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Multifamily Waste Characterization Study

2016-2017

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SECTION 1: INTRODUCTION

In March 2017, Metro completed three studies to evaluate the performance of the regional multifamily garbage and recycling collection system to help inform potential system improvements. The secondary goal was to build a baseline dataset against which to compare future multifamily collection system performance. This report presents the results of the three studies:

Study 1: Curbside recyclables program performance

This study looked at the amount of curbside recyclables in garbage bins at multifamily communities.

Study 2: Contaminants in recycling

This study looked at the amount of contaminants that were in recycling bins at multifamily communities.

Study 3: Per-unit Generation Study

This study looked at the total amount of garbage, commingled recyclables, and glass generated by multifamily residents per unit, per week.

The evolution of recycling in our region

Recycling saves energy, reduces air and water pollution, reduces greenhouse gases, and conserves natural resources.

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.

Within the region, recycling collection is required for multifamily households. However, implementation of recycling services at multifamily properties has been inconsistent.

Recycling makes it possible to make millions of products out of materials that would otherwise go to the landfill. A successful recycling system depends on the quality of material collected.

Metro designed the studies described here to evaluate the performance of multifamily recycling collection service to help ensure that the region continues to generate the best and most marketable recyclable materials through its collection programs.

Background

A key finding from Metro's mid-term review of the 2008-2018 Regional Solid Waste Management Plan (RSWMP) was that, despite educational efforts, collection services offered to multifamily residents remain inconsistent, including inequitable access to convenient recycling bins. This finding prompted Metro to convene the Multifamily Recycling Project to examine the challenges and opportunities to improve multifamily garbage and recycling collection.

The Multifamily Recycling Project was a collaborative effort between Metro, the cities of Beaverton, Gresham and Portland, and Clackamas and Washington counties. This project focused on gathering and analyzing a range of data about garbage and recycling collection in apartment and condominium buildings. The purpose of the project was to identify opportunities for improvement in multifamily garbage and recycling collection related to policy, infrastructure, and education. The project goals included:

- ensuring access across the region to recycling services for people living in multifamily households,
- increasing the amount of materials recycled by multifamily households,
- ensuring the recyclable materials collected are high quality, and therefore have value in recycling markets.

The Multifamily Waste Characterization Studies were one of four major data sources used by the project team to better understand the current conditions of the multifamily garbage and recycling collection system. The data was used to inform and identify a menu of options that could be implemented to help the region achieve the project goals. The information will also be used to inform the 2030 Regional Waste Plan update process that is currently underway. The Regional Waste Plan is the blueprint that guides how the region's garbage and recycling system is managed. The plan is updated every 10 years and is adopted by the Metro Council.

What is multifamily?

Apartment and condominium buildings with five or more units; may also include retirement communities and mobile home parks. At the time of these studies, there were 6,291 multifamily communities within the Metro region totaling more than 260,000 units.

Bins

In this report the word "bins" is used to refer to all receptacles used to collect garbage, mixed recycling and glass at multifamily sites.

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.

SECTION 2: CURBSIDE RECYCLABLES PROGRAM PERFORMANCE

Overview

This study evaluated the amount of curbside recyclables in multifamily garbage bins. More than 18,000 pounds of garbage were collected and sorted over the course of the study. The goal was to provide data on the amount of recyclables placed in the garbage that could have been put in recycling bins.

Garbage samples were taken directly from bins located at multifamily communities. There were many different types of systems including garbage chutes, compactors and dumpsters. This picture shows a typical garbage chute.

Methodology

Sample Selection

Samples were collected from the cities of Beaverton, Gresham, Portland, and Clackamas and Washington counties as shown in Table 1. Samples were collected directly from garbage bins located at 91 multifamily communities with over 14,000 units represented.

Three lists of randomly selected multifamily communities were generated for each jurisdiction. Each list contained the target number of samples for each city or county and was ordered from the communities with the least number of units to the greatest number of units. If a multifamily community did not meet the sample criteria, or a property manager refused to participate in the study, the corresponding number from the second list was used to identify a replacement site.

Table 1. Sampling results for Curbside Recycling Program Performance study

Jurisdiction	Number of units	Samples	Total weight of samples (lbs)	Average sample weight (lbs)
Beaverton	22,143	8	1,556	194.60
Gresham	18,378	7	1,426	203.78
Portland	111,661	40	8,642	216.07
Washington County	55,282	21	4,154	197.81
Clackamas County	40,780	15	3,073	204.87
Total Sample	248,244	91	18,851	207.18

The projected growth of multifamily households

According to the 2013 American Community Survey, 23 percent of greater Portland households live in "multifamily housing." These households vary across ethnicity, income and education demographics. Metro's Urban Growth Report projects that 60 percent of the next 200,000 households added within the Urban Growth Boundary will be multifamily.

