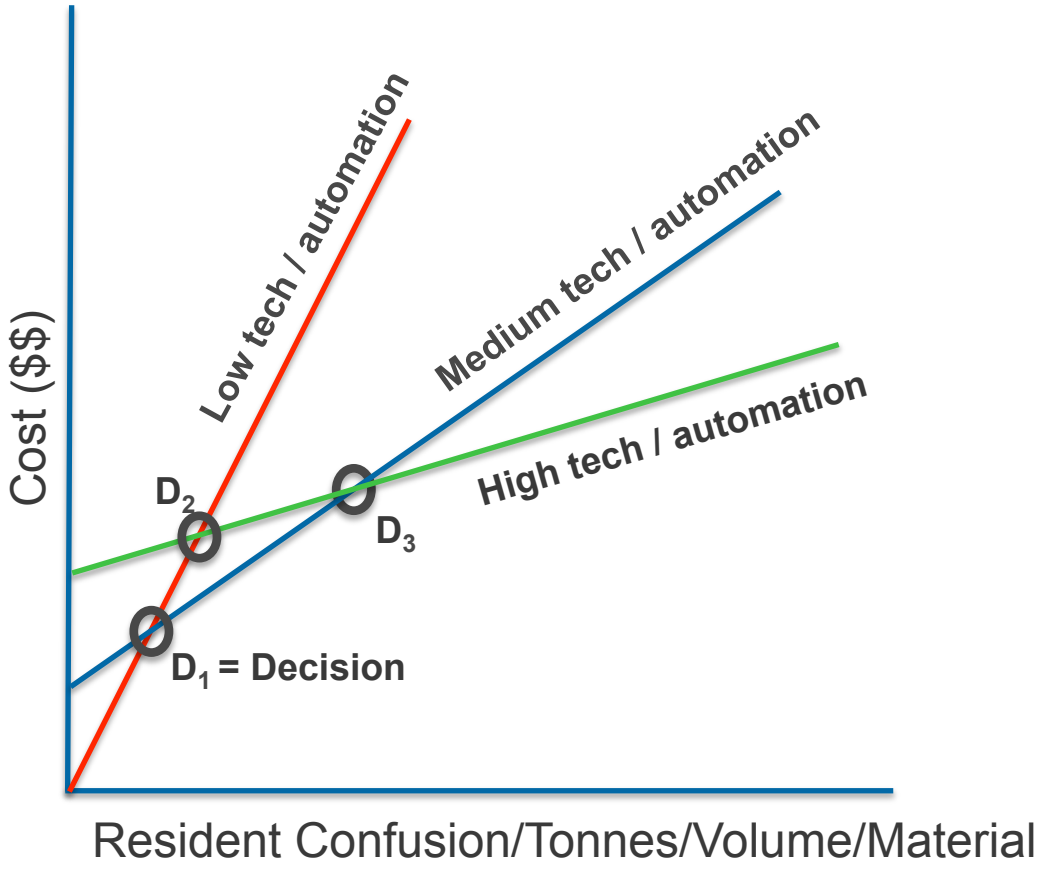
Insights from the MRF

Carrie Nash, CIF

CIF
CONTINUOUS
IMPROVEMENT FUND

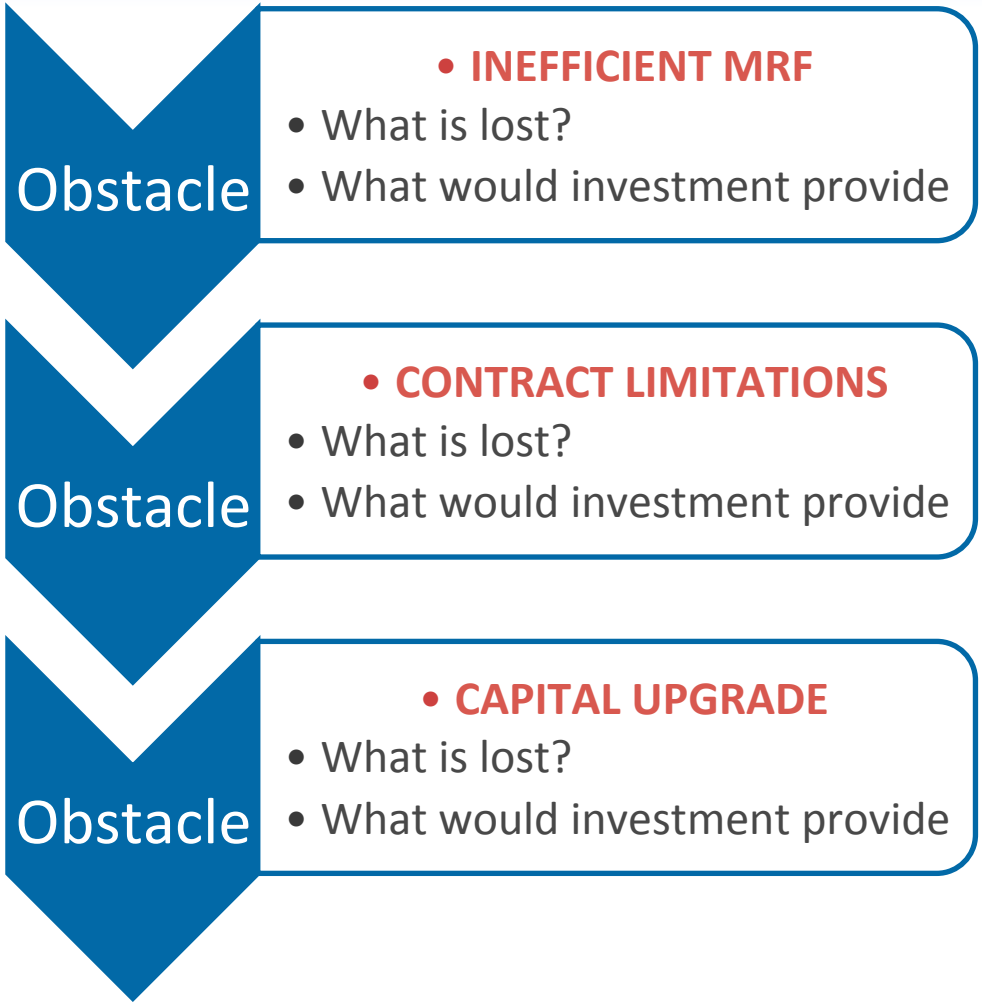
Current Challenges

- Material composition & volumes
  - Mixed plastic, film plastic, paper laminates
  - Pieces per tonne
- Resident influence
  - Confusion
  - Desire for an all inclusive program
- Available Solutions
  - Expensive
  - Untested



Solutions? We've got a few to share…

- Careful analysis before investment
  - Business case & payback
- Shared risk
  - Municipal & MRF operator partnership
  - Share in the cost & share in the benefits
- Technology
  - Cost savings to be achieved



Speakers

- Container Line Performance Audit & Development of Improvement Options
