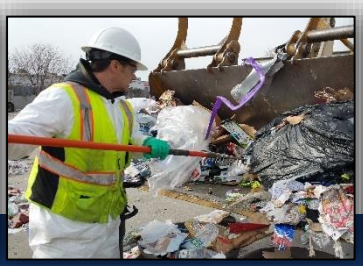
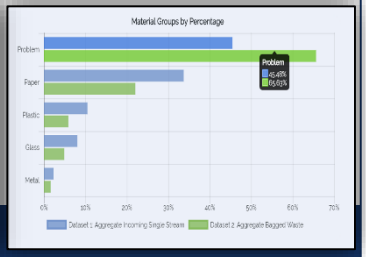
Measuring Composition and Contamination at the MRF

NORTHEAST RECYCLING COUNCIL
FALL CONFERENCE
OCTOBER 31, 2018

MSW CONSULTANTS







Introduction

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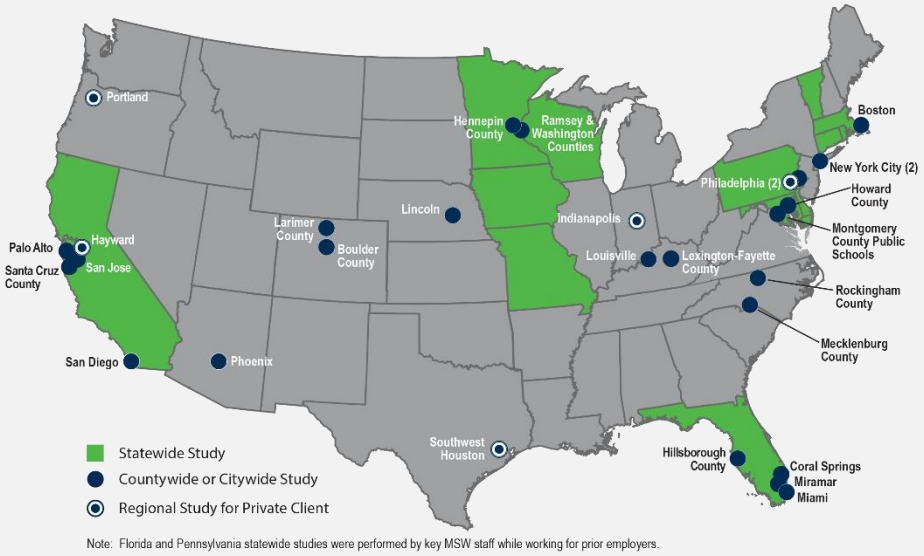
- Collection Optimization
- SWMP/Zero Waste
- Procurement Support
- Cost/Rate Studies
- Recycling/Organics

Material Characterization



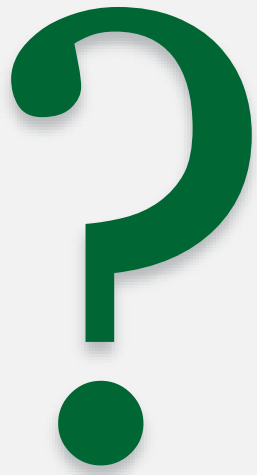
Note: Florida and Pennsylvania statewide studies were performed by key MSW staff while working for prior employers.

Topics

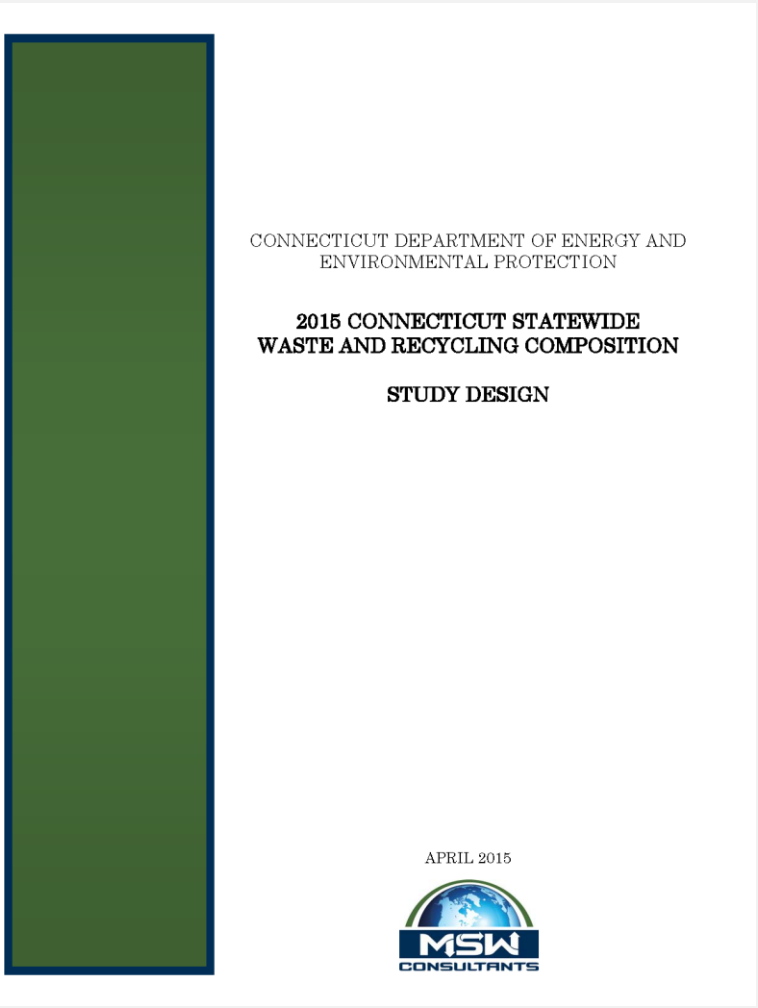
- Compare methods of characterizing mixed recyclables
- Review MRF contamination rates
- Case Study: Quantify the impact of poor data on processing contract management
- Briefly describe a new solution for more consistent, cost-effective composition and contamination monitoring