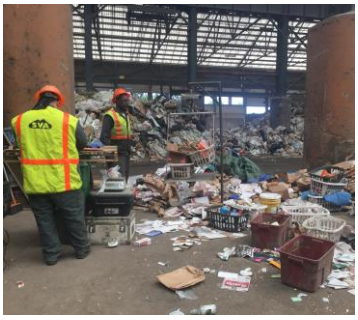
Local government assessed the list of multifamily communities to ensure they were not operating with one of the following study disqualifiers:

- A mixed use building where multifamily tenants share the garbage and recycling bins with commercial businesses
- A retirement community where tenants are not responsible for taking their own garbage and recycling to the enclosure
- A retirement community where tenant waste and commercial waste (e.g. from the kitchen) is mixed together in the same bin
- A multifamily community where residents receive individual service and there is not a shared enclosure for garbage and recycling (such as a mobile home park)

Samples for this study were taken directly from the garbage and recycling bins located onsite at the verified multifamily communities. For this reason, community outreach and data gathering was required prior to sample collection to minimize site disruptions and to ensure successful capture of the samples. Local governments have invested time and resources into developing long term relationships with multifamily customers located in their jurisdiction. As such, city and county staff were responsible for recruiting property managers and/or owners to participate in the study on behalf of their multifamily community. If the contact person for a site refused to participate, the property was replaced.

All the data needed for sample collection was summarized in a packet and was given to the contractor conducting the sample collection and sort. If a map of the property was available that was included in the packet along with a detailed description of where bins were located for each material stream. Collection schedule information provided by the haulers was also included in the packet to help ensure material was available when the contractor arrived to capture a sample.

The samples were collected between July 2016 and January 2017. Once the site information was provided to the contractor, local government staff notified property managers and provided them with the approximate timeframe for when the sample would be collected. If an onsite property manager was present, the contractor was responsible for checking in at the office upon arrival to notify the contact person that sample collection was occurring. If more than one bin was available per stream, the contractor was also responsible for randomly selecting from which bins to take the sample. Then a vertical cross section, or "slice," of material was taken from the designated bins. Each sample consisted of all the material in the slice, from the top to the bottom of the bin. After the sample was collected, it was taken to a facility where waste sampling and sorting occurs. The minimum sample weight requirement for each garbage sample was 175 pounds, the average sample weight for all samples in the study was 207 pounds.



Samples are weighed after being sorted.

Material Categories

The samples were sorted into the individual material categories listed in Table 2. Metro included the additional materials to inform future program planning. The material definitions used were consistent with the Oregon Department of Environmental Quality's waste composition studies and can be found in Appendix B.

Table 2. Recyclables in Garbage Material Categories

Acceptable curbside recyclables:
1) Cardboard
2) Paper
3) Plastic
4) Metal
5) Glass
Additional materials:
6) Yard debris
7) Food
8) Household hazardous waste
9) Oregon E-Cycles electronics
10) Waste

Regional Performance

Overall the study showed that by weight, 15 percent of what is in a typical multifamily garbage bin in the region are materials that could have been in curbside recycling bins. This percentage, shown in Figure 1, was calculated by combining the results from the 91 garbage samples. Paper makes up the largest portion of recyclables thrown away as garbage.

A 95 percent confidence interval was used for this study. The confidence interval tells us based on the study results we are 95 percent confident that the percentage of recyclables in the garbage bin is between 13 percent and 16 percent.

Figure 1: Recyclables in the garbage bin

* Numbers do not sum to total due to rounding

Recyclables Disposed

The study indicated that every year multifamily households throw away 28,000 tons of acceptable curbside recyclables.

The greenhouse gas emissions benefits of recycling these materials would be equivalent to taking 15,000 passenger vehicles off the road.

In 2014-15, Metro completed similar studies to assess the performance of the region's single-family household recycling programs. As a point of comparison, a finding from the Single-family Curbside Recyclables Performance Study was that 14 percent of what was in a typical garbage bin could have been put in a curbside recycling bin.

Results for Other Materials

The study incorporated additional material categories, including organics, household hazardous waste and electronics, to help inform future program planning.