  - David Faris Yousif, City of Hamilton
- Expanded Blue Box Program
  - David Miles, Halton Region
- The Evolution of Optical Sort Machinery
  - Matt Risko & Charles-Étienne Simard, Machinex Recycling Services Inc.

Container Line Performance Audits & Development of Improvement Options
CIF Project #816.3

Dave Faris Yousif

City of Hamilton

Project Highlights

- Project goal: Evaluate performance of container line & assess efficiency of new glass clean up system installed in 2013
- Impacts: Development of improvement options to increase recovery rates & decrease costs
- More information:
  - David.Yousif@Hamilton.ca
  - www.hamilton.ca

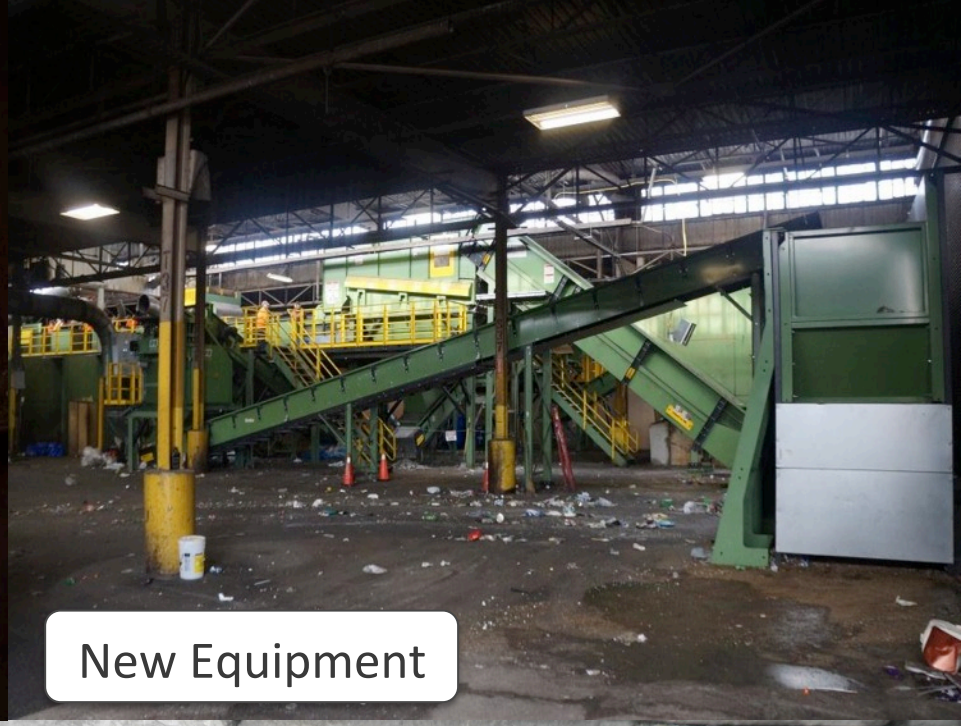
Why the Container Line Audit?