Why Characterize Recyclables?

- Required (or allowable) by a processing contract
- Quantify the value of your recycling stream
- Understand if recyclers are properly using the recycling program
- Identify and quantify problem materials
- Measure **recycling capture rates** (in conjunction with disposed waste characterization)



Methods for Characterizing Recyclables



- Grab Sampling
- Curb Sampling
- Run Test with Post-Process Sorting and Mass Balance

All Methods Include Sorting and Weighing

Grab Sampling

- Pros:
  - Based on published standard for material composition analysis
  - Measures composition at the supplier/processor transaction point (on the tip floor!)
  - Least expensive
  - Relatively many comparable studies
- Cons:
  - Obtaining representative samples is not trivial
  - “Statistics”

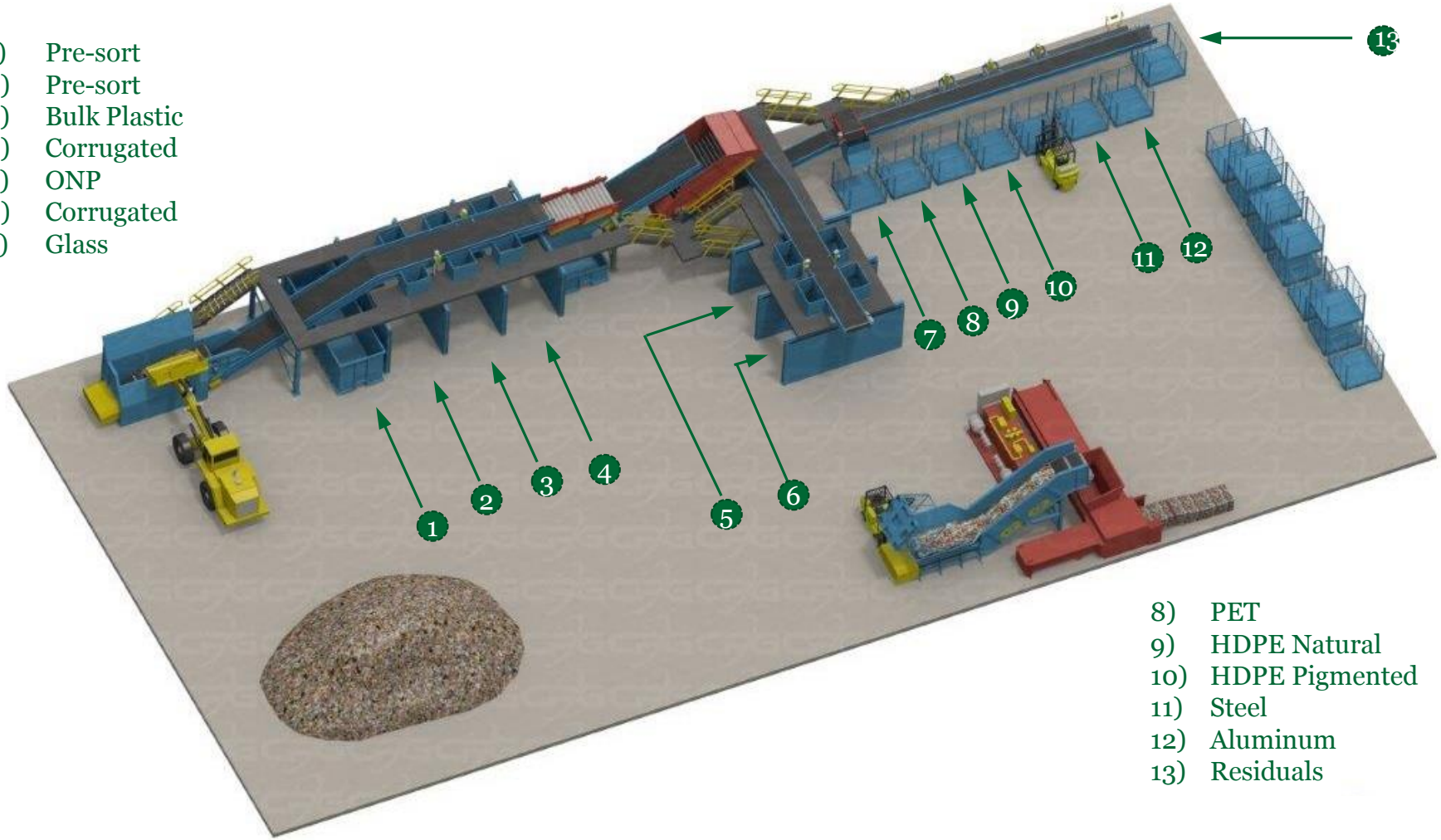