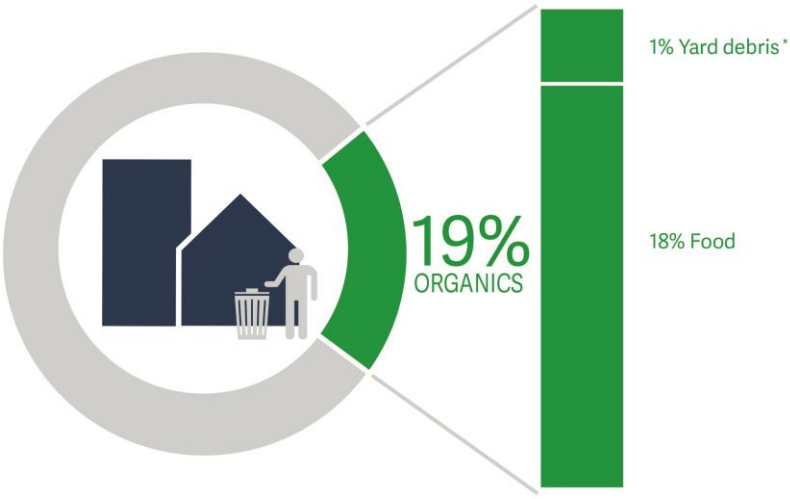
Organics

Most multifamily properties hire landscape companies to maintain their community's green space. Typically, as part of this service, the landscapers take the yard debris off-site.

Therefore, multifamily communities typically do not receive yard debris collection service from their collection company. Food scraps collection service is not typically available to multifamily customers or it is optional.

The study found that organics represented 19 percent of the material in garbage bins region-wide and that this material is primarily food waste, as shown in Figure 2.

Figure 2: Percentage of Garbage: Organics by material



Household Hazardous Waste

The study found that household hazardous waste represented 0.16 percent of the material in garbage bins region-wide. To put this low percentage into context, the average weight per sample was .34 pounds.

Oregon E-Cycles Electronics

Since 2009, residents have had access to the Oregon E-Cycles program that provides free recycling of computers, monitors and televisions. The study showed that these electronics represented 0.52 percent of the material in garbage bins region-wide. The average weight was .19 pound per sample

SECTION 3: CONTAMINANTS IN RECYCLING STUDY

Contaminants

Items found in the mixed recycling bin that are not recyclable curbside.

Overview

This study evaluated the amount and types of contaminants in mixed recycling bins at multifamily properties. Contaminants are defined as items that are not recyclable curbside.

Methodology

The minimum sample weight requirement for recyclables was set at 125 pounds per sample, which is less than the minimum weight for garbage samples because capturing a complete sample of recyclables is challenging due to low service volumes and the light weight of the material. 88 samples were analyzed and the samples were sorted into the material categories listed in Table 3. More detailed information about the categories is available in Appendix B.

Table 3: Material categories

1) Acceptable standard recyclables (cardboard, paper, plastic, metal)
2) Container glass (in the commingled bin)
3) Plastic bags and film
4) Unacceptable paper
5) Unacceptable rigid plastics
6) Yard debris and food
7) Diapers
8) Pet waste
9) Oregon E-cycles electronics
10) Other residuals

Recycling samples were taken directly from different types of bins including roll carts and dumpsters located at multifamily communities.

Sample Selection

The study drew samples from the cities of Beaverton, Gresham, Portland, and Clackamas and Washington counties. The number of samples allocated per jurisdiction is proportionate to the number of units in the jurisdiction to ensure the sampling was representative of the Metro region as a whole, as shown in Table 4.

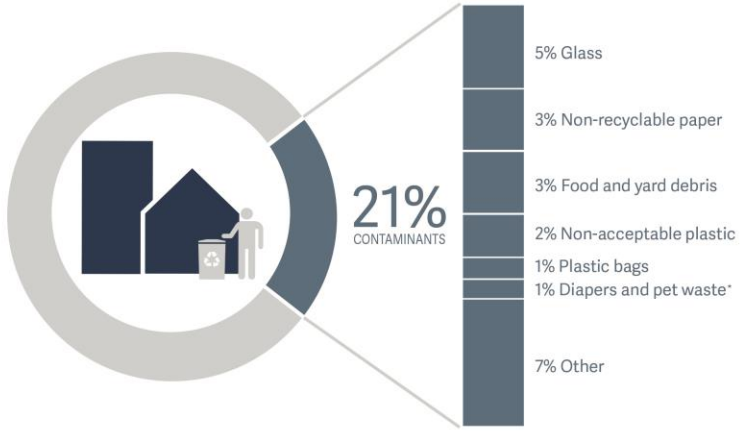
Table 4: Sampling results for the Contaminants in Recycling study