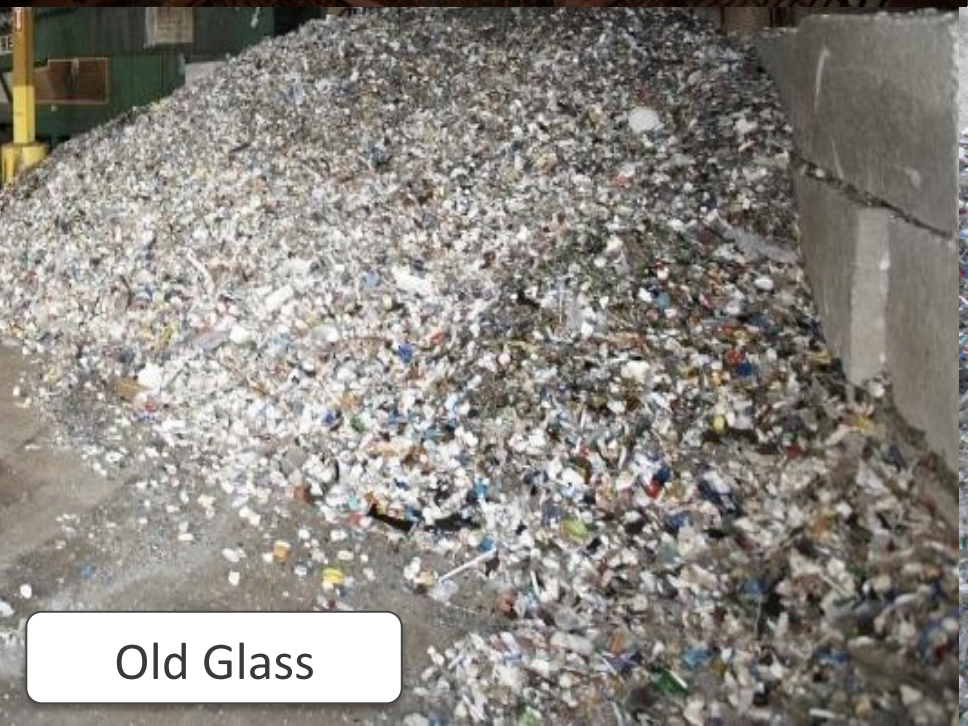
- Ensure glass clean-up system is working
- Identify post front-end improvement opportunities
  - Measure current sorting efficiency & effectiveness
  - Provide improvement options
  - Develop cost models to incorporate recommendations

The Glass Clean up System

- Why the glass clean-up system?
  - Contamination in glass stream ~50% (included high-value recyclables)
  - Difficult & costly to market
- Summer 2013 installation
- Comprised of drum feeder, fines screen, ORSE screen, eddy current, & bag breaker
- Results indicate:
  - Contamination reduced to 8-10% NGR
  - Easier access to glass market
  - Capture of recyclables previously lost in glass stream


