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# Commercial Mixed Recyclables Composition Study

May 2020

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## **SECTION 1: INTRODUCTION**



In November 2019, Metro completed the Commercial Mixed Recyclables Composition Study to evaluate the amount and types of non-acceptable material, known as contaminants, placed in recycling bins by businesses and their employees in the Metro region. More than 38,000 pounds of mixed recyclables, or 173 samples, were collected and sorted over the course of this study. The information gathered through this study will be used by Metro and local governments to inform the development and implementation of strategies designed to decrease the overall level of contamination in mixed recyclables.

## The evolution of recycling in our region

Recycling makes it possible to make millions of products out of materials that would otherwise go to the landfill. Manufacturing products with recycled content materials saves energy, reduces air and water pollution, reduces greenhouse gases, and conserves natural resources that would otherwise be used as raw materials in production.

Curbside collection of recyclables makes recycling convenient. This service has been a key element of the Metro region's recycling programs since 1983, when the Oregon Opportunity to Recycle Act required communities throughout the state to provide curbside collection.

A successful recycling system depends on the quality of material collected. In 2017, overseas recycling markets began to limit the amount of recyclables Oregon could send to these markets, disrupting Oregon's recycling system. One reason for the change was some countries were no longer willing to accept recyclables that were contaminated with trash or other contaminants.

Metro designed the study described here to evaluate the performance of commercial recycling collection service in terms of the quality of materials sent to material recovery facilities for preliminary processing. The study is intended to help the region generate the best and most marketable recyclable materials through its collection programs.

#### Bins

In this report the word "bins" is used to refer to all receptacles used to collect garbage, mixed recycling and glass. For businesses, bin types vary and could include roll carts, large cages or dumpsters.



#### **Commingled Recyclables**

In the Metro region, recyclable paper, cardboard, plastic and metal are mixed together in a collection bin. Glass is separated and collected in its own designated bin.

## Background

Since September 2008, more than 59,400 businesses located in the Metro region have been required to separate all recyclable paper, cardboard, glass and plastic bottles and jars and aluminum and steel cans for recycling. The Business Recycling Requirement is implemented and enforced by local governments in the Metro region through local code. Local governments must notify businesses, establish a compliance program and report annually to Metro. Businesses must provide collection containers for recyclables in work areas and post signs with recycling instructions for employees. Similar to the region's residential recycling collection system, businesses typically mix all recyclables in one bin except for glass, which is collected on the side.

Metro has conducted two previous studies evaluating the levels of contamination in residential recycling streams (2017 Multifamily Waste Characterization Study, 2015 Single-family Recycling Composition Study) but this is the first study to evaluate the composition of mixed recyclables generated by the business sector.

While the study includes the amount and types of acceptable material set out by businesses (quantity), the non-acceptable material (quality) was the primary focus of the work. Reducing the amount of contamination in mixed recycling bins will help ensure there are viable markets for recyclable material collected from businesses and residents in the Metro region. The information will also be used as the baseline for one of the 2030 Regional Waste Plan indicators. The plan includes a robust measurement framework that is used to evaluate and communicate the overall trajectory of progress towards its vision and goals. Recycling contamination by sector is one of the plan's key indicators.

## **SECTION 2: STUDY METHODOLOGY**

As noted above, Metro took 173 samples of mixed recyclables. The minimum weight requirement for a sample was 200 pounds and the average weight per sample was 221 pounds. All of the samples were sorted into the material categories listed in Table 1. More detailed information about the categories is available in Appendix A.

#### **Table 1: Material categories**

Paper categories	Plastic categories	Other categories
<ul> <li>Acceptable cardboard</li> <li>Acceptable other paper</li> <li>Acceptable cartons (such as milk cartons and boxes for broth and other liquids)</li> </ul>	<ul> <li>Acceptable plastic bottles, jars and round plastic containers</li> <li>Rigid plastic packaging such as takeout and square</li> </ul>	<ul> <li>Food and liquids</li> <li>Yard debris</li> <li>"Tanglers" such as wires, hoses, chains and electric</li> </ul>
<ul> <li>Non-acceptable other paper</li> <li>Metal categories</li> <li>Acceptable metal</li> </ul>	as takeout and square plastic containers · Other rigid plastic · Foam food packaging and black foam	<ul> <li>Coras</li> <li>Medical waste</li> <li>Textiles and shoes</li> <li>Disposable diapers</li> <li>Batteries</li> </ul>
Glass* <ul> <li>Acceptable glass</li> <li>Non-acceptable glass</li> </ul>	<ul> <li>Plastic shopping and produce bags</li> <li>Wrap, film and bags</li> <li>Other plastic</li> </ul>	• Other residuals

\*In the Metro region, glass is collected separately from mixed recyclables in a separate bin, therefore, both acceptable and non-acceptable glass were considered a contaminant in this study.