Curb Sampling

- **Pro**: Provides the best understanding of how effectively residents sort their recyclables

- **Cons**
  - Does not reflect the condition of the recyclables when tipped at the MRF
  - May not capture non-residential and/or multi-family recyclers included in collection program
  - Can be more expensive

Run Test with Mass Balance: Definition

1) Pre-sort
2) Pre-sort
3) Bulk Plastic
4) Corrugated
5) ONP
6) Corrugated
7) Glass

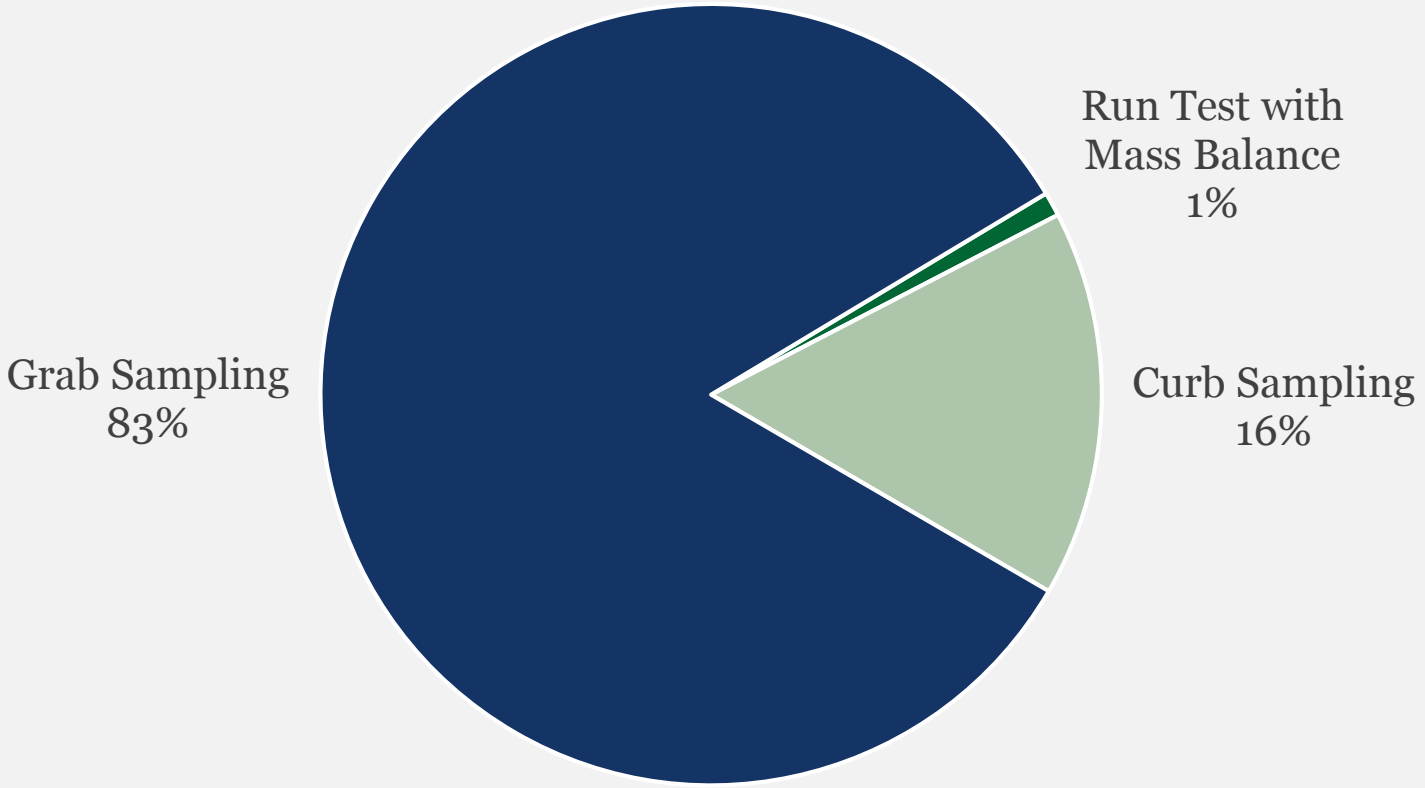


8) PET
9) HDPE Natural
10) HDPE Pigmented
11) Steel
12) Aluminum
13) Residuals

Run Test with Mass Balance

- Pros:
  - Provides the best understanding of the effectiveness of material separation
  - Tests a large quantity of recyclables
- Cons:
  - Does not clearly reflect the condition of recyclables as tipped
  - Expensive and intrusive on MRF operations