Old Trommel


New Equipment


Old Glass


New Glass

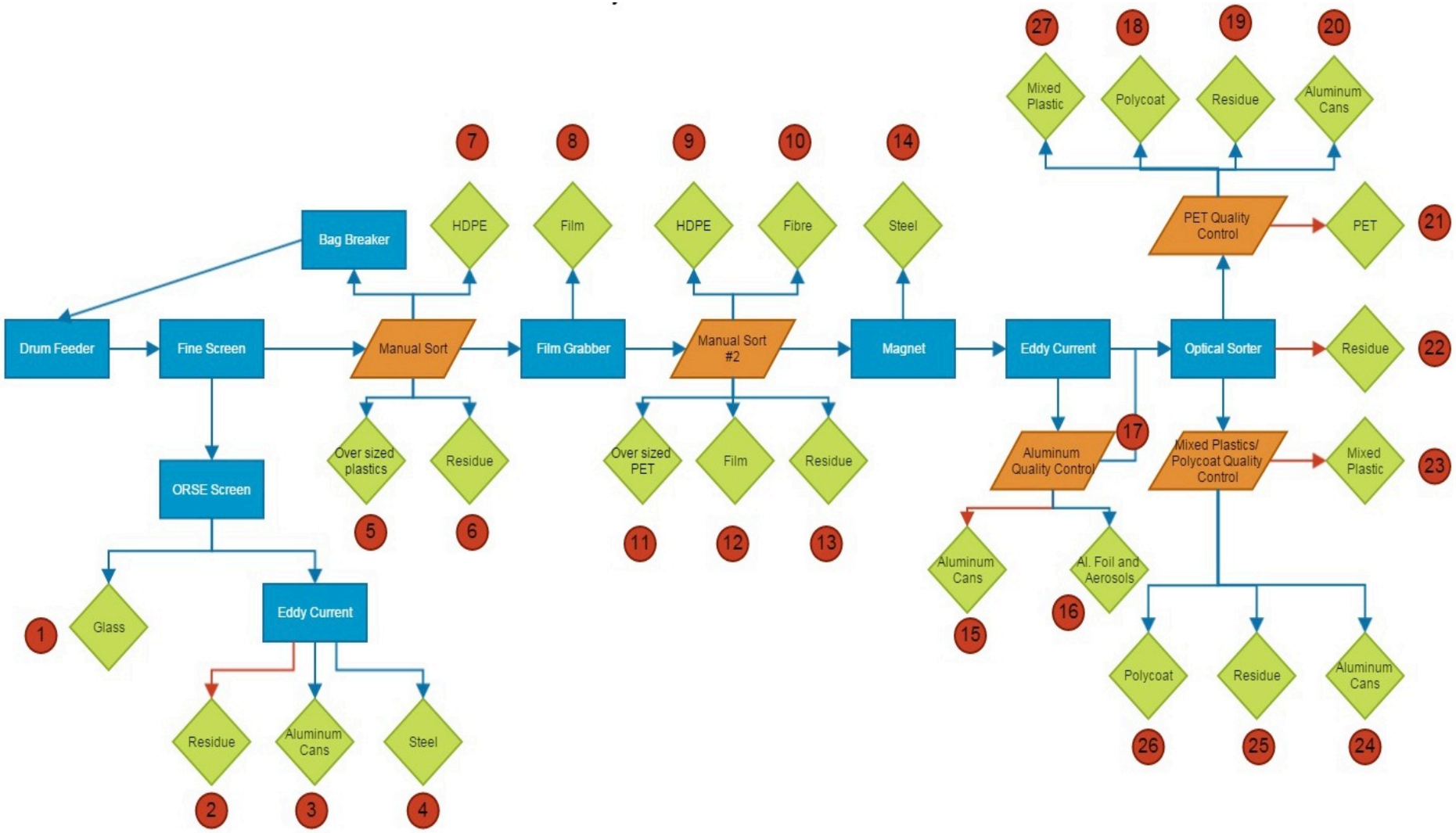
Looking for Next Improvement Opportunities