A minimum sample size of 160 was determined to provide a statistically valid sample with a confidence level of 95% and a margin of error of 2%. Variation in samples was assumed to be similar to Metro's 2017 Multifamily Study. The study drew samples from businesses located within the Metro boundary and in the cities of Beaverton, Gresham, Portland, and Clackamas and Washington counties. The number of samples drawn from each jurisdiction was proportionate to the number of businesses in each jurisdiction to ensure the sampling was representative of the Metro region as a whole. Information about the samples collected in each jurisdiction is provided in Table 2.

Jurisdiction	Number of businesses	Target samples	Completed samples	Total weight of the sample (lbs)	Average sample weight (lbs)
Beaverton	4,200	11	12	2,455	205
Gresham/Troutdale	3,000	7	8	1,764	221
Portland	29,200	77	92	20,136	219
Washington County	12,900	33	33	7,338	222
Clackamas County	10,200	28	28	6,547	234
Total	59,400	160	173	38,239	221

#### Table 2: Samples collected in each jurisdiction

More than 40 private haulers collect recyclables, food scraps, yard debris and garbage from customers in the Portland region. Most city and county governments utilize a franchise system which determines the geographic territories each hauler may serve and the rates charged to customers. To determine the number of samples needed from each collector in each franchised jurisdiction, Metro randomly selected business addresses that were used to identify the garbage and recycling collector for that customer and determine the number of samples collected from each company.

Since commercial collection is not franchised in the City of Portland, a business's collection company is unknown, making the random selection method used in the franchise areas more difficult. As an alternative method, Metro hired a contractor to do field verification of the collection companies for 77 randomly selected businesses located within the city limits.

For both franchised and non-franchised jurisdictions, Metro used data from the Regional Material Collection Database (known as ReTRAC) to evaluate the sample allocation and make adjustments as needed based on the tons of mixed recyclables collected by each hauler in each jurisdiction.

## Sampling process

Samples were taken directly from recycling trucks upon arrival at a Material Recovery Facility. Metro coordinated with route managers to collect purely commercial samples by sampling trucks from business-only routes. If a collection company was able to deliver a pure commercial load to Metro's sorting contractor, then the contractor took two samples from the truck, one from the back and one from the front. If the load was from a mixed commercial and multifamily route, the driver had to isolate the multifamily material in the front or back of the load, and the contractor took one sample from the commercial-only side of the truck.

## The garbage and recycling system

Our regional garbage and recycling system handles products and packaging at the end of their useful life. The system includes:

## **Repair and Reuse**

Hundreds of organizations in the Portland region help businesses extend the life of their products by repairing them or supporting their reuse instead of disposal.

## Collection

40+ private hauler companies collect the materials like food scraps and mixed recyclables that are separated by businesses.

## Transfer

Seven transfer stations serving our region accept garbage, yard debris and food scraps. They consolidate these materials and transfer them to landfills and compost and biogas facilities.

## Recycling, Compost and Biogas production

40+ recycling, compost and biogas facilities process materials and turn them into a beneficial use.

## Material Recovery Facility (MRF)

MRFs separate materials for the purposes of recycling from an incoming, source-separated waste stream.

## Landfill

Seven landfills located across Oregon and Washington receive the greater Portland area's garbage. The 173 samples were collected in four weeks between June and November 2020. Table 3 provides information about the collection schedule, sorting locations and number of samples collected and sorted each week.

