would require manual sorting to ensure the bottle was captured for recycling. In a smaller facility where the containers are manually sorted, sorters can be trained to sort the container into the appropriate bunker. In this case, the full-sleeved PET bottle would end up in the PET bunker.
- **Opportunity:**
  Manufacturers of optical sorting equipment report their equipment is capable of identifying the bottle polymer despite the label substrate, colour, and coverage; however, it may require a software upgrade at the MRF in order for this capability to be realized.

RECOVERY

- **Current state:**

- Several North American re-processors have invested in de-labeling equipment to mechanically remove labels from bottles. This is important because many shrink sleeve labels today are PETG-based or PVC-based film with density higher than water. Accordingly, they cannot be separated from PET flakes during the sink-float separation step of the recycling process, and they thus contaminate the recycled PET stream and deteriorate the quality of recycled PET (rPET) products.

- **Opportunity:**

- Trials have been conducted at reprocessing facilities to document the effects of adding perforations to the labels to aid in removal during crushing, baling, and mechanical de-label processing. Eastman Chemical, working with re-processors, has conducted multiple de-labeling and perforation trials and found a minimum of 97% of all perforated labels are removed with de-labeling equipment.[3]

ADDITIONAL RESOURCES

The Association of Plastics Recyclers. (2017). Sleeve Labels.
http://www.plasticsrecycling.org/apr-design-guide/design-guide-resources/sleeve-labels

[3] Alexander, Holli, *Eastman Chemical.* (2014). PAC NEXT Webinar Presentation: *Optimizing Labels on PET Packaging*.

GABLE TOP ASEPTIC CONTAINERS

Examples: Gable top and aseptic cartons used for juice, milk, soups, and broth

RECOMMENDATIONS	
CAPTURE	MRFs are encouraged to accept polycoated containers. MRFs are encouraged to sort cartons into their own grade.

DESIGN

- **Current state:**

- Gable top and aseptic cartons (cartons) are food and beverage paper packaging types. Gable top cartons, otherwise known as 'refrigerated,' are made up of about 80% paper and 20% polyethylene; aseptic cartons, otherwise known as "shelf stable," are made up of about 74% paper, 22% polyethylene, and 4% aluminum. Cartons are generally used as a package for various non-carbonated beverages, like fruit juices and dairy products, and for liquid food products, like soup and broth.

CAPTURE

- **Current state:**

- The majority of municipal recycling programs accept gable top and aseptic cartons today.
- Within the recycling industry, cartons as a commodity are typically referred to as "polycoat," in reference to their polyethylene coating
- Gable top and aseptic cartons are typically reprocessed into high-value fiber, whether manually or optically sorted.
- Optical sorters for polycoated containers can see the polycoat on gable top or aseptic cartons.
- In single stream plants, if the cartons are flattened during collection (compaction), they can end up flowing over a mixed paper or finishing screen, thereby ending up in the mixed paper stream. Mixed paper bales can accommodate a small level of cartons. However, some components in cartons can impact the pulping process and lead to decreases in fibre yields in mixed paper pulping applications. Moreover, this outcome decreases the economic value of cartons, as the price paid for polycoat bales is generally higher than the price paid for mixed paper bales. When cartons are sorted into their own grade, these problems are avoided.

- **Opportunities:**

- MRFs of different types (single or dual steam, using automated or manual sorting) are able to sort polycoated cartons into their own grade for recycling. Various best practices are encouraged based on the design and needs of the MRF. Refer to the Carton Recycling Primer produced by the Carton Council of Canada.[1]

[1] http://www.recyclecartons.ca/municipalities-sorting-centers/#cartonrecyclingprimer

RECOVERY

- **Current state:**
- The Carton Council of Canada tracks the performance of used cartons on a national basis, using publicly available information from stewardship and government agencies. For 2016, the national carton recovery rate was 57%. This is a combination of various metrics, as reported by each provincial/territorial jurisdiction, including curbside capture, marketed tonnes, and redemption performance.
- **Opportunities:**
- Similar to other recyclable materials, there is an opportunity to capture additional volumes of used cartons from the IC&I sector, including the away-from-home segment (e.g., schools).