Step 1: Container Line Audit

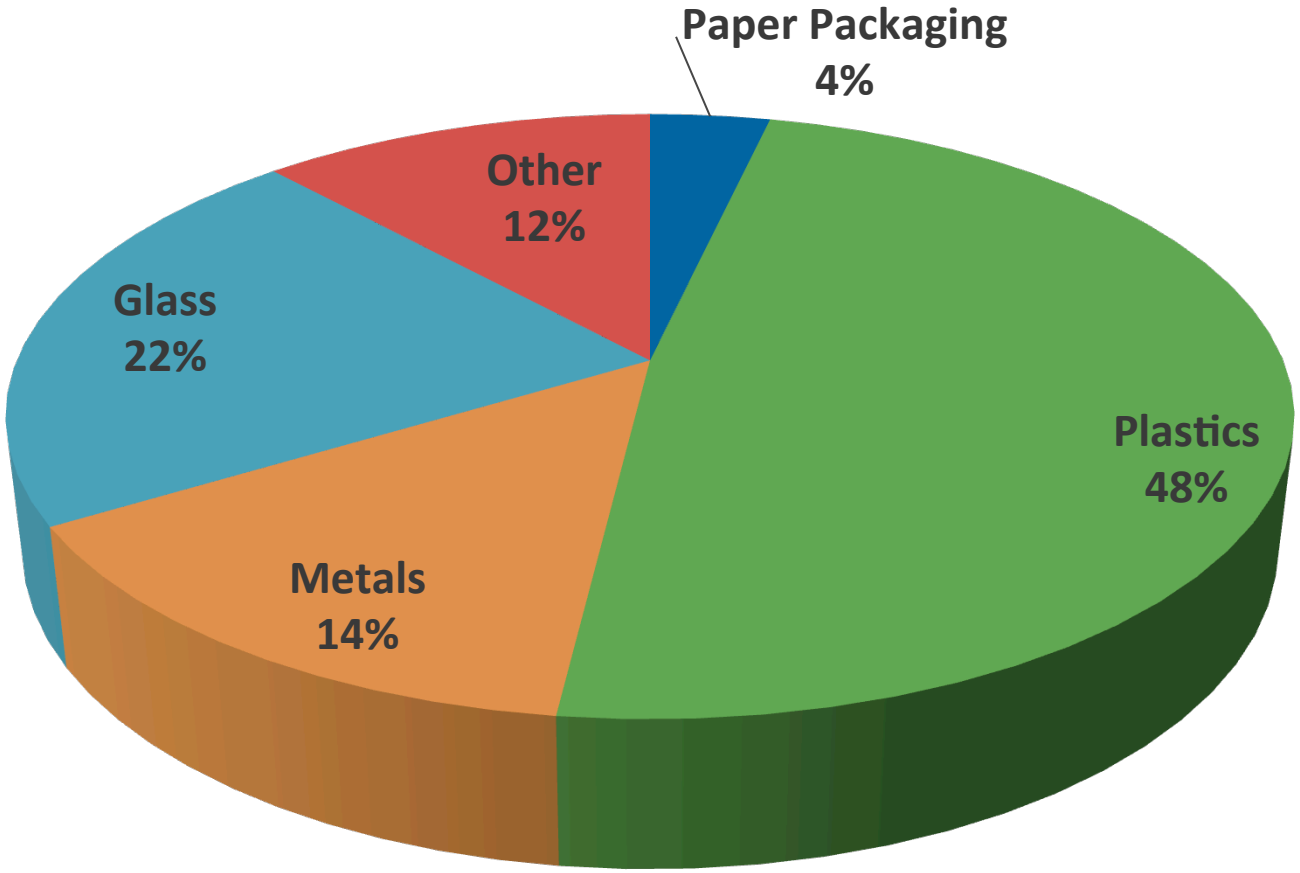
- Objective: Represent regular operations as closely as possible
  - Run full scale tests
  - Empty all lines & bunkers on container side
- Test: Ran ~2 tonnes of material through container line
  - Once clear of lines, collect material from all bunkers/stations
  - Audit bunker/station material to 24 material categories
- Analysis: Process flow & mass balance models
  - Track material through facility & develop recommendations




Current Container Line Process Flow



Key Findings – Tip Floor Composition (%)



Key Findings – Equipment Performance

Equipment	Target Material	Expected Efficiency	Measured Efficiency
Fine Screen	Glass	--	98%
ORSE Screen	Glass	98%	100%
Film Grabber	Plastic film	30%	0%
Magnet	Food & beverage	98%	98%
	Aerosols		100%
Eddy Current	Food & beverage	98%	86%
	Foil, trays & aerosols		68%
Optical Sorter	PET bottles, jugs, jars	90-98%	77%
	PET thermoforms		84%
	Gable top cartons		89%
	Aseptic cartons		85%
	Ice cream containers		79%
	Mixed plastics #4-7		63%

Key Findings – Material Capture Rates

Target Material	Capture Rate (%)
Aluminum food & beverage cans	84%
Aluminum foil, trays & aerosols	63%
PET	73%
HDPE	81%
Mixed Plastics	43%
Film	55%
Cartons	74%
Steel	94%
Glass	98%

- Lower than expected capture rates for high value recyclables
- HDPE currently sorted manually at first 2 manual sort stations
- High rates of PET & HDPE in Mixed Plastics