Study Week	Dates	Number of samples	Jurisdictions	Material Recovery Facilities
Week 1	June 11-14 <sup>th</sup>	40	<ul> <li>Clackamas County</li> <li>City of Beaverton</li> </ul>	<ul> <li>Willamette Resources</li> <li>Inc. (WRI)</li> <li>KB Recycling</li> <li>Far West Fibers</li> <li>Hillsboro</li> </ul>
Week 2	July 8-12 <sup>th</sup>	48	<ul> <li>Washington</li> <li>County</li> <li>City of Beaverton</li> <li>City of Portland</li> <li>City of Gresham</li> <li>City of Troutdale</li> </ul>	<ul> <li>WRI</li> <li>Far West Fibers Northeast</li> <li>Far West Fibers Hillsboro</li> </ul>
Week 3	July 29-Aug 2 <sup>nd</sup>	32	Washington County City of Portland	<ul> <li>Environmental Fibers</li> <li>Inc. (EFI)</li> <li>KB Recycling</li> </ul>
Week 4	Nov. 11-15 <sup>th</sup>	53	<ul> <li>City of Portland</li> <li>City of Troutdale</li> </ul>	<ul> <li>EFI</li> <li>Far West Fibers</li> <li>Northeast</li> </ul>

## Table 3: 2019 commercial mixed recycling sample collection schedule

## **Section 3: Regional Composition**

Metro calculated regional averages for the amount and types of contaminants in mixed recycling bins from businesses. The study results showed an average contamination rate for all samples combined of 14 percent. The sample with the least amount of contamination was 0% and the sample with the most contamination was 97%. The average weight of non-acceptable materials per sample was 30 pounds out of an average sample size of 221 pounds.

Metro has completed similar studies assessing the performance of the region's single-family and multifamily household recycling programs. As a point of comparison, findings from the 2014-15 single-family study found a regional level of 9 percent contamination in mixed recycling bins. Findings from the 2016-2017 multifamily study found a regional level of 21 percent contamination. A 95 percent confidence interval was used for this study. The confidence interval tells that there is a 95 percent probability that the percentage of contaminants in the average regional recycle bin is between 11.3 percent and 15.9 percent.

## Figure 1: Contaminants in the Commercial Recycling Bin



A comparison of contamination rates between Washington and Clackamas counties and Cities of Portland, Beaverton and Troutdale and Gresham is shown in Table 4. The horizontal lines are contamination rates. The thick bars represent the confidence interval around each estimate (margin of error). The vertical lines represent the variation of observed, per-load contamination within that jurisdiction, from the most contaminated sample to the least contaminated sample. The numbers shown for each jurisdiction are the average contamination rates followed by the margin of error. For example, in Clackamas County, the average contamination per sample was 6% and there is 95% confidence that the average contamination in commercial recycling bins is between 4% and 8%.

A statistical test, known as a t-test, was used to determine whether the difference in contamination rates between jurisdictions is statistically significant. When an analytical result is statistically significant it means the finding is not due to chance. The study results show only a few of the jurisdictional differences were statistically significant. The results show the mixed recyclables set out in bins by businesses in the City of Portland are more contaminated than those in Clackamas and Washington counties. It is important to note that there are many variables that can affect business recycling contamination rates in a jurisdiction and it is beyond the scope of this study to determine which have had the biggest impact.



Table 4: Variation in the percentage of contamination by area of the region

## Acceptable curbside recyclables

The study also looked at the composition of acceptable curbside recycling materials in each

sample. Figure 2 shows the average percent for the four material categories. Cardboard makes up the largest portion of acceptable recyclables in the recycling bin, followed by paper. The average weight of acceptable curbside recyclables per sample was 191 pounds.



The garbage and recycling system creates jobs, supports families, spurs economic activities and strengthens industries. When residents and businesses in the Metro region pay for garbage and recycling services, their payment has direct and indirect impacts on our region's economy, totaling more than \$537 million in economic activity each year.

## Figure 2: Acceptable Materials in the Recycling Bin



## Non-acceptable plastic film and shopping bags

Plastic film and other non-acceptable plastic materials were found in commercial recycling bins across the region. Combined, plastic categories make up 3.74% of the contaminants. Figure 3 shows the breakdown of plastic contamination by plastic categories. A majority of the non-acceptable plastic is film plastic such as polyethylene and shrink wrap used for shipping and storing materials and products. It is common for shopping bags and film plastic to jam sorting machinery at recycling facilities, thereby increasing the cost of processing recyclables for shipment to end-markets. Plastics, especially film, tend to be much lighter compared to other materials in the recycling bin such as cardboard, so even a small weight percentage of film contamination can create a large negative impact on the quality of the material.



Study sample that contained film plastic and tangles

## Non-acceptable plastic categories

#### Film

Polyethylene plastic shrink wrap and sheeting, hay sleeves and silage bags, fertilizer and feed bags from agricultural operations, furniture and mattress wrap. Garbage bags, shower curtains, chip bags, plastic beverage and food pouches.