Jurisdiction	Number of units	Completed Samples	Total Weight of the sample (lbs)	Average sample weight (lbs)
Beaverton	22,143	8	1,417	177
Gresham	18,378	6	1,068	178
Portland	111,661	39	6,291	161
Washington County	55,282	20	3,725	186
Clackamas County	40,780	15	2,592	173
Total	248,244	88	15,093	171.62

Regional Performance

Using the study results, Metro calculated regional averages for the amount and types of contaminants in mixed recycling bins from multifamily residents. The study showed a regional average of 21 percent contamination in the commingled recycling stream.

Figure 1: Contaminants in the Recycling Bin



*Numbers do not sum to the total due to rounding

In 2014-15, Metro completed similar studies assessing the performance of the region's single family household recycling programs. As a point of comparison, findings from the Single-family Curbside Recyclables Performance Study found a level of 9 percent contamination in mixed recycling bins.

A 95 percent confidence interval was used for this study. The confidence interval tells us based on the study results, we are 95 percent confident that the percentage of contaminants in the recycle bin is between 18 percent and 24 percent.

The study indicates that the region's multifamily households throw more than 8,000 tons of contaminants in the commingled recycling bins each year.

Acceptable curbside recyclables

The study also looked at the amount of acceptable curbside recycling materials in each sample. Table 5 shows the average percent for the four material types. 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 135 pounds.

Table 5. Percent of acceptable curbside recyclables

	Average
Cardboard	47%
Paper	42%
Plastics	7%
Metals	4%

Plastic film and shopping bags

Plastic film[1], including shopping bags that are not recyclable curbside, was found in multifamily recycling bins across the region. These plastics can jam sorting machinery at recycling facilities, thereby increasing the cost of converting recyclables into new products. There was an average of 11 shopping bags per sample in addition to other types of plastic film in the overall sample. Table 6 provides the average percentage of film plastics included in this study and the count when available. The average weight of film plastic per sample was 1.63 pounds.

Plastic bags

For this study, a plastic bag is defined as a bag that is provided by a retail establishment or food provider to a customer and is not a reusable bag

Table 6. Percent and count of plastic film contamination in commingled recycling

	Average	Count
Carry-out bags	.11%	11
Other recyclable film and bags	.43%	n/a
Non-recyclable film	.42%	n/a

[1] Plastic film includes plastic bags, tape, sheeting, and other non-rigid items.

Glass

Glass is intended to be collected curbside in a separate bin, however, throughout the Metro region glass was found as a contaminant in recycling bins. Table 7 provides the average percent for two categories of glass: deposit bin glass and non-deposit bin glass. The non-deposit category includes glass that is both accepted and not accepted in the curbside program. The average weight of glass per sample was 8.35 lbs.

Table 7. Percent of glass contamination in commingled recycling

	Average
Glass deposit containers	1.51%
Glass: other containers	3.31%

Glass

In the Metro region, glass is recyclable curbside in a bin separate from other recyclables.

Oregon Bottle Bill Deposit Containers

The study also looked at the amount of deposit containers in each recycling sample. Table 8 shows the average percentage of deposit containers per sample by material type. The average count of all deposit containers combined is 50 per sample.

Table 8. Percent and count of deposit containers in commingled recycling

	Average	Count
Glass deposit containers	1.51%	5
Metal deposit containers	.61%	30
Plastic deposit containers	.58%	15

The Oregon Bottle Bill requires every container of beer, other malt beverages, carbonated mineral waters, carbonated soft drinks, water and flavored water in metal, plastic or glass containers (that are 3 liters in size or less) that is sold in Oregon to be returnable. In 2017, the refund value increased from a nickel to a dime.

SECTION 4: PER-UNIT MULTIFAMILY GENERATION RATES

Overview

This study evaluated the amount of materials generated by multifamily households. More than 255,829 pounds of material was weighed to provide data about the amount of garbage, mixed recyclables and glass generated per unit, per week.

What is generation?

Generation is the sum of disposal and recovery and represents the total weight of the waste stream.

According to DEQ in 2015 the Metro region's per capita waste generation was 2,748 pounds. Of the waste generated per capita, 1,253 pounds was disposed and 1,495 pounds was recovered.