Key Findings – Revenue Potential

Materials	Avail. Tonnes	Capture Rates (%)	Captured (tonnes)	Expected Revenue ($)	Actual Revenue ($)	Net Diff. ($)
Aluminum Prime	626	84%	528	$1,095,678	$923,375	($172,302)
Aluminum B-Grade	87	63%	54	$98,489	$61,683	($36,807)
PET	2,842	73%	2,078	$1,124,653	$822,126	($302,527)
HDPE	993	81%	806	$606,551	$492,733	($113,819)
Mixed Plastics	1,406	43%	606	$76,519	$33,002	($43,517)
Film	1,116	55%	615	$0	$0	$0
Cartons	376	74%	277	$40,478	$29,806	($10,671)
Steel	1,372	94%	1,288	$423,337	$397,414	($25,924)
Glass	3,100	98%	3,034	($85,396)	($83,579)	$1,817
TOTAL	**11,917**	**78%**	**9,286**	**$3,380,309**	**$2,676,558**	**($703,751)**

Key Findings – Post-Optical Residue

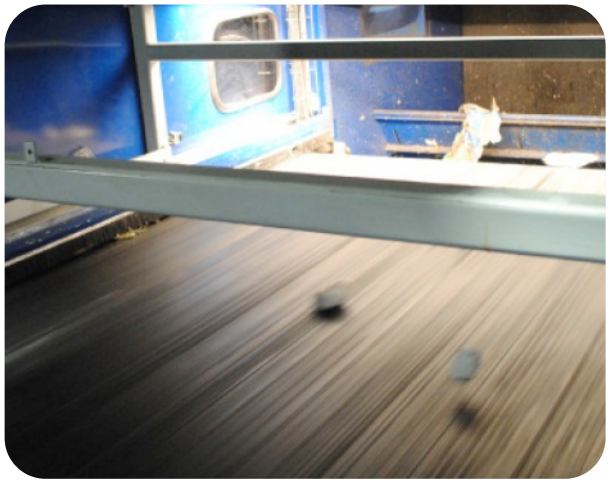
Commodity	Max. Revenue ($/ tonne)	Capture Rates (%)	Reasonable Revenue ($)
Aluminum	$77,363	74%	$61,991
PET	$88,660	73%	$64,811
HDPE	$16,426	81%	$13,344
Mixed Plastics	$11,545	43%	$4,979
Cartons	$2,366	74%	$1,742
Steel	$1,672	94%	$1,570
Glass	-$869	98%	-$850
Residue	-$13,674	64%	-$8,758
TOTAL	**$183,489**		**$138,829**

- Modest recapture of high value recyclables in optical sorter residue would yield ~ $140,000/ annually

Main Recommendation

- 1a: Collect film through alternative programs
  - Depots, return-to-retail, etc.
- 1b: Reconfigure film grabber & install second optical sorter
  - Reconfigure film grabber
  - Optically sort HDPE containers
  - Repurpose existing staff to reduce residue through

Optical Sorters



Alternative Recommendations

- Recommendation 2: Install residue return re-process line
  - Reasonable revenue of ~$140,000 can be generated from reprocessing optical sorter residue
  - Based on conservative capture rates

Next Steps

- Develop price estimate for implementing recommendations
- Estimates will be used to set aside funds for 2015
- RFP/Tender
- After chosen retrofit, carry out a post-mass balance audit

Expanded Blue Box Program
CIF Project Number #631.2

David Miles

Halton Region

Project Highlights: CIF Project # 631.2

- Project goal:
  - Expand BB program to include mixed plastics
- Anticipated impacts:
  - Increase tonnes/volume of BB material
  - Decrease residual material
- More information:
  - david.miles@halton.ca
  - www.halton.ca

Why this Project?

- November 2011 - Halton Regional Council approved the 2012-2016 Solid Waste Management Strategy
- 6 key components to increase waste diversion to 65%
  1. Expand Blue Box Materials & Enhance Blue Box Capacity
  2. Enhance Promotion, Education & Outreach
  3. Enhance Multi-Residential Waste Diversion
  4. Decrease Garbage Bag Limit & Introduce Bag Tags
  5. Enhance Textile Communications
  6. Expand Special Waste Drop-Off Day Events

Focus on First Key Component of SWMS

1. Expand Blue Box Materials & Enhance BB Capacity

- Allows Halton to:
  - Achieve diversion goal sooner
  - Implement changes at the same time
  - Create effective P&E campaign
  - Address confusion around what is & is not acceptable in BB (e.g. Plant Pots & Trays)
  - Decrease amount of residual material

Steps to Implementation

1. Negotiate with MRF Contractor
   - Change to unit price & contract term
   - Addition of new materials
   - Purchase, install & commission Optical Sort Line
2. Operations
   - Establish plan to continue processing during installation
3. Receive Council approval
4. Develop & execute communication strategy

Negotiate with Contractor

- Situation
  - Halton has an agreement to receive, market & process BB material at privately owned & operated MRF
  - Desire to expand; add new BB materials
- Options
  1. Negotiate contract amendment OR
  2. Wait till next contract

Action Selected

- Solution – amend current contract
  - Contract extension to 2018; 8 → 10 years
  - Infrastructure upgrades for mixed plastics
  - Addition of paint cans & spiral wound containers
- What made this possible?
  1. Council support – Approval 2012 – 2016 SWMS
  2. Strong business case – Reasonable payback period & increased potential for revenue
  3. Willingness of MRF Contractor to incorporate new opportunities, market material, & negotiate fairly

Infrastructure upgrade Options

- 2 options for upgrades
  1. Contractor purchase & install
     - New processing rate for municipality
  2. Cost sharing between Halton & contractor
     - Discounted processing rate for municipality relative to option 1
- Select option 2 – Key benefits
  1. Cheaper processing rate – $175,000 / yr
  2. Funding from CIF for infrastructure & P&E

Cost Share Between Halton & Contractor

- Titech Optical Sort System
  - Effective capture of mixed plastics
  - Efficient sorting for markets
- Costs for equipment purchase & install
  - Budget – $1,060,000
  - Actual – $925,000
- CIF funding
  - Equipment – $500,000
  - P&E – $80,000

Communications Strategy

P&E Communication Tool	Cost
Billboards & transit ads	$80,994
Blue Box giveaway events	$38,814
Information Kits	$54,287
Public Service Announcements	$0.00
Total	$174,095

P&E – Look What's NEW in Blue

Results

BB material (tonnes)	2012	Anticipated	Actual	2013
Mixed Plastics	283	100%	223%	915
Polycoat	186	0%	56%	290
Curbside BB	41,943	3%	3.6%	43,451
Multi-Res BB	4,793	2%	2.7%	4,922
Curbside GreenCart	26,388	5%	6.5%	28,116
Curbside Garbage	64,323	-3%	-3.9%	61,791

Summary

- Compliance with best practice – expansion of BB acceptable materials & provision larger BBs
- Continuous Improvement achieved by optimizing MRF & how material is collected curbside
- Performance on Contract
  - Increased service
  - Increased revenue
  - No Net change in operating costs

Optical Sort Equipment for MRFs of Today and Tomorrow

Matt Risko & Charles-Étienne Simard

Machinex

Overview

- The Business Case
- Evolution of Optical Sorting – Hyperspectral Imaging
- 5 Key Things to Understand About Optical Sorters
- Conclusion: The Future of Optical Sorting

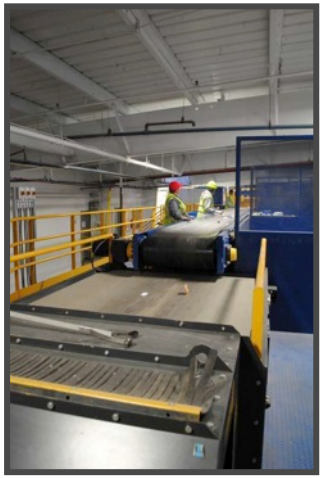
The Business Case (1)

- Does it promote cost savings?
- Is it less expensive than manual labour?
- Does it increase diversion?

- Increases efficiency
- Increases diversion rates
- Increases quality of end product
- Reduces labour costs
- Reduces residue rates

The Business Case (2)

- A person, over an 8 hour shift, can average between 100 to 200 kg/hour
- 3% PET @ 25 tonnes/hour means 750 kg/hour, therefore 5 sorters are required.



- An optical sorting unit can process 7000 kg/hour of plastic and eject an average of 3500 kg/hour
- An optical sorting unit can process 750 kg/hour & be >90% efficient

Evolution of Optical Sorting

Hyperspectral Imaging

- Conventional Vis/NIR spectroscopy only provides point or area measurements, and therefore cannot quantify the spatial variation or distribution of properties and attributes in the product item.
- Moreover, the technique is largely empirical, relying on the development of calibration models relating spectral information to reference measurements that are often destructive (Lu, 2007).
- Hyperspectral imaging is used to overcome these limitations

Hyperspectral Imaging

Conventional Spectroscopy

Hyperspectral Imaging

The HD (high-definition) version of Spectroscopy

5 Key Things To Understand About Optical Sorters

Your Input Affects Your Output

- Mass feed systems require the waste stream to be spread out in a single-layer over the width of a wide belt
- 2D is better than 3D – Perforator/Flattener
- Constant and Regular Input Stream
- Remove bulky objects & glass before Optics
- The cleaner the material going in, the higher the purity coming out

Efficiency VS Purity

Efficiency is how many pieces of a certain material visible on the belt, are ejected by the optical sorter.

Most manufacturers will guarantee anywhere from 90-95% efficiency, because the optical sorter is very good at seeing something if it is visible on the belt.

Purity is what the actual material stream looks like when it comes out of the other side.

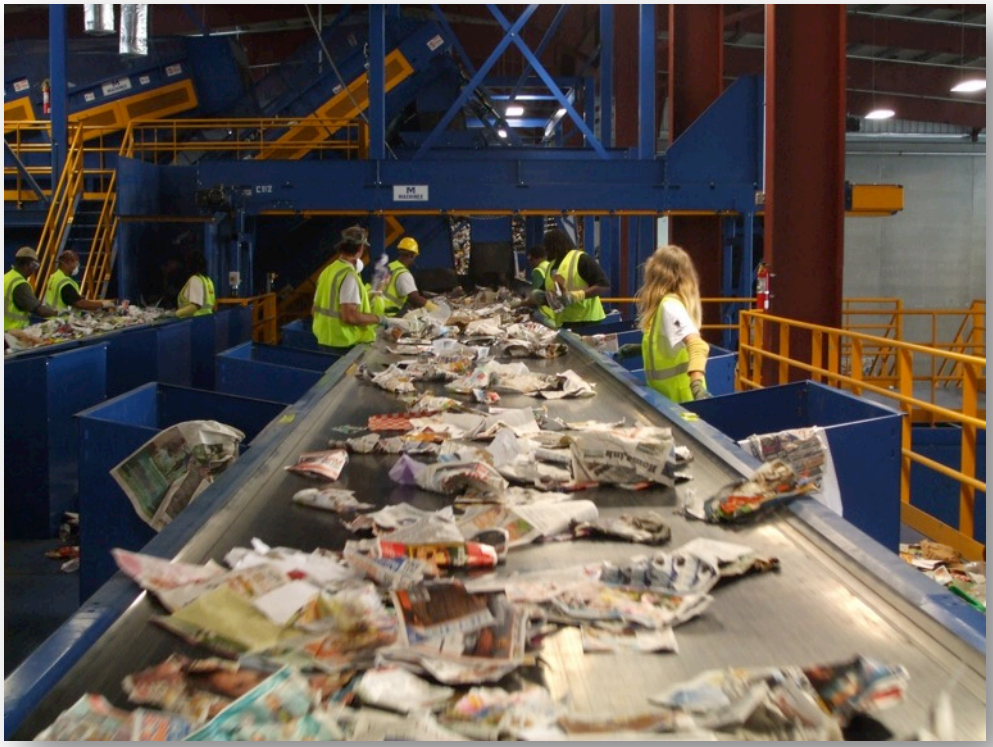
The actual purity of the output is harder to guarantee as there are a lot of variables in play that determines the final output (ex: bi-products).

What You See is What You Get

- The Optical will only eject what it can see
- At least 25% of the object surface to be ejected must be visible
- Black or dark objects on black belt
- Product with liquid/ice inside

We Still Need Manual Labour

- Humans are safe for now!
- QC stations are required (ex: thermoform PET)



It’s a Million Dollar Investment

- Optical Unit
- Speed Belt
- Compressor
- Transfer Conveyors
- Structure, platforms, maintenance access
- Civil work, building permits, enclosures
- Delivery & installation

Future of Optical Sorting

- Hyperspectral imaging equals:
  - Wood classification (C&D, MSW,…)
  - Boxboard classification from paper stream.
  - Much more to come…but it is a secret 

Thank You!

More information:
mrisko@machinexrt.ca
www.machinextechnologies.com

CIF
CONTINUOUS
IMPROVEMENT FUND