## **Carry-out bags**

Plastic grocery and retail carry-out bags.

## **Rigid plastic packaging**

Plastic rigid packaging that is not an acceptable plastic bottle, jar or tub. Examples include single-use drink cups, lids and clamshells.

## Other rigid plastic

All other rigid plastic that is not packaging, for example, toys.

## Foam packaging

Polystyrene and polyethylene foam containers and packaging. Examples include foam deli and takeout containers, clamshells, drink cups, block foam and peanuts.

## Figure 3: Non-Acceptable Plastics by Plastic Category



## Tanglers

Tanglers are similar to film plastic because they are lightweight and can jam up sorting equipment when received from a mixed recycling bin. For this study, tanglers were defined as unaccepted items that are long and thin. Examples include electrical cords, garden hoses, caution tape, box strapping, twine, and rope. It is common for tanglers to be present in recyclables collected from businesses because plastic or metal strapping is frequently used to store boxes of supplies or merchandise together on a pallet. In this study, on average, tanglers were less than one percent of the average sample in terms of their weight, but their impact on the recycling system is likely underestimated because their presence is likely greater by volume.



An example of a plastic tangler that was found in a sample used for this study



## **Looking Ahead**

Working together, Metro and its local government partners and private sector service providers will use these studies, along with other information, to inform the development and implementation of policy, education and technical strategies to reduce contamination in commercial recyclables, as well as capital and operating improvements that material recycling facilities can use to more effectively sort out contaminants present in the recyclables they process.

## **SECTION 5: SUMMARY OF CONCLUSIONS**

## There is an opportunity to reduce the amount of contamination in commercial recycling bins.

The study showed a regional average of 14 percent contamination in recycling carts.

## Contamination in the business recycling stream varied across jurisdictions.

While the findings of the study demonstrate there are differences in the levels of contamination, it's important to note that many variables can affect business recycling contamination rates in any one jurisdiction. It is beyond the scope of this study to determine which have had the biggest impact.

### The contamination rates for some samples suggested there might be operational issues that, if addressed, could have a positive impact on material quality.

The eight most contaminated samples had contamination rates between 36% and 97%. Removing these samples from the analysis would have lowered the regional contamination rate for the study from 14% to 11%. Addressing the source of this contamination could yield a positive impact on regional contamination reduction.

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Environmental Fibers Inc. (EFI) Far West Fibers, Hillsboro and NE Portland locations KB Recycling Willamette Resources Inc. (WRI)

Metro would like to thank the following recycling and waste collection companies for their participation in the study and providing the route information needed to allow collection of the samples.

City Sanitary	Hoodview Disposal
Cornelius Disposal	Oregon City Garbage
Garbarino Disposal	Portland Disposal
Gresham Sanitary	Pride Disposal
Heiberg Garbage	Recology
Hillsboro Garbage	Republic Services

Sunset Garbage Walker Disposal Waste Connection Waste Management West Linn Refuse and Recycling

## **APPENDIX A: MATERIAL CATEGORY DEFINITONS**

## **Commercial Mixed Recyclables Composition Study Material Category Definitions**

#		Material	Definition
1		Acceptable cardboard	Corrugated cardboard and Kraft paper. Does not include waxed and plastic coated cardboard.
2		Acceptable other paper	High grade paper, low grade, mixed paper, newspaper, phone books, paperboard, magazines.
3	Paper	Acceptable cartons	Aseptic and gable-top cartons composed of polyethylene-coated bleached packaging board and containing beverages, soups, or flowable food.
4		Non-acceptable other paper	All paper that is not acceptable in commingled collection, including freezer boxes, coffee cups, padded shipping envelopes, hard-covered books, waxed/poly-coated containers such as waxed cardboard.
5		Acceptable plastic bottles, jars and tubs	Deposit and non-deposit plastic bottles and jars 6 oz or larger. Plastic Tubs 6 oz or larger, usually round with a wider rim than base and contain products such as salsa or yogurt. Rigid nursery pots larger than 4 inches in diameter and buckets 5 gallons or smaller. Does not include bottles that have held motor oil, pesticides or herbicides which are considered Other Residuals (see #22 below).
6		Rigid plastic packaging	Plastic rigid packaging that is not an acceptable plastic bottle, jar or tub. Examples include tubs, trays, clamshells, single-use drink cups, lids, egg cartons, cake domes, covers, deli containers, and other thermoform packaging.
7	stics	Other rigid plastic	All other rigid plastic. Does not include mixed plastic material.
8	Pla	Foam food packaging and block foam	Polystyrene foam containers and packaging. Examples include foam and solid/rigid deli and takeout containers, clamshells, drink cups, block foam and other foam packaging such as peanuts.
9		Carry-out bags	Plastic grocery and retail carry-out bags as defined by <u>Portland Bag Ban's</u> definition.
10		Plastic film and bags	Polyethylene plastic and shrink wrap, newspaper bags, bread bags, dry cleaner bags, bubble wrap, clear and black polyethylene plastic sheeting, hay sleeves and silage bags, fertilizer, peat and feed bags from nurseries/agricultural operations, furniture and mattress wrap.
11		Non-recyclable film	Garbage bags, polypropylene (#5) films and bags, shower curtains, chip bags, plastic beverage and