Methodology

Sample Size

This study collected and weighed a week's worth of generation for garbage, mixed recyclables and glass. Metro used the list of randomly selected multifamily sites from Studies 1 and 2 described earlier to identify which collection companies to work with on the generation study. The 6 collection companies with the most multifamily customers on the list were asked to partner with Metro by collecting the generation data used for the analysis. Since the availability of equipment, service area sprawl and proximity to a local transfer stations varies greatly by hauler, staff worked with companies one-on-one to achieve one of the following two data collection options:

1) Site specific measurement

Weigh a week's worth of garbage and mixed recyclables from an individual site using a truck scale or by taking the material directly to a transfer station for a sample weight. The glass roll bins were weighed by Metro staff. This option provided per unit generation rates *or site specific measurement.*

2) Multifamily samples collected together based on service day

Garbage and mixed recyclable samples from multifamily sites were combined together in the same truck based on material stream and service day. The glass bins were weighed by Metro staff. This option provided per unit generation rates but *not site specific measurement.*

Metro and the collection companies worked together to refine the final list of sample sites used to achieve one of the two data collection options. A goal of achieving material weights generated by 1,000 units was established for each hauler. The list of sites used for Studies 1 and 2 provided a starting point for the list of generation sample sites, however the two lists were not identical. Reasons for this included complex collection schedules or a low number of units. For example, a multifamily site in downtown Portland had a 7 days per week collection schedule and would have negatively impacted staffing levels at the hauling company. Similarly, the study was biased towards sites with larger unit counts because it would have taken more time and resources to achieve the 1,000 unit goal with smaller, low unit-count sites.

With the exception of glass collection, it is common for multifamily properties to have more than one collection day per week for the garbage and mixed recyclables. During the development of the methodology, the project team hypothesized material set-outs on a Monday are more likely to be heavier compared to other collection days due to weekend accumulation. This hypothesis led to a decision to ask haulers to weigh a full week's worth of mixed recycling and garbage accumulation from each site rather than one day only. Since glass collection is different and typically occurs one time per week, Metro staff weighed glass recycling bins to lessen the impact on haulers.

Data collection took place from August 2016 through March 2017. Material weights were collected from sites distributed across the region with two collection efforts occurring on the west side of the region, one on the east side of the region, one on the south side of the region and two within the City of Portland, one downtown and one in North/Northeast Portland. At the end of the study, generation data was collected from 42 properties with over 7,500 units.

Local haulers collected a week's worth of garbage and mixed recyclables generated by multifamily residents at 42 communities.

Table 9: Sampling results for the Generation Study

Collection Company	Jurisdiction	Number of Communities	Number of Units
Waste Management	City of Beaverton	7	1,332
Pride Disposal Co.	Washington County	6	993
Gresham Sanitary Service	City of Gresham	7	1,434
Trashco	City of Portland (Downtown)	8	1,300
Waste Connections	City of Portland (N/NE)	8	1,009
Republic Services	Clackamas County/Wilsonville	6	1,439
	Total	42	7,507

Glass was weighed by Metro staff.

Bins include all glass, mixed and garbage receptacles on site. This includes roll carts, tubs, cages, drop boxes and compactors. Unlike Studies 1 and 2, there was no separating of material sub-streams within the bin; if a discard was in the garbage bin, it was for all purposes treated as garbage. This same approach to categorizing of material was also used for mixed recyclables and glass recycling bins.

Per unit generation rates were calculated by summing each site's total weekly sample weight per material type and dividing it by the number of occupied units. The occupancy value for each site was calculated by multiplying the total number of units at the site by an estimate of the vacancy rate for that jurisdiction. The data analysis showed an unexpected trend that the 11 communities with compactors had a higher generation rate of garbage than sites without compactors. More research was conducted to gather a historical record of compactor weights from July through December 2016. The 6 months of historical data was then averaged by site and incorporated into the final analysis. While the additional compactor data did not change the results dramatically, it did reinforce that the compactor weights were accurate. The final

results for each community were then averaged together to calculate the regional per-unit generation rate for garbage, mixed recyclables and glass.

Regional Performance

Using the study results, Metro calculated a regional weekly per-unit generation rate for the garbage, mixed recyclables and glass collected at multifamily sites. The generation rates are summarized in Table 10.

Table 10. Average generation per unit, per week

	Pounds	95% Confidence Interval Range in Pounds
Garbage	29	25 - 33
Mixed recyclables	6	5 - 8
Glass recyclables	1	.84-1.42

Looking Ahead

Working together, Metro and its city and county partners will use these studies, along with other information, to inform the Regional Waste Plan.