ADDITIONAL RESOURCES

Carton Council of Canada. (2016).
http://www.recyclecartons.ca/carton-recycling/

GLASS JARS AND BOTTLES

Examples: Beverage bottles, oil and vinegar bottles, jars for pasta sauce, baby food, pickles and condiments

RECOMMENDATIONS	
CAPTURE	Glass should remain a collected recyclable in single stream programs. Where dual stream collection systems exist, it is encouraged to have consumers put glass into the respective bin. Consumers should always be encouraged to redeem glass containers, when covered in a deposit program.
RECOVERY	Considering the prevalence of single stream recycling collection programs in North America, the glass container industry recommends the following sorting equipment upgrades and adjustments at materials recovery facilities (MRFs) to increase glass capture rates and reduce wear and tear on sorting equipment: • Installation of old corrugated container (OCC) screens to enhance current sorting efforts • Moving all glass sorting equipment to the front end of the MRF process • Installation of a glass breaker screen • Covered glass bunkers for outside storages and separation of glass (in those instances where glass is delivered to the MRF in a separate manner)

CAPTURE

- **Current state:**
- Glass captured in a single stream system needs to be properly sorted to reduce contamination with solid waste and other recyclables. If contamination issues are properly addressed, more glass and other recyclables can be recovered, and MRFs may experience reduced wear and tear on their sorting equipment.
- Dual stream collection of glass is another option for local governments to consider. Dual stream MRFs typically separate glass at the front end of the system. This is done utilizing screens and separators. Dual stream collection results in better quality glass, which is more suitable for recycling.
- **Opportunities:**
- Since glass and other commonly recycled commodities are increasingly collected through single-stream programs, the glass container industry supports specific measures at the MRF to better handle glass and other recyclables, along with funding, grants, partnerships and other publicly available resources to improve the quantity and quality of glass collected.

EXAMPLES

Single Stream MRF	Dual Stream MRF
In Québec city, an implosion technology generates a shockwave that breaks up the pieces of glass and reduces the material to cullet, leaving labels and other contaminants intact. These contaminants (metals, plastics, fibres) can then be more easily removed by magnets, aspiration, and vibratory screening. In addition, the system enables the production of two sizes of glass. After only two month of operations, the efficiency of cleaning both small fraction (<12 mm) and large fraction (>12 mm) have shown promising results.	In Hamilton, a fine screen (star screen) is used to separate glass from non-glass containers (plastic and metal containers float), allowing glass to channel down through the screen). Next, the glass goes through an organic separator, where lightweight and non-glass materials (e.g., shredded paper, caps, lids, and bottle caps) are removed. The contamination rate of the glass sorted in this manner is lowered to 10%.

RECOVERY

- **Current state:**
- Much of the glass captured through single stream collection ends up in secondary, low-value, one-time applications, including road aggregate and landfill cover.
- For glass captured through dual stream collection or processed in an enhanced single stream MRF, larger pieces are used for glass container and fiberglass manufacturing, with smaller pieces reused for end markets such as sandblasting, water filtration, or ornamental mulch.
- For glass recovered through a deposit program, nearly all of it ends up in high quality manufacturing operations, such as glass container[1] or fiberglass production.
- There are emerging end market applications for foam glass[2] or cement additive[3]; the glass characteristics in insulation, fire, and moisture resistance or even impermeability of salt components make this a viable option in concrete and building construction industries.
- **Opportunities:**
- MRFs that have invested in improved sorting equipment and adjustments (listed in the recommendations above) have reported experiencing increased captures of glass and other recyclables headed through their sorting lines, along with reduced wear and tear on their rubber sorting equipment since glass is removed earlier on in the process. These MRFs have also seen reduced costs in landfilling glass and other recyclables, and increased payments from purchasers for glass and other recyclables.
- Conditioning glass for the highest quality (by colour and by size, free of contaminants) at the highest revenue helps to stabilize current markets.
- There are opportunities for recycling, hauling and manufacturing industries to receive recycling grants for systems upgrades by building partnerships with municipalities and local governments. Where funding is available, matching grants from industry stakeholders, tied to implementation and results, should be considered. Additionally, The Recycling Partnership and The Closed Loop Fund offer low interest and zero interest loans to improve recycling efforts.

ADDITIONAL RESOURCES

Glass Recycling Coalition. (2017). Case Studies.
http://www.glassrecycles.org/case-studies

[1] "Massachusetts Container Deposit Return System," page 7 http://www.container-recycling.org/images/stories/PDF/MA CDR Employment and Economic Impacts Report_IEc 6-8-2017.pdf
[2] http://www.ecoentreprises.qc.ca/documents/pdf/Fiches%20Verre%20l'innovation/3_fiche_verre_cellulaire_vfa.pdf
[3] http://www.ecoentreprises.qc.ca/documents/pdf/Fiches%20Verre%20l'innovation/5_fiche_ajouts_cimentaires_vfa.pdf

LABELS ON PET THERMOFORMS

Examples: Labels on fresh produce, labels on bakery packaging

RECOMMENDATIONS	
DESIGN	Use APR certified labels where possible.

DESIGN

- **Opportunity:**
- APR has developed a protocol and guidelines for approved labels, inks, and adhesives. Certified labels and suppliers, who can provide certified labels at comparable costs to current labels, are listed on their website.[1]

CAPTURE

- **Current state:**
- PET thermoforms are accepted at curbside for recycling.
- Optical sorters can identify the PET thermoforms and send them to the PET stream. Any material not identified will most likely end up in the mixed plastics stream.
- Where MRFs use manual sorting, these materials will either be put in the PET bottle stream or in the mixed plastics stream.

RECOVERY

- **Current state:**
- PET thermoforms are washed and shredded to create rPET flake.
- The label, ink, and adhesive need to be washed off cleanly from the PET thermoforms to avoid discoloration and contamination of the flake. The use of these types of labels, however, has been prohibited due to higher costs. Nonetheless, this is changing based upon recent developments.

ADDITIONAL RESOURCES

PAC NEXT. (2015). Label Optimization Progress report.
http://pac.ca/assets/pn-pfw-april-progress-report.pdf

The Association of Plastic Recyclers. (2015). Thermoform Label Test.
http://plasticsrecycling.org/images/pdf/design-guide/test-methods/Thermoform_Label_Test_PET-S-04.pdf

[1] http://plasticsrecycling.org/champions-for-change/recipients

METALLIZED TUBES

Examples: Toothpaste tubes, personal care products, prescription creams

RECOMMENDATIONS	
CAPTURE	Educate consumers that this packaging is not appropriate for curbside collection at this time.
RECOVERY	A waste-to-energy approach can prevent this packaging from going to landfill. Invest in other innovative processes, such as Microwave Induced Pyrolysis, to help capture more value from this packaging.

DESIGN

- **Current state:**
- Multiple materials are used in this packaging (multiple plastics and sometimes metal), and residual product contents cause contamination in other materials.

CAPTURE

- **Current state:**
- This packaging is generally not accepted at curbside for recycling. However, consumers tend to put this packaging in the recycling bin.
- It is manually sorted or ends up in residue.

RECOVERY

- **Current state:**
- There is currently no end market for this packaging.
- **Opportunities:**
- There is work being done to retrieve aluminum from this packaging for create an end market for it. Enval in the U.K. uses patented technology based on a process known as Microwave Induced Pyrolysis, developed at the University of Cambridge, to separate metal or foil from plastic.

ADDITIONAL RESOURCES

Recycling Today. (March 2015). Enval project targets aluminum in laminate packaging.
https://www.recyclingtoday.com/article/enval-project-uk-aluminum-packaging

MULTI-MATERIAL LAMINATES

Examples: Zipper and stand-up pouches, snack bags and wrappers, meat and deli wrappers

RECOMMENDATIONS	
DESIGN	Use life cycle assessment to assess whether this packaging type is the best environmental option for the intended application. Package designers should consider using mono-material packaging where feasible.
CAPTURE	Educate consumers that this packaging is not appropriate for curbside collection at this time. Multi-material laminates should not be collected at curbside recycling programs until sorting technology allows this material to be separated, especially from paper and flexible mono-layer PE, and viable end markets have been secured. Continue to support emerging solutions and initiatives (highlighted on p. 2).
RECOVERY	Seek investment opportunities to accelerate development of viable and secure end markets.

DESIGN

- **Current state:**
- Multiple materials are used in the construction of this package (multiple plastic resins and sometimes a metalized layer, sealants, and adhesives) to achieve various barrier properties and sealability features.
- **Opportunity:**
- There are examples of packagers that have created a mono-material pouch that addresses recyclability concerns while also providing barrier technology.[1,2,3]

CAPTURE

- **Current state:**
- This type of packaging is currently not accepted for recycling by municipalities. However, residents are mistakenly putting these materials into their curbside recycling bin and/or including them with flexible mono-layer PE bag collection.
- This packaging category is here to stay with significant forecasted growth over the next several years, with US demand for pouches growing approximately 7% annually to reach almost 24

[1] http://www.dow.com/en-us/news/press-releases/breakthrough-dow-technology-enables-recyclable-flexible-plastic-packaging
[2] http://www.packagingdigest.com/sustainable-packaging/seventh-generation-switches-to-recyclable-pouches-for-dishwasher-detergent-2016-01-22
[3] http://www.tempoplastics.com/CdnPkg-11012015.pdf

billion units in 2018.[4] As a result, MRFs are observing an increasing presence of this material being collected at curbside.

- Due to its flat shape and light weight, this packaging tends to behave like paper, and in a single stream system, may flow through a MRF with the paper stream, thereby contaminating this stream. In a dual stream system, this packaging may hinder the sortation of other valuable streams, like aluminum cans, PET, and HDPE bottles.
- Manual sortation at the MRF is currently required to remove multi-material laminates as today's optical sorting technologies are not proven in removing all contaminants from the fibre stream. When removed at the MRF, these packages may end up in mixed plastics or in residuals that go for landfill or energy-from-waste.

• **Opportunity:**

- Pilot programs in the US have shown that it is possible to get consumers to put plastics films and laminates into larger and branded bags that can be readily identified and removed from the conveyor infeeds at a MRF.
- Continue to support emerging solutions and initiatives, such as the ones as highlighted below:

EnergyBag™ Programs
The Purple Energy Bag Pilot Program[5] collected non-recyclable plastic packaging at curbside in Citrus Heights, California that was separated at a MRF and sent to a nearby facility to convert into fuel. The Hefty® EnergyBag™ program[6] has residents of Omaha, Nebraska put non-recyclable plastics into special orange bags. The bags are then collected at curbside and sorted at a local facility, and the plastics are converted into energy to make cement.
Materials Recovery For the Future
The project is an industry collaborative that released research findings[7] that showed that automated sorting technologies in use today can be optimized to capture flexible plastic packaging, including multi-material laminates—potentially creating a new stream of recovered materials while improving the quality of other recycling streams.
REFLEX UK
The *REFLEX* project report[8] was a result of two-year consortium project co-funded by Innovate UK that evaluates optimization of NIR (Near Infra-red) sorting technologies to detect and separate mixed polyolefin (PP and PE) packaging, such as candy wrappers and chip bags.
PAC NEXT's Multi-Material Laminates Project
The project's objectives are to 1) Bring together industry experts to evaluate and develop strategies to demonstrate feasibility of recycling PCR multi-material laminates and, 2) Initiate and complete a pilot that demonstrates that post-consumer multi-material laminates can be recycled from a MRF.

RECOVERY

• **Current state:**

- There is no large scale end market for this packaging type at this time.

• **Opportunity:**

• Enval technology in the UK has the ability to recover aluminum from multi-material laminated packaging[9]

[4] "The US Market for Stand-Up Pouches to 2018", PCI Films Consulting Ltd. as cited in http://www.plasticstoday.com/articles/us-stand-pouches-continuing-growth-path

[5] http://msdssearch.dow.com/PublishedLiteratureDOWCOM/dh_0929/0901b80380929667.pdf

[6] http://www.hefty.com/whats-new/articles/hefty-energy-bag-program/

[7] https://www.materialsrecoveryforthefuture.com/research-results/

[8] http://www.reflexproject.co.uk/wp-content/uploads/2016/12/REFLEX-Summary-report.-Final-report.pdf

[9] http://www.enval.com/Collection-Trials.php

- There is potential for specialty end markets, such as engineered fuel, lumber core, fuel substitution in cement kilns, and other industrial uses.[10] Today, it is more practical to use post-industrial materials compared to highly contaminated post-MRF residuals.

ADDITIONAL RESOURCES

McKinlay, Richard & Morrish, Liz. (November 2016). REFLEX Project.
http://www.reflexproject.co.uk/wp-content/uploads/2016/12/REFLEX-Summary-report.-Final-report.pdf

Nonclercq, Aurélie. (October 2016). Mapping flexible packaging in a Circular Economy [F.I.A.C.E].
https://ceflex.eu/public_downloads/FIACE-Final-report-version-24-4-2017-non-confidential-version-Final.pdf

PAC NEXT. (December 2016). Multi-Material Laminates Project: 2015-2016 Progress Report.
http://pac.ca/assets/pac0819-multilayer.pdf

Sustainable Packaging Coalition®. (2017). Multi-Material Flexible Packaging Recovery: A global database of initiatives and resources to advance recovery options.
https://multi-materialflexiblerecovery.squarespace.com/#

[10] http://www.plastics.ca/_files/file.php?filename=file_Final_Flexible_Film_Report.pdf

NON-PET CLAMSHELLS

Examples: Bakery goods, electronics packaging

RECOMMENDATIONS	
DESIGN	Consider PET if using look-alike plastic as non-PET can contaminate PET recycling. Select labels, inks, and adhesives that can be cleanly removed from clamshell packaging by referring to APR's recyclability guidelines.[1] Also check industry guidelines regarding UV barriers and other additives that can also affect the quality of the recycled PET.
CAPTURE	Implement best sorting practices to minimize contamination and maximize quality before attempting to separate non-PET clamshells and market PET thermoforms.
RECOVERY	Communicate buyer specifications for clean, high-quality bales to support investment in best sorting practices.

DESIGN

- **Current state:**
- This packaging is referred to as a look-alike plastic to PET, since most consumers cannot tell the difference between the two.
- Labels, adhesives, and inks can further contaminate recycled PET if it cannot be cleanly removed. UV barriers and other additives can also affect the quality of the recycled PET.
- **Opportunity:**
- Several Canadian retailers collaborated in 2010 and volunteered to use only PET thermoforms in bakery and produce applications for their private label brands.[2]

CAPTURE

- **Current state:**
- This packaging is typically placed in the recycling bin.
- Where MRFs use optical sorting, the optical sorter can be set up to identify all non-PET clamshells and eject them into the mixed plastics stream.
- Where MRFs use manual sorting, extensive sorter education is required, including brand recognition to distinguish PET from non-PET containers (e.g., PVC has a blue glow and also turns white when folded over). This is difficult to implement and sustain.
- Non-PET materials that end up in the PET bale are a contaminant.

[1] http://www.plasticsrecycling.org/pet-design-guide

[2] http://www.packworld.com/sustainability/recycling/collaboration-enables-sustainable-win

- MRFs and re-processors can distinguish between resin types, particularly where optical sorting is employed.

• **Opportunity:**

- Where markets exist for mixed plastics bales, non-PET clamshells can be included in the bale.

RECOVERY

• **Current state:**

- Despite concerns about contamination (i.e., labels, inks, adhesives, additives) and yield, re-processors still require more PET material to meet the demand.

• **Opportunity:**

- PET thermoform packaging, such as clamshells, blisters, and trays, offer a new source of PET feedstock, beyond bottles.

ADDITIONAL RESOURCES

The Association of Plastic Recyclers. (2017). PET Critical Guidance.
http://www.plasticsrecycling.org/images/pdf/design-guide/test-methods/PET_Critical_Guidance_PET-CG-01.pdf

National Association for PET Container Resources (NAPCOR). (2017). PET Thermoform Recycling.
https://napcor.com/recycling/thermoform-recycling/

Dimino, Resa. Plastics Recycling Update. (2016, November). Going Beyond Collection.
http://napcor.com/wp-content/uploads/2016/12/PRU_PET-Thermoforms2016.pdf

PLASTIC BAGS AND FILMS

Examples: Single-use bags, grocery and dry cleaning bags, overwrap films

RECOMMENDATIONS	
DESIGN	Encourage reuse and recycling behaviour by clearly communicating proper disposal on bags and films. Consider including handles for larger packaged items to reduce overuse of carry bags.
CAPTURE	Support existing return-to-retail and depot program initiatives. Implement depot and/or return-to-retail programs where collection does not exist. Curbside collection can cause high contamination rates. Where plastic bags and/or films are accepted curbside, reinforce bag-in-bag collection and encourage consumers to put in bigger, transparent bags for easier manual sorting at the MRF. Refer to CPIA's best practices.[1]
RECOVERY	Work together with producers and processors to drive solutions that help reduce contamination of non-PE films entering the stream.

DESIGN

- **Current state:**
- LDPE and HDPE is widely used for production of various films and bags. Films made of low and high density polyethylene are tensile and compression resistant, impact-resistant, water and vapor proof. The use of LDPE and HDPE varies greatly by users – stretch wraps to shopping bags. In general, the two types of resins are recyclable provided it is clean and dry, free of contaminants such as paper and labels. Further, colour selection influences the final recycled product and its further use. Clear films have a greater ability for multiple uses compared to coloured films.
- **Opportunity:**
- Emerging marker technology for packaging including film may be used to increase capture rate in MRF setting with optical sorters.[2]

CAPTURE

- **Current state:**
- Film collection is provided by both retail stores and municipalities; however, provision of collection service varies across Canada as film is not a standard recycling or blue box item.

[1] https://www.plastics.ca/?f=Recycling/file_file_files_Best_Practices_Guide.pdf&n=file_file_files_Best_Practices_Guide.pdf
[2] https://resource-recycling.com/plastics/2017/08/03/stakeholders-advance-project-coordinate-marker-technologies/

- Return-to-retail (R2R) locations typically have a collection bin at the store front or at a consumer help desk; this style of collection provides a cleaner film material. However, it can be a concern to retail locations due to possible contamination (i.e., film may have residual food or product. Promotion of the film collection service also varies store to store with no uniform approach.
- Municipalities generally provide collection at depot/curb side services. When film is collected, it is always accepted along with other recyclable materials, never on its own, and residents will be told how to set it out, bag-in-bag.
- Design of curbside programs include single stream and two stream. Single stream is simply one container for all fibre and containers together, and two stream splits fibre and containers. Nevertheless, film is known to be collected in both streams. That is some programs promote film in the fibre side and others in the container side.
- Debate continues on curbside collection and which stream to put film in. On the fibre side, it can be easier to capture as it acts like paper most times and stays cleaner. On the container side, residents see it as a plastic that goes with other plastics, but the film gets dirtier due to other container residuals contaminating it and getting caught in with rigid products.
- Film recycling at a facility is a challenge when the material is not bag-in-bag. When film is on its own, single bags, they tend to 'float' and 'wrap'. Air pushes them into unwanted areas where it cannot be properly managed. In addition, due to the flexibility and stretch of film, it easily wraps around equipment belts and shafts.

• **Opportunity:**

- Municipalities that recycle film will provide Promotion & Education (P&E) information on their websites regarding the correct recycling of plastic bags and films. It is important to reinforce the information because consumers continue to be unsure about how to identity the types of film to be included and how to follow the preferred bag-in-bag method of collection.

RECOVERY

• **Current state:**

- PE film processors manage both LDPE and HDPE film. PE film recycling on the whole is a fairly stable system with processors producing engineered resins for specific end uses. The applications of recycled PE are limited by the quality and quantity produced.

• **Opportunity:**

- Work more closely with processors to improve recovery rate of bales and manage contaminants by assessing their needs, while also working with producers of post-consumer PE film to educate the importance of dealing with local markets and to specifications of processors.

ADDITIONAL RESOURCES

American Chemistry Council. (2017). Plasticfilmrecycling.org. http://plasticfilmrecycling.org/

American Chemistry Council. (2017). 2015 National Post-consumer Plastic Bag & Film Recycling Report. https://plastics.americanchemistry.com/2015-National-Post-Consumer-Plastic-Bag-and-Film-Recycling-Report.pdf

Canadian Plastics Industry Association. (2011). Best Practices Guide for the Collection and Handling of Polyethylene Plastic Bags and Film in Municipal Curbside Recycling Programs. https://www.plastics.ca/?f=Recycling/file_file_files_Best_Practices_Guide.pdf&n=file_file_files_Best_Practices_Guide.pdf

Butler, Nina; McCormick, Joel; Menezes, Neil; Nash, Carrie. (2016). Options & Alternatives for Managing Plastic Film. [Presentation slides]. http://thecif.ca/events/orw/documents/ORW-Spring-2016-Panel2.pdf

CAPS ON PLASTIC BOTTLES

Examples: Beverage bottle caps, personal care bottle caps

RECOMMENDATIONS	
DESIGN	Ensure resources provided by various agencies are consistent.
CAPTURE	Because caps are valuable resources that need to be recovered, it is encouraged to educate consumers to a greater degree and with a clear message to replace caps on empty plastic bottles to increase plastic recycling.
RECOVERY	Participate in discussions with industry stakeholders where trade associations (which support caps on), re-processors (which also support caps on), and municipalities (some of which who support caps on and some of which who do not) can collaborate and agree on standards, and create a common messaging resource pool.

DESIGN

- **Current state:**
- Generally, caps are made out of high density polyethylene (HDPE) and polypropylene (PP). Plastic bottles and caps come in all shapes and sizes; many can be recycled. Companies use different types of plastic resins to do different jobs, such as keeping condiments fresh, preserving the life of medications, and maintaining bubbles and flavour.
- **Opportunity:**
- APR and CPIA has provided resources that support a Caps On approach to promote full plastic recovery[1,2]
- SPC has developed an “Empty & Replace Cap” how-to-recycle label[3] in which some manufacturers are adopting.

CAPTURE

- **Current state:**
- Based on the recycling program in a community, the messaging about caps varies. Consumers can be confused about whether to leave caps on, to throw caps out, or to separate caps when disposing of bottles due to cross over messaging between programs.
- When caps are removed and put into the recycling streams, they fall through the screens due to their small sizes and can contaminate the glass cullet stream.
- When caps are removed, bottles are likely empty before being recycled; however, loose caps are also likely to become litter or marine debris[4]

[1] https://plastics.ca/_resources/file_NR_PlasticCapsOnBottles.pdf
[2] http://www.plasticsrecycling.org/education/faqs/caps-on
[3] http://www.how2recycle.info/labels
[4] https://www.noordzee.nl/project/userfiles//SDN_Doppenrapport_EN_2017_DEF_small.pdf

- Lighter-weight bottles are more prone to flattening during collection than heavier-weight bottles, resulting in their mis-sorting.
- Capped, light-weight bottles are more likely to retain their shape and be efficiently sorted than those that are uncapped.
- Capped bottles may still contain product or decanted material which may cause a problem with material quality and operations.

• **Opportunity:**

- Various parties have developed 'caps on' images for use in promotions and recycling instructions.
- Best practices exist for Promotion & Education (P&E) to educate consumers regarding emptying bottle contents and replacing caps before recycling.

RECOVERY

• **Current state:**

- End markets exist for PP and HDPE caps.

• **Opportunity:**

- APR has developed model bale specifications to include caps in commodity bales, has developed FAQs on caps, and has presented webinars addressing the opportunity.

ADDITIONAL RESOURCES

Canadian Plastics Industry Association. (2014, March 31). Plastic 'Caps on Bottles' – Designed to be Recycled. https://plastics.ca/_resources/file_NR_PlasticCapsOnBottles.pdf

The Association of Plastic Recyclers. (2017). Recycling Rigid Plastics Beyond Bottles: CAPS ON! http://www.plasticsrecycling.org/education/faqs/caps-on

SINGLE-SERVE HOT BEVERAGE PODS

Examples: Multi-material, polystyrene and polypropylene K-Cup® pods, metalized cups

RECOMMENDATIONS	
DESIGN	Use life cycle assessment (LCA) tools to evaluate your options and support your packaging design decisions. If designing for recycling, consult with MRFs and municipal groups to understand results in recycling operations. If designing for composting, use BPI certification to validate the packaging's compostability[1] and consult with composting facility operators and municipal groups to understand results in composting operations. Incorporate clear, on-pack communication for the proper method of disposal.
CAPTURE	Non-recyclable and non-compostable pods should not be put into waste diversion programs (e.g., blue bins and green bins) but may be returned to the pod retailers/producers (in store or via mail), where this option exists. Check local municipal websites for information on the proper disposal of recyclable and compostable pods. Use consistent communication and education at the residential level to increase clarity on appropriate disposal methods.
RECOVERY	Support initiatives that are working to increase recovery and build end markets for the pod materials.

DESIGN

- **Current state:**
- This is a highly evolving market where four out of every 10 dollars spent on ground coffee in the US is now spent on single-serve pods, such as K-Cup® pods, according to Nielsen.[2]
- **Opportunity:**
- Concerted efforts in the coffee pod industry have been made to design and develop sustainable packaging solutions. Considerable research and investment has sparked new innovative packaging in order to address concerns about waste associated with these products. Although not all of today's recycling and composting systems have been designed to handle these new packaging formats, the drive to continuously improve packaging sustainability should be encouraged and collaboration can help as part of the larger move towards a circular economy.

[1] http://www.bpiworld.org/Resources/Documents/BPI Cert Decision Tree v1.pdf
[2] http://www.foodnavigator-usa.com/Markets/Single-serve-pods-account-for-41.2-of-dollar-sales-of-ground-coffee-in-the-US

CAPTURE

- **Current state:**

- When full, this packaging is generally not accepted at curbside for recycling or composting due to the multiple components of pod, filter, lid and grounds. While most of the pods are put in the garbage bin for landfill, some consumers are putting these materials (separated and unseparated) into the recycling bin and the green bin for organics (where available).
- Unseparated pods that still contain grounds can drop through the mechanical screens with heavy materials and contaminate other streams, particularly glass.
- Non-compostable pods were introduced into the organics stream in one specific municipality to understand whether they could contaminate the compost. The pods did not break up into smaller pieces, even when crushed by heavy processing equipment. It was determined that the screening equipment was able to extract all of the single serve cups and none ended up in the final compost.
- Note that separated pods (pod, filter, grounds) are accepted in British Columbia's new recycling program[3] for PS or PP content – coffee pods would be ejected with the optical sorter. Otherwise, the pods are manually sorted from the line or left to go with the mixed plastics as the negative sort. Many pods still end up in residuals that go to landfill.

- **Opportunity:**

- Many brands and packaging suppliers are working to respond to consumer interest in pods that can go into waste diversion processes. On the composting side, fully compostable pods are available in which all the components usually break down at rates comparable to other types of food waste accepted by municipal composting facilities. On the recycling side, there are innovations to make the separation process much easier for consumers and to improve the material of the outer cup so that it is more valuable for downstream recyclers.

EXAMPLES

Compostable Pods
New compostable bio-resins have been developed to create a BPI-certified, 100% compostable single-serve pod (e.g., Club Coffee's PürPod100). These pods have been tested extensively across many municipalities and found to break down effectively in facilities designed to produce high quality compost. Concerns have been raised about acceptance of compostable single serve pods into composting programs due to the belief that residents will not differentiate between compostable and non-compostable formats and will put both into the source separated organics (SSO) programs, resulting in potential contamination of compost. Visual differentiation is an important aspect of this and will significantly improve success.
Recyclable Pods
New Recyclable pods have been developed by large brands (e.g., Mother Parkers, Keurig) so that the outer cup, made of either polystyrene or polypropylene, can be recycled (where #5 and #6 plastics are accepted). The recyclable pods from Mother Parkers are designed for disassembly to facilitate simple separation of outer cup from the rest of the pod. Trials run at MRFs have shown that two inch glass screens do not screen out empty pods and that in a range of high/low tech, single/dual stream facilities, an estimated 70-75% of the pods are available for capture. Tests performed by Keurig indicate that an average of 90% of the empty K-cup® pods made it to the container line.[4] These efforts work in conjunction with consumer education to remove coffee grinds and lid before recycling the outer cup.

[3] http://www.cbc.ca/news/canada/british-columbia/keurig-k-cups-now-recyclable-in-metro-vancouver-if-you-do-the-work-1.3399982

[4] http://keurigrecycling.com/wp-content/uploads/2017/09/Case_Study_Small_Format_Plastics_May_2017_FINAL.pdf

- Companies with compostable and recyclable pods are seeking partnerships with recycling, composting and municipal groups to make these solutions work in ways that consumers expect.
- There is an opportunity to study consumer willingness to correctly dispose of pods and to determine the best communication methods that effectively encourage participation. Consumer research results could be shared broadly to an enable coffee brands to help influence consumer behaviour positively.

ADDITIONAL RESOURCES

CBC News. (2016, September 30). Compostable coffee pods developed at University of Guelph set to hit store shelves.
http://www.cbc.ca/news/canada/kitchener-waterloo/university-guelph-compostable-coffee-pods-keurig-loblaw-1.3786212

Food in Canada. (2015, October 15). Tim Hortons launches EcoCup pods.
http://www.foodincanada.com/food-in-canada/tim-hortons-launches-ecocup-pods-132228/

Caliendo, Heather. Plastics Technology. (2016, June 22). PP Recycling Provides New Life for Keurig K-Cups.
http://www.ptonline.com/articles/pp-recycling-provides-new-life-for-keurig-k-cups

Quantis. Prepared for PAC. (2015, June 2). Life Cycle Assessment of coffee consumption: comparison of single-serve coffee and bulk coffee brewing.
http://pac.ca/assets/pac0680-full-lca.pdf