#		Material	Definition
			food pouches and all other film plastic not in the "plastic film and bags" category.
12	Metal	Acceptable metal	Deposit and non-deposit steel and aluminum cans, aluminum foil and trays, empty aerosol cans and all other metal items that are less than 30" long and weigh less than 30 pounds.
13	SS	Acceptable glass	Glass deposit containers, non-deposit glass bottles and jars.
14	Glas	Non-acceptable glass	Glass that is not acceptable in the mixed recyclables collection program including pint glasses, water cups and other dishware.
15		Food & liquids	Food wastes and scraps, including bone, rinds, etc. Includes contained liquids. Excludes the weight of food containers, except when container weight is not appreciable compared to the food/liquid inside.
16		Yard debris	Weeds, leaves, grass clipping, branches less than 4 inches in diameter and other vegetation, including soil adhering to plant roots.
17		Tanglers	Unaccepted items that are long and thin. Examples include electrical cords, garden hoses, caution tape (and similar tape), streamers, chains, box strapping, twine and rope.
18	Contaminants	Medical waste	Includes syringes, tubing, gauze, blood-containing and similar materials, including urine-filled roadside bottles. Bags and containers with visible medical waste are not sorted further. Thus, other non- medical waste is weighed as medical waste if it is in a bag or container with other apparent medical waste.
19	Other	Fabrics & shoes	Clothing, rags and accessories made of natural and synthetic textiles such as cotton, wool, silk, woven nylon, rayon, polyester, leather and other materials. Examples include pants, shirts, fabric purses, bed sheets, towels and shoes.
20		Disposable diapers	Disposable baby diapers and adult protective undergarments.
21		Batteries	Lead-acid and dry-cell batteries. Lead-acid includes large batteries from vehicles or boats. Dry-cell batteries includes regular alkaline, NiCad, lithium and small-sealed lead-acid batteries.
22		Other residuals	All other non-recyclables.

## **APPENDIX B: CONTAMINANTS IN RECYCLING STUDY STATISTICAL ANALYSIS**

Appendix B provides a summary of the data and analysis staff produced for the figures and tables in this study. The first section provides background on the calculations used in the study, number of samples and average sample weight. The remaining sections are organized by table and include analysis and outputs from R, the statistical software program used for the analysis of the data collected for the study.

## **BACKGROUND DATA CALCULATIONS**

The amount of material in each recycling bin sample that is not recyclable curbside is calculated as a ratio by dividing the weight of the contaminant materials in each sample by the sample's total weight. The regional average is then calculated by taking the average of these sample ratios. This approach ensures the contamination rate of each sample contributes equally to the regional calculation and it controls for variation in sample weight.



### SAMPLE ALLOCATION AND AVERAGE SAMPLE WEIGHT

This study drew samples from the cities of Beaverton, Gresham/Troutdale, Portland and unincorporated Clackamas and Washington Counties. The number of samples allocated per jurisdiction was proportionate to the number of businesses in the jurisdiction to ensure the sampling was representative of the Metro region as a whole. A minimum target of 160 samples collected from across the region was set based on the anticipated variation from a previous Metro study for achieving a 95% confidence interval. All recycling samples met the 200 pound minimum requirement. The average sample weight was 221 pounds.