The Regional Waste Plan is the blueprint that guides how the region handles and transports more than 2 million tons of garbage, food scraps, yard trimmings, recycling and hazardous waste every year to their final destination. It also guides programs to reduce the total waste generated in greater Portland. The plan has typically been updated every 10 years and is adopted by Metro Council.

SECTION 5: SUMMARY OF CONCLUSIONS FROM THE THREE STUDIES

There is an opportunity to reduce the amount of recyclables in garbage containers.

The study showed that 15 percent of what's in garbage carts is material that could have been placed in curbside recycling carts. This percentage indicates that approximately 28,000 tons of curbside recyclables are disposed each year.

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

The study showed a regional average of 21 percent contamination in recycling carts. This amounts to about 8,000 tons of contaminants placed in recycling carts annually.

Per-unit generation rates could be used to inform Regional Waste Plan recommendations.

The study showed approximately 29 pounds of garbage, 6 pounds of mixed recycling and 1 pound of glass recycling are generated per unit, per week. These data could be used to inform a per-unit minimum service level requirement or serve as a measure of level of access to collection bins. Options like these will be considered during the Regional Waste Plan planning process.

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Waste Management
Trashco
Waste Connections
Republic Services

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

APPENDIX A: Detailed Methodology

MULTIFAMILY SECTOR WASTE CHARACTERIZATION STUDIES

Detailed Methodology

Measure #1: Curbside Recycling Program Performance Study

Description

This measure is the percentage of acceptable curbside recyclables in the garbage at multifamily properties.

Measurement method

Using the Data Resource Center, multifamily communities will be randomly selected proportionate to the number of multifamily units in each jurisdiction. For the selected properties that agree to participate, samples of garbage weighing a minimum of 175 pounds will be collected directly from garbage bins located at multifamily sites. The samples will be sorted into categories to determine what types of curbside recyclable materials are being thrown away by multifamily households. Additional categories of potentially recyclable materials are also included for program planning purposes.

Confidence Interval

A 95 percent confidence interval (z) is being used for this study.

Level of precision

The error bound or required precision selected for this study is +/- .02

Planning Standard Deviation

The standard deviation (sigma) is used to project a required sample size and is estimated based on data from prior studies. Data from Metro's 2006 Multifamily Garbage Study was used to determine the variation in the amount of recyclables found in the garbage. The standard deviation was calculated based on that range. The sample size options considered by Metro are shown in Table 1.

Table 1. Multifamily Sample Size Options

Error Bound	Sigma*	z	n
0.04	0.0975	1.96	23
0.03	0.0975	1.96	41
0.02	0.0975	1.96	92
0.01	0.0975	1.96	366

Number of samples

Metro determined 92 samples is the target number of garbage samples collected and sorted for this study to achieve the statistical validity described above, as noted in Table 1.

Seasonality

An analysis of 2009 Oregon Department of Environmental Quality waste composition data indicated minimal variation in the amount of curbside recyclables in the garbage between warm (April-September) and cold (October-March) seasons with the exception of yard debris. As a result, the study will not be a yearlong analysis although samples will be collected from both warm and cold months.

Material categories	The Curbside Recycling Program Performance Study will sort acceptable standard recyclables into individual categories and will serve as the primary measure. Additional material categories will be included in the study to inform future program planning. Detailed definitions for categories will be consistent with the Oregon Department of Environmental Quality waste composition studies. See Appendix B for more information about the categories including definitions.
Calculations	Total Percent Recyclable Material: (total weight of waste / total weight of all curbside accepted recyclables) X 100

Measure #2: Contaminants in the Recycling Study

Description	This indicator is the percentage of non-acceptable items (contaminants) in the recycling stream at multifamily sites.
Measurement method	The same properties that will be selected for garbage sampling will be used for sampling and sorting of collected recyclables. For the selected properties that agree to participate, samples of recyclables weighing a minimum of 125 pounds will be collected directly from recycling bins located at multifamily sites. The samples will be sorted into categories to determine the percentage of contaminants in the recycling.
Number of samples	The research team recommends sampling the mixed recycling in parallel with the garbage samples as an efficient approach to yielding a reasonable sample size. Therefore the target number of recycling samples is also 92 and recycling samples were collected at same time and from the same communities as the garbage samples.
Material categories	The Contaminants in the Recycling Study will include 18 materials categories including counts for deposit containers and plastic shopping bags. Detailed definitions for categories will be consistent with the Oregon Department of Environmental Quality waste composition studies. See Appendix B for more information about the categories including definitions.
Calculations	Total Percent Contaminants: (total weight of all contaminants / total weight of recycling collected including contaminants) X 100