52 Recycling Composition Studies



Source: MSW Consultants

Overview of Recycling Contamination Rates

Definitions

- **Contaminant**: Any item that is not targeted by the recycling program (or not allowable under the terms of the processing agreement)
  - **Pre-sort** stations are typically removing larger contaminants
- **Residue/Residual**: Materials that are ejected off the end of the processing line. May include contaminants as well as targeted recyclables that were not captured by sorting system (yield loss).

Inbound Recycling Contamination: US Overview

Recycling Stream Attributes

- Collection Method
  - Curbside
- Date Range
  - 2013-2017
- Generators
  - Residential
  - Mixed
- States of Origin: 21
- Wastesheds
  - State
  - Region
  - County/City
  - Facility
- Material Streams
  - Single Stream
  - Mixed Fiber
  - Commingled Containers

Source: MSW Consultants

Inbound Recycling Contamination

- **Minimum Contamination Rate**: Less than 4%
  - Curbside fiber stream
  - 2013
  - Pre-carts
- **Maximum**: Almost 40%
  - Curbside, carted single stream
  - 2016

- Other Contamination Rate Observations

Average Contamination	
Fiber	5%
Commingled Containers	14.5%
Single Stream	20%

  - 32% of single stream recyclables exceeded 25% contamination
  - 68% exceeded 15% contamination

Source: MSW Consultants

Inbound Recycling Contamination: Northeast

Year	Study	Recyclables	Contamination Rate
2015	Connecticut Statewide	Single Stream	18.2%
2017	New York City Residential	Dual Stream Metal/Glass/Plastic	19.5%
2017	New York City Residential	Dual Stream Paper	8.3%
2017	Philadelphia Residential	Single Stream	19.2%
2014	Boston Residential	Single Stream (Curb Sort)	8.4% - 13.5%
		Average	**15.2%**

Inbound Recyclables Audit Case Study

Audit Results

Group	Material	Percent	Market Value ($/Ton)	Weighted Value ($/Ton)
Paper	Corrugated Cardboard	28.9%	$81.25	$23.48
	Residential Mixed Paper	19.6%	$50.31	$9.86
	Aseptic Packaging and Gable-Top Cartons	0.3%	$113.75	$0.36
Plastic	#1 PET Plastics	4.2%	$274.40	$11.41
	#2 HDPE Plastics Natural	1.0%	$618.80	$6.12
	#2 HDPE Plastics Colored	1.3%	$503.20	$6.31
	#4, #5, #7 Plastics	0.6%	$0.40	$0.00
	Bulky Rigid Plastics	3.0%	$5.00	$0.15
Glass	Glass Bottles and Broken Glass	17.7%	-$15.50	-$2.75
Metal	Aluminum Beverage Cans & Trays	1.2%	$1,315.00	$15.19
	Steel/Aerosol Cans	1.2%	$53.75	$0.66
Contamination		18.0%		

Calculated Value

$70/ton

Follow-up Audit Results

Group	Material	Percent	Market Value ($/Ton)	Weighted Value ($/Ton)
Paper	Corrugated Cardboard	18.0%	$81.25	$14.63
	Residential Mixed Paper	22.8%	$50.31	$11.47
	Aseptic Packaging and Gable-Top Cartons	0.3%	$113.75	$0.36
Plastic	#1 PET Plastics	5.1%	$274.40	$13.99
	#2 HDPE Plastics Natural	1.1%	$618.80	$6.81
	#2 HDPE Plastics Colored	1.3%	$503.20	$6.54
	#4, #5, #7 Plastics	0.5%	$0.40	$0.00
	Bulky Rigid Plastics	1.5%	$5.00	$0.08
Glass	Glass Bottles and Broken Glass	28.0%	-$15.50	-$4.34
Metal	Aluminum Beverage Cans & Trays	1.2%	$1,315.00	$15.78
	Steel/Aerosol Cans	2.2%	$53.75	$1.18
Contamination		22.0%		

Follow-up Audit Value

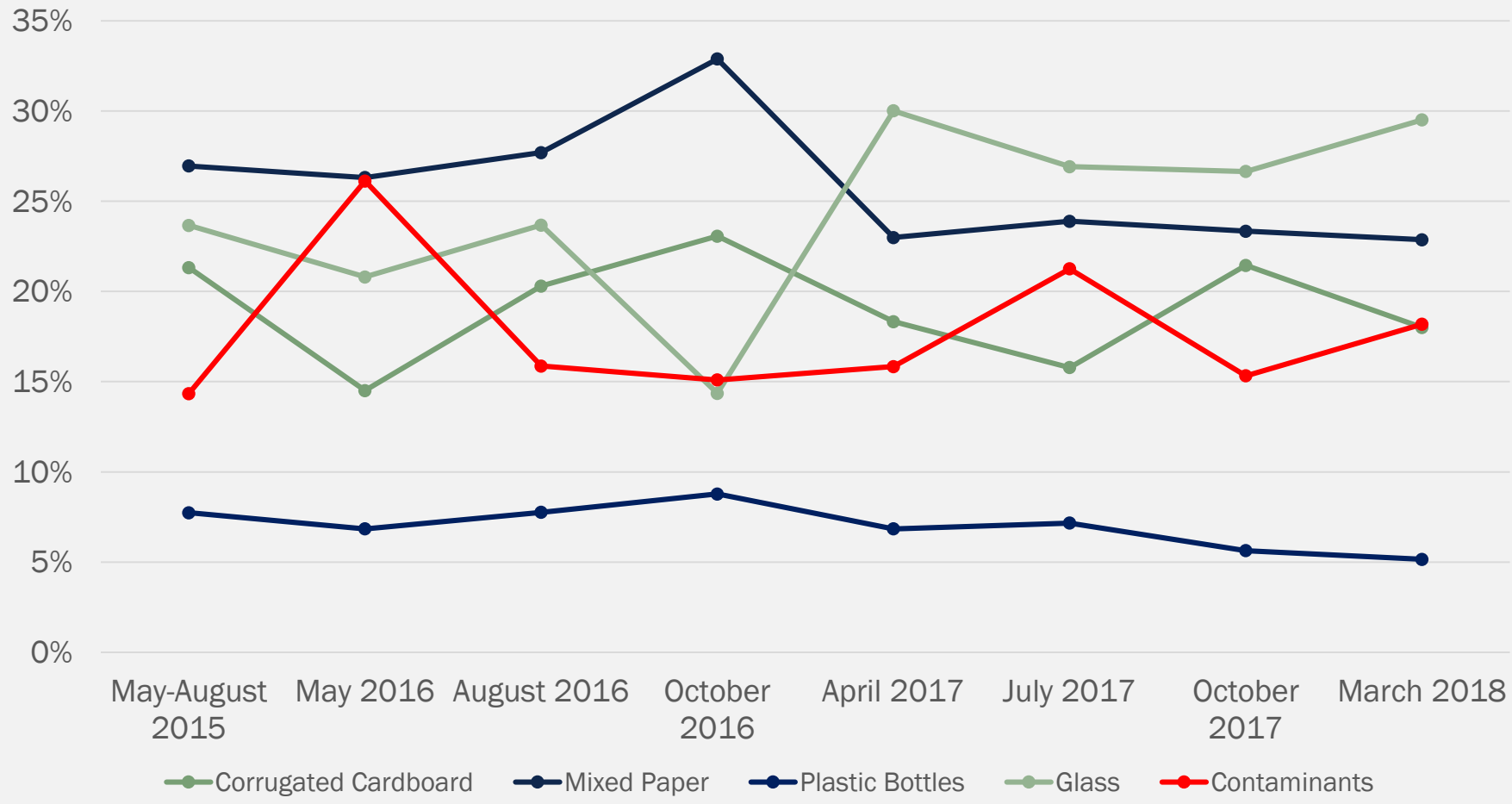
$66/ton

(6% less)

Financial Impact

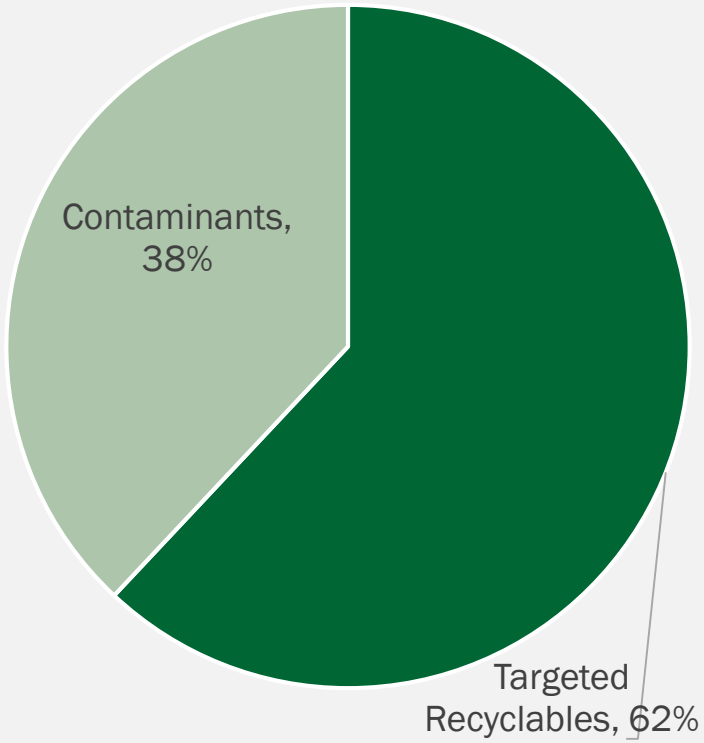
$300,000 swing

Composition Time Series



Bagged Wastes

- Bagged materials have averaged 4.6 percent of inbound recyclables
- Over time bagged materials have contained incrementally more Contaminants



Conclusions: Recycling Composition…

- *Depends on the methodology*
  - *Bagged materials?*
  - *Newspapers in sleeves?*
- *Is influenced by many factors*
  - *Weather*
  - *Routes*
  - *Seasonality*
- *Changes over time*
- *Is hard to measure*

Is best measured through routine audits that capture material samples over time from all routes and all seasons

Is there a better way to audit recyclables?

SEEKING FEEDBACK FROM CITIES, TOWNS AND PROCESSORS

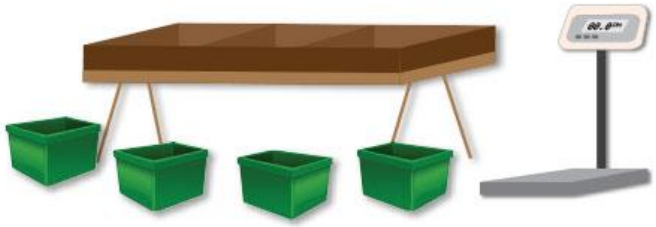
How can audits be easier, cheaper, better?

- Collaboratively developed audit protocol that meets technical standards
- Standardized, proven sorting tools and equipment
- Web-based data management platform
  - Upload and analyze audit data
  - Store pictures of inspected loads and/or audited samples
  - Share data with processor and supplier in real time

WasteInsight™

The Grading and Purity (GAP) System

Customized Audit Protocol

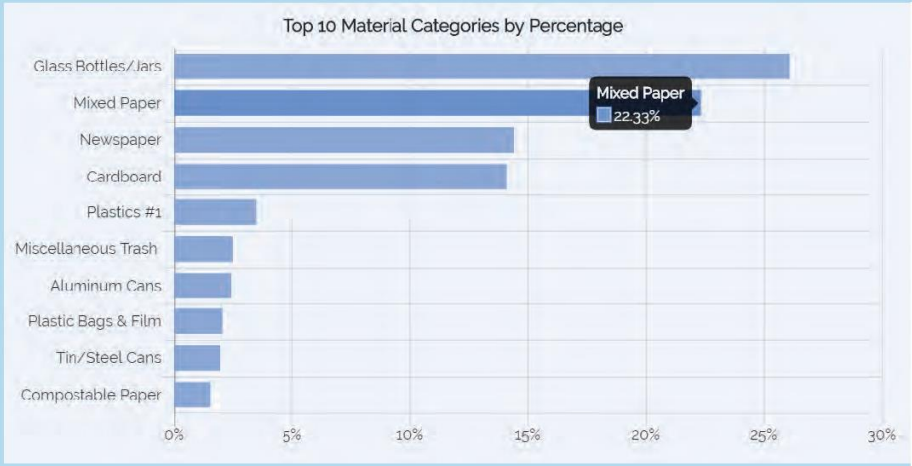


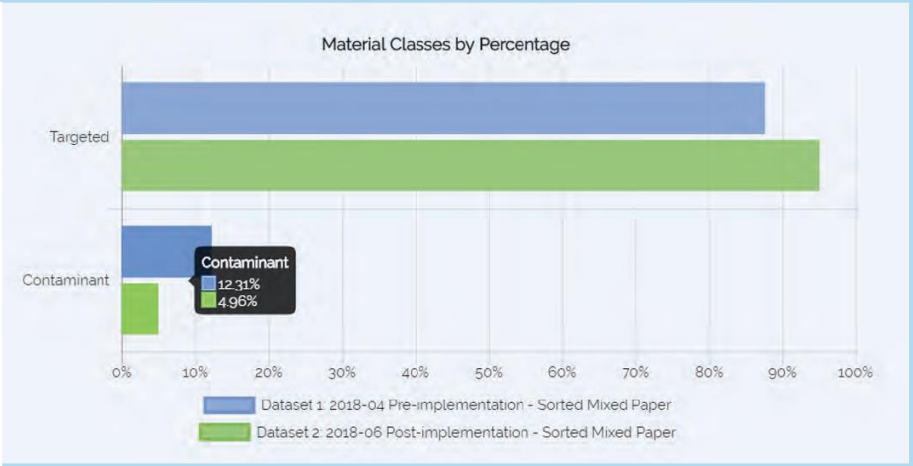
Specified Equipment
for sorting, weighing, and data recording

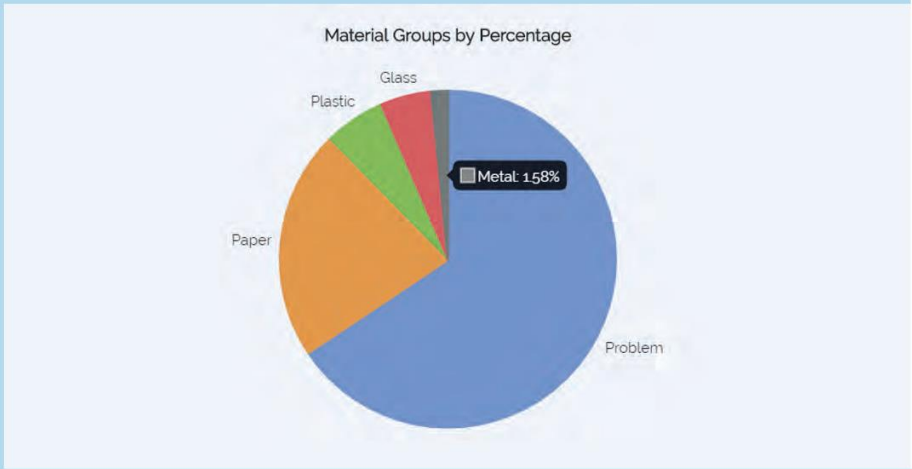
Cloud Based Data Management

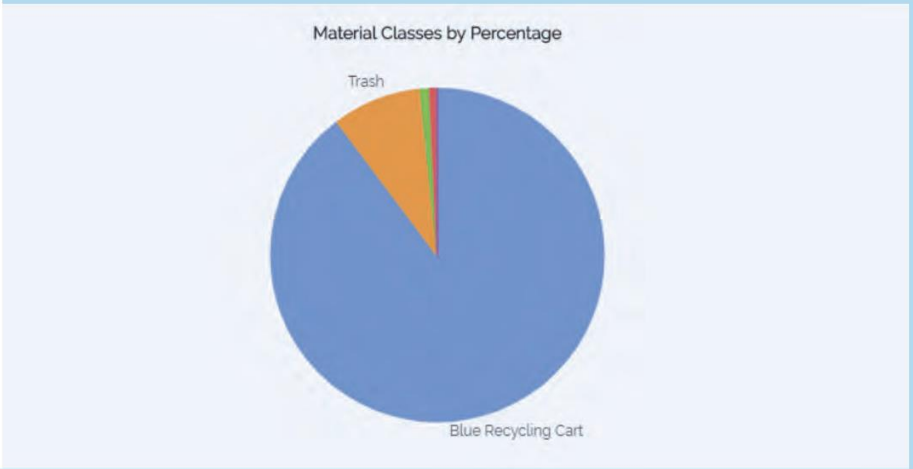
Composition, Market Value & Contamination Report
for You / for Your Supplier

All data is provided numerically and graphically. You may download your data into a spreadsheet at any time. Built-in queries provide you with the composition based on any grouping you need to evaluate the material quality. Analyze the composition by individual commodity, or view the level of contamination, or create a custom view to meet your needs.

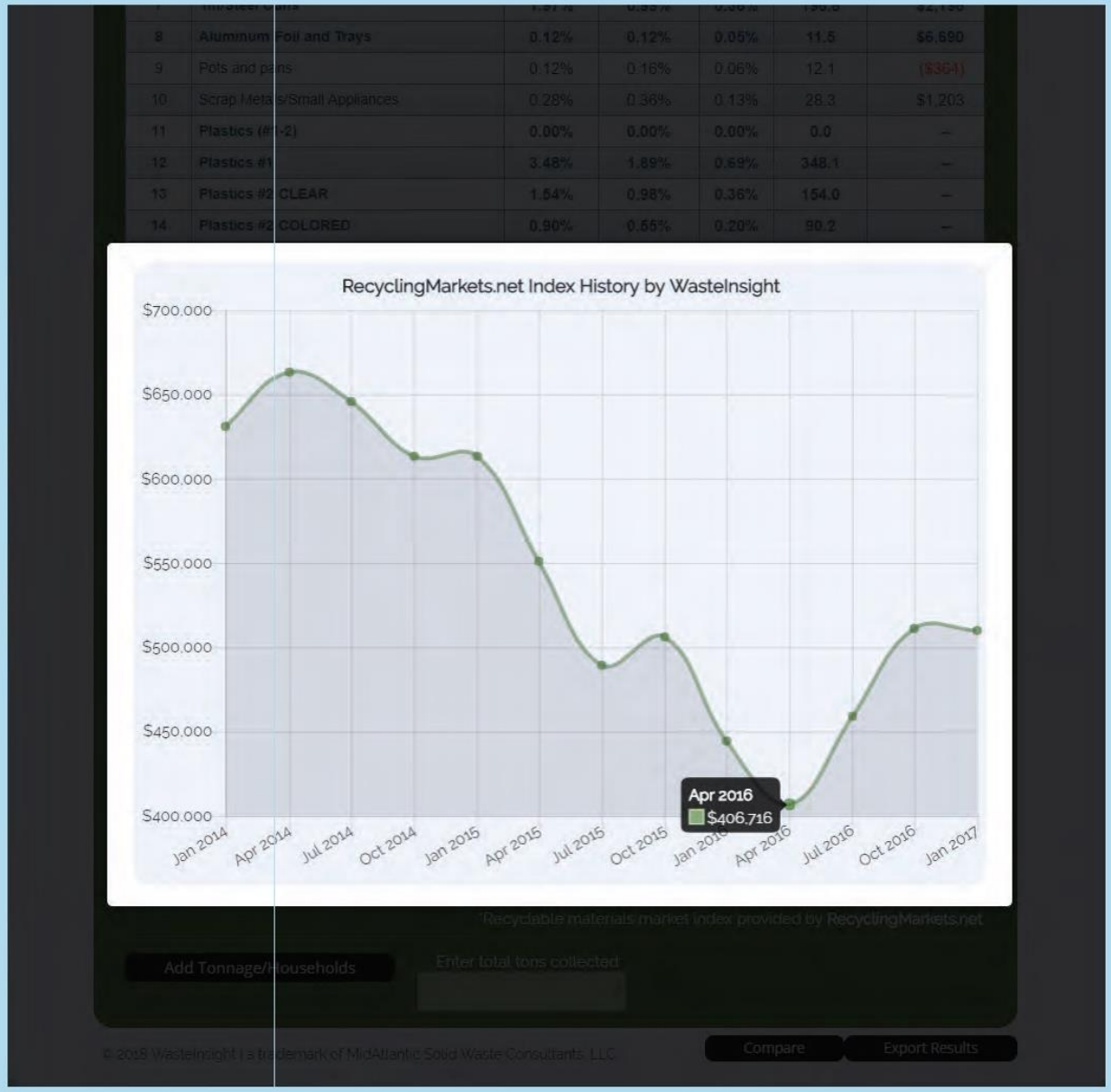




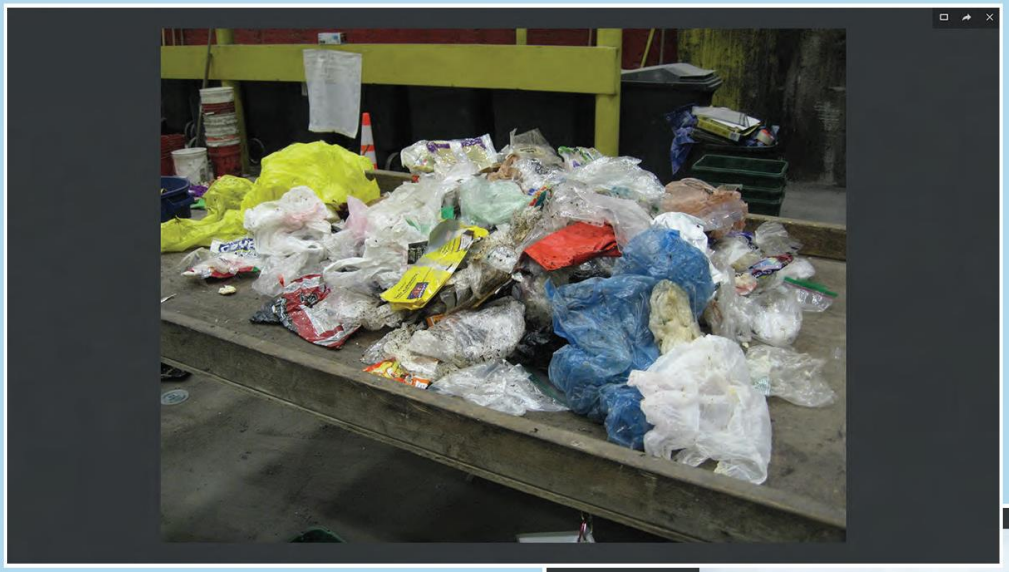




You can also back-calculate the value of the audited material stream for the preceding three years based on RecyclingMarkets.net historical pricing.



Pictures can be browsed and downloaded for each sample or load.
The ***WasteInsight***™ team can help develop customized reports that combine data and photos.



Feedback Requested

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GAP System in Action