#### Table 1: Sample allocation, size and weight

Jurisdiction	Number of commercial businesses	Sample target	Samples completed	Total weight of the sample (lbs)	Average sample weight (lbs)
Beaverton	4,200	11	12	2,455	205
Gresham/Troutdale	3,000	7	8	1,764	221
Portland	29,200	77	92	20,136	219
Washington County	12,900	33	33	7,338	222
Clackamas County	10,200	28	28	6,547	234
Total	59,500	156	173	38,240	221

### **STANDARD DEVIATION**

The standard deviation of the amount of contaminants in the recycling sample was 15.3%. A low standard deviation value indicates the data points are closer to the mean and are therefore less variable. A high standard deviation value indicates there is a wider spread of the data points from the mean and therefore the results are more variable. The standard deviation for this study is fairly high and comes from the wide distribution of data at the upper tail of the curve which are the most contaminated loads.

#### Table 2: Descriptive statistics

	Sample size	Minimum	Maximum	Mean	Standard Deviation
Percent Contamination in Recycle Samples	173 samples	0%	96.8%	13.6%	15.3%

## CONTAMINANTS IN THE RECYCLING

The mean for the percentage of all contaminants in recycling samples is 13.6%, 95% CI [11.3%, 15.9%] by weight. To put this into context, a typical sample weighing 221 pounds contained an average of 30 pounds of contamination. Table 3 provides the estimated composition of the waste stream for individual contaminants at a 95% confidence interval (CI). This confidence interval tells us based on the results of the study, we are 95% confident that the range in the table below contains the true population mean of the percentage of contaminants in the recycling bin.

#### Table 3: Contaminants in the recycling container by material type\*

Material	Lower	Mean	Upper
Other unacceptable material	2.4%	3.6%	4.9%
Non-acceptable other paper	2.6%	3.2%	3.7%
Plastic film and bags	0.7%	1.3%	1.9%
Rigid plastic packaging	0.5%	0.9%	1.3%
Other rigid plastic	0.7%	0.9%	1.2%
Food or liquids	0.5%	0.8%	1.2%
Yard debris	0.0%	0.6%	1.1%
Textiles or shoes	0.3%	0.6%	0.9%

Non-recyclable film	0.4%	0.5%	0.7%
Recyclable glass	0.3%	0.5%	0.7%
Tangles	0.1%	0.2%	0.4%
Foam food packaging and block foam	0.1%	0.1%	0.1%
Diapers	0.1%	0.1%	0.2%
Carry-out bags	0.02%	0.04%	0.06%
Non-recyclable glass	0.01%	0.02%	0.04%
Batteries	0.000%	0.001%	0.001%
Medical waste	0.0%	0.0%	0.0%

\* The individual mean material percentages may not sum to the total regional contamination rate. This is a known characteristic of the averaging method used (average of ratios) which controls for sample weight.

#### CONTAMINATION RATE BY JURISDICTION

Table 4 provides the mean sample weight percentage for individual jurisdictions at a 95% confidence interval (CI). This confidence interval tells us that we are 95% confident that the range in the table below contains the true population mean of the percentage of contaminants in the recycling bin.

Jurisdiction(s)	Lower	Mean	Upper	Number of samples
Cities of Gresham and Troutdale	11.7	17.5	23.3	n=8
City of Beaverton	3.6	8.07	12.5	n=12
City of Portland	13.7	17.5	21.3	n=92
Clackamas County	3.9	5.9	8.0	n=28
Washington County	6.9	10.1	13.3	n=33
Regional average	11.3	13.6	15.9	n=173

Table 4. Variation in the percentage of contamination by area of the region

#### ACCEPTABLE RECYCLABLES

The mean for the percentage of acceptable curbside recyclables found in recycling container samples is 86.4% (95% CI [84.1%, 88.7%]) by weight. Table 5 provides the mean, upper and lower for recyclable cardboard, paper, plastics and metal at the 95% confidence interval. To put this into context, a typical sample weighing 221 pounds contained an average of 191 pounds of acceptable recyclables.

. ,	, 0		/ 1
Material	Lower	Mean	Upper
Cardboard	58.6%	61.9%	65.3%
Cartons	0.3%	0.3%	0.4%
Paper: other commingled-acceptable	17.1%	19.5%	22.0%
Plastic: bottles, jars, tubs	2.2%	2.6%	3.0%
Metal: commingled-acceptable	1.5%	2.0%	2.6%

\* The individual mean material percentages may not sum to the total regional contamination rate. This is a known characteristic of the averaging method used (average of ratios) which controls for sample weight.