Measure #3: Per-Unit Multifamily Generation Rates	
Description	This measure is an estimate the per-unit generation rate for multifamily sites in the Metro region for garbage, mixed recyclables and recyclable glass.
Measurement method	Total weight of material in garbage, recycling and glass bins will be used to estimate the weekly per-unit generation rate for material discarded to each stream. The generation rate for each stream will be calculated by summing a week's worth of discard weights into each stream and dividing by the number of occupied multifamily units.
Number of samples	Ideally, standard deviation estimates are available from prior studies and can be used to calculate a representative sample size for future studies. In the case of the Generation Study, there is not a historical dataset available to inform the sample size because this type of study is the first of its kind conducted in the Metro region. In the absence of available data, the methodology will be designed to fit within the time frame of the Multifamily Project and in a way that minimizes disruption to collection company operations.
Seasonality	Samples will be collected in two separate batches in Summer and Fall
Measure	Pounds of garbage, commingle recyclables and glass generated in a week
Calculations	Total pounds discarded into each stream/ Number of occupied multifamily units in the sample

Study Implementation Steps for Measures 1 and 2

This document outlines the steps taken by Metro staff to implement the Curbside Recycling Program Performance Study and the Contaminants in the Recycling Study.

Step 1: Sample Selection

The number of samples per jurisdiction are allocated proportionately to the number of units in each city or county.

Jurisdiction	Total Units	Percentage	# Samples
City of Portland	111,661	45%	41
City of Gresham	18,378	7%	7
City of Beaverton	22,143	9%	8
WA County	55,282	22%	21
Clackamas County	40,780	16%	15
TOTAL	248,244	100%	92

Metro's Data Resource Center will randomly select the 92 communities where the samples will be captured. Three lists of samples will be generated for each jurisdiction. Every list will be numbered and ordered from least number of units to the greatest number of units. If it is determined that a sample should be excluded from list number 1, the corresponding number from list number 2 will be used to identify the replacement site. This process will be repeated as needed both in the initial vetting processes and in the recruitment process if a property manager refuses to participate.
Circumstances where samples will be replaced include the following scenarios:

- A mixed use building will be replaced if commercial businesses and multifamily tenants share the garbage and recycling enclosure.
- A retirement community will be replaced if tenants are not responsible for taking their own garbage and recycling to the enclosure.
- A retirement community will be replaced if tenant waste and commercial waste from the kitchen is mixed together in the same enclosure.
- A multifamily community will be replaced if residents receive individual service and there is not a shared enclosure for garbage and recycling.
- A multifamily community will be replaced if a valet waste company provides services to the property.

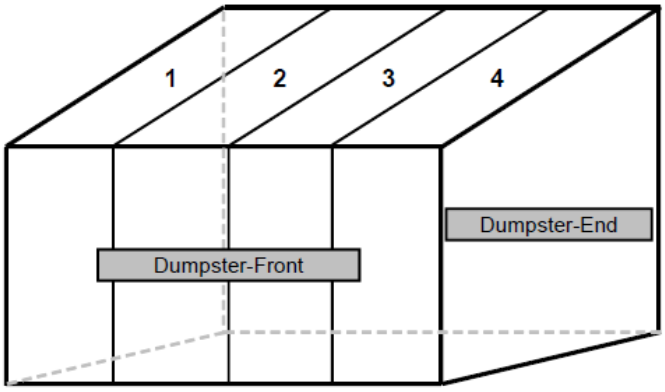
Step 2: Recruiting Multifamily Communities to Participate in the Study
Local governments have invested time and resources into developing long term relationships with multifamily communities located in their jurisdiction. For this reason, property managers are more likely to participate in the study if they are approached by someone they know and trust. A recruitment script that includes talking points about the purpose of the study will be created by Metro and used by local governments to recruit the randomly selected multifamily communities. If a property manager refuses to participate, the property will be replaced by a community of a similar size from the additional lists list. If the recruitment strategy is not successful, the Multifamily Workgroup will reassess the approach.

Step 3: Site Attribute Data Collection
Once a property manager has agreed to participate in the study, local governments will be responsible for sending Metro's logistical support team information about the site including the property manager's name and phone number. The logistical support team will schedule a site visit prior to sample collection. The data collected during the initial visit includes number, locations and approximate size of containers for waste and/or recyclables, types of waste streams collected on site and how yard debris and bulky waste are handled. Staff will contact haulers for collection schedule information.

Step 4: Sample Collection Coordination
The logistical support team will coordinate the communication needed for Metro's contractor to pick up both the recycling and garbage samples. This ideally will include a map of the property. The logistical support team will inform the property manager when the samples is expected to be collected. The hauler for that site will also be informed about the day and time the contractor will be collecting the sample.

Step 5: Sample Collection and Data Entry
Once Metro's contractor arrives onsite to collect a garbage sample, they will be responsible for randomly choosing a vertical cross section, or "slice," of material from a randomly selected container. Each sample will consist of all material in the slice, from the top to the bottom of the container. An illustration of the "slice" concept for dumpsters is shown in Figure 1. The minimum weight for a garbage sample will be 175 pounds. After the sample is collected, the contractor will transport each sample to the facility where samples are sorted and weighed.

Figure 1. Illustration showing how a “slice” of a dumpster is randomly selected for sample collection



A similar approach will be followed for sample collection of recyclables. Since recyclables are lighter, the minimum weight requirement will be lower than a garbage sample and will be set at 125 pounds. A complete recycling sample is not always available and the following protocol provides guidance to the contractor for how to handle this circumstance:

- If there is are least 200 pounds of recycling on site, samples averaging 200 pounds and a minimum of 175 pounds for any individual sample are to be collected.
- If there are less than 200 pounds of recycling on site, the entire on-site recycling will serve as a sample. The minimum sample weight is 125 pounds.
- If there are less than 125 pounds of recycling on site, arrangements will need to be made to collect additional recycling to meet the minimum 125 pound minimum.

APPENDIX B: MATERIAL CATEGORY DEFINTIONS

Curbside Recycling Program Performance Study Material Category Definitions

#	Material	Definition
1	**Cardboard**	Corrugated cardboard and Kraft paper. Includes wine-bag-in boxes and pizza delivery boxes. Does not include waxed and plastic coated cardboard.
2	**Paper**	High grade paper, low grade, mixed paper, newspaper, phone books, magazines, milk cartons and drink boxes.
3	**Plastics**	Deposit and non-deposit plastic bottles six ounces or larger with necks smaller than the base. Plastic tubs six ounces or larger, usually round with a wider rim than base and contain products such as salsa or yogurt. Rigid nursery pots larger than four inches in diameter and buckets five gallons or smaller. Does not include bottles that have held motor oil, pesticides or herbicides.
4	**Metal**	Deposit and non-deposit steel and aluminum cans, aluminum foil and trays, empty aerosol cans, all other metal that are less than 30" long and weigh less than 30 pounds. Does not include metal with food or other non-metallic materials.
5	**Container glass**	Glass bottles and jars only, all colors.
6	**Yard debris**	Weeds, leaves, grass clipping, branches and other vegetation, including soil adhering to plant roots. Branches must be less than four inches in diameter and 36 inches long.
7	**Food**	All food such as vegetables, fruits, breads, meats, pastas, tea bags and coffee grounds. This category includes bones, shells, husks, pits and similar non-edible food items. Does not include large amounts of grease and oil. If packaging is a majority of the weight, food will need to be de-packaged and weighed separately
8	**Compostable paper**	Paper towels, napkins, coffee filters, and compostable bags with food residue.
9	**Household hazard waste (HHW)**	HHW waste accepted at Metro facilities (paint, batteries, pesticides and cleaners). Does not include empty containers.
10	**Covered electronics**	Desktops, laptops, monitors and televisions. Includes computer peripherals such as keyboards and mice.
11	**Waste**	All other waste. Includes garbage bags.

Recycling Sample Material Categories

#	Material	Definition
1	**Cardboard**	Corrugated cardboard and Kraft paper. Includes wine-bag-in boxes and pizza delivery boxes. Does not include waxed and plastic coated cardboard.
2	**Paper: other commingled-acceptable**	High grade paper, low grade, mixed paper, newspaper, phone books, paperboard, magazines, milk cartons and drink boxes.
3	**Paper: not compostable or acceptable in commingled**	All paper that is not acceptable in commingled collection, including freezer boxes, coffee cups, hard-covered books, waxed/poly-coated containers such as waxed cardboard.
4	**Plastic: deposit containers**	Plastic soft drink, water, and beer bottles covered in 2016 under the Oregon Bