



MULTI-MATERIAL LAMINATES PROJECT

2015-2016 PROGRESS REPORT

DECEMBER 2016



The purpose of this PAC NEXT executive summary is to share the progress made on the multi-layer laminates project program through mid-2015 and 2016 and to highlight priorities for 2017. Multi-layer laminates are categorized as flexible packaging comprised of multiple plastic resins, sometimes including foil. This includes zipper and stand-up pouches, bags and foiled wrappers.

Team Membership & Project Objectives:

The project co-chairs are Guy McGuffin of Guy McGuffin Consulting and David Yousif of Reclay StewardEdge. The project team includes the participation of 24 PAC NEXT members (see list in Appendix). The program objectives are as follows:

- To bring together industry experts to evaluate and develop strategies to demonstrate feasibility of recycling PCR multi-layer laminated film
- To initiate and complete a pilot that demonstrates that PCR multi-layered laminated film can be recycled from a MRF

Project Highlights:

The project team held eight meetings in 2015 and five meetings in 2016 to date. Growing presence of multi-layer laminates in the marketplace (US demand for pouches growing approximately 7% annually to reach almost 24 billion units in 2018¹) has resulted in an increasing presence of this material being collected at curbside. This has resulted in numerous initiatives launched globally to explore scalable recovery solutions. As such, the emphasis has been on creating a forum for expert information sharing including guest presentations as follows: (Continued on the next page)

¹ "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>

PARC Corporation presentation on Multilayer Flexible Film Packaging Process

- Plastics Advanced Recycling Corporation developed and invented technology used to process multi-layer laminated flexible packaging films in order to reduce of landfill waste and to facilitate closed loop recycling. Post consumer and labour intensive plastic scraps are collected and processed into commingled bales. Full loads are sent to the PARC processing plant in China where sorted multi-layer flexible films are pelletized sold to be reused in a wide range of applications such as end caps for the steel industry, and floorboards for sea containers.
- For more information: <http://www.parcusa.com/>

Zzyzx Trial with PCR Laminated Film presented by Phil Brunner

- 50 lbs of typical PCR film was sent to Zzyzx and processed into natural grey and green pellets using their SSSP (Solid-State Shear Pulverization) process. The majority of the PCR mixed film is PE based with evidence of EVOH, PET, PS as well as organic containment such as Cheetos and dog food. Zzyzx tested the Thermal Properties, Melt Flow Index and Mechanical Properties of the treated PCR and developed a melt and impact modifier with UHMWPE (Ultra-high-molecular-weight-polyethylene) for application with compression molds, film, thermoform and injection molds. Post-Consumer Recycled Laminate Film - Injection Molding Grade Data sheet released by Zzyzx.
- Zzyzx's next steps include conducting a Pilot Plant Study to process a thousand pound bale of as-received PCR laminate film waste, obtaining equipment for automated feed of PCR film into the SSSP machine, as well as looking into working with partners to find new ways to integrate PCR laminated film waste into new industrial and/or consumer products
- Applied for GOALI (Grant Opportunities for Academic Liaison with Industry) grant with Lafayette College. This project is aimed at dealing with the organic waste components that contaminate and limit the potential applications of PCR laminated film waste. The three phases of the project include: determining organics present in PCR film, quantifying the transport rates of organics in various solvents and temperature and measuring the mechanical properties.
- Zzyzx received grant from the Closed Loop Foundation in an effort to advance film plastic packaging recycling. For more information: <http://zpolymers.com/>

Greenable Technology Group & Plastics Redeemed facility in Cambridge

- Pre-consumer laminate material used to make decking material, including foil laminates. Indicated that the product has secured an end market.
- Presentation by Leo Blakely, Greenable Technology Group
 - Plastics Redeemed facility running at 80% capacity using Greenable Technology licensed machinery. 3 new machines being manufactured for use in Ontario for 2016, each capable of running 3 million pounds/year. Aiming to work with municipality on a similar pilot modeled after the Dow Purple Energy bag in Citrus Heights.
- Presentation by David Yousif, formerly with City of Hamilton
 - With only 50% of film being properly sorted at the Hamilton facility from blue box collection, actions to prevent film ending up in landfill and the contamination of existing PE film streams are necessary as well as exploring options of alternative collection methods such as return-to-retail.

- Facility in Cambridge testing out the ability to convert post consumer residue from post optical container sort; primarily oversized film & laminates to composite plastic lumber.
- Presentation by Rob Kuepfer, Plastics Redeemed
 - The key operation is to convert post industrial film into composite plastic lumber sold primarily into specific construction applications and farming, particularly in barns and fencing. Currently accepting PS foam, potato chip bags and commingled materials. The goal is to set-up a pilot to process post-consumer material in the future.
 - There is a 3-month breakeven point on technology: equipment is worth approximately \$500,000, operating upwards to .5 million above breakeven point and running at about 60% capacity. Another \$300,000 will allow more capacity.

Materials Recovery for the Future Project presented by Emily Tipaldo, ACC

- Project run by Dow, American Chemistry Council (ACC), Resource Recycling Systems (RRS) and Research Foundation for Health and Environmental Effects (RFHEE) aimed at effective and economic material recovery options for flexible packaging. Proposed testing on the potential of currently available MRF sorting technologies, particularly separation screens and optical sorters to improve separation of flexible packaging in the existing system to produce flexible packaging bales as well as development of new technologies for Plastics Recovery Facilities (PRFs) to ensure the mechanical recycling of resins that currently have markets.
- Research methodology by RRS; preformed 3-hour trial using positive sort. The trial highlighted that both screens and optical sorters were overwhelmed during the trial. Working to find the right capacity combined with the right configuration of screens and optical sorters for maximum efficiency.
- Seeded materials were a mix of mono-layer PE and multi-layer laminates; individual units, not bag in bag. Approximately 88% of flexibles moved with fibre line, 8% of seeded material ended up in residue and some materials were lost passing the air drum separator during baseline trial. The trial was not aimed to figure out how to sort PE from multi-material laminates; no targets for metabolized layers.
- Future goals include: equipment testing in Nashville (NRT), Germany (Steinert) and France (Pellenc), energy recovery solutions for flexible films and looking into technologies provided through WRAP and the REFLEX project.
- Read for the full results here: <https://www.materialsrecoveryforthefuture.com/wp-content/uploads/2016/09/Flexible-Packaging-Sortation-at-Materials-Recovery-Facilities-RRS-Research-Report.pdf>

Laminated Film Pilot Project, Canadian Stewardship Services Alliance (CSSA) presentation by Sherry Arcaro

- Flexible laminates are currently deemed as contamination in the LDPE/HDPE film plastic recycling stream, so re-processors need to be found that can manage/separate LD/HDPE film from flexible laminates, or have a sustainable product they can produce with a combination of the two.
- CPIA/CIF and CSSA working on a project plan to secure material and bale, ship material to end-processor locations, pre-treatment (if required), and to ship post-processing pellets to manufacturers for testing.

Re-processor Trials:

- 3 different re-processors found to test 1000 lbs of materials each.
- SO/CPIA/CIF project is currently pending more information from end processors. The project's objectives include: trying to find end markets for reprocessed material, and looking for a solution with several end processors and give flexibility with regards to how laminates are collected.
- Highlighted the importance of understanding the changes that will occur if Ontario goes fully EPR.

REFLEX Project presented by Richard McKinlay, Axion Consulting

- REFLEX is a collaborative project that is co-funded by Innovate UK with the aim to create a circular economy for flexible packaging through cooperation throughout the value chain. Project activities include: implementing innovative packaging design, development of recycled polymers derived from PCR flexible packaging, improving ID and sorting, and developing DfR guidelines. The aim is to dispel the amount of perceived technical barriers that surround flexible packaging recycling.
- Sorting films (mono and laminate materials) through NIR technology has been successful. Pilot trial proved that the material was able to be effectively processed into high quality recyclate, though there were technical challenges with PVdC coated PP.
- REFLEX is exploring marking and sorting technologies - marker ink on package during printing stage using fluorescent inks or digital watermarks; identifiable at commercial sorting speed (+2m/s).
- For more information: <http://www.reflexproject.co.uk/>

Recycle Ready Pouch by Lamy Chopin, Dow Chemical

- With RecycleReady technology, Dow uses its Retain™ brand of compatibilizer to allow polyethylene and ethylene vinyl alcohol to be reprocessed together to create a recyclable film with enhanced barrier properties.
- For more information: <http://www.dow.com/en-us/packaging/innovation/recycleready>

Plans for 2017:

- Continue to share information, latest technology developments and explore viable recycling and energy recovery alternatives for multi-layer laminates
- Explore opportunities to run pilot programs (with partners) for PCR multi-layer laminates
- Publish a report that evaluates options for recycling flexible films

To receive access to the presentations mentioned in this document and to find more about joining this project team, please contact Rachel Morier at rmorier@pac.ca.

Guy McGuffin and David Yousif for and on behalf of the PAC NEXT project team

Appendix – Project Team Members

Guy McGuffin (Chair)	Guy McGuffin Consulting
David Yousif (Chair)	Reclay StewardEdge
Emily Tipaldo	American Chemistry Council
Kate Davis	Alpha Poly
Debra Swift	Alpha Poly
Isabelle Faucher	Carton Council of Canada
Rick Everest	CKF Inc.
Joe Hall	CPIA
Krista Friesen	CPIA
Jon Pyper	Dow Chemical
Pierre Benabides	EEQ
Martin Vogt	EFS Plastics
Paulina Leung	Emterra Environmental
Dan Lantz	Green By Nature
Leo Blakely	Greenable Technology Group
Michael Buttigieg	Maple Leaf Foods
Bruce Smith	Molson Coors
Ben Bennett	Municipal Waste Association
Keith Fanta	P&G
Brent Heist	P&G
Norm Lee	Region of Peel
Philippe Cantin	Retail Council of Canada
Frances Gamache	Sobeys
Len Giglio	Tempo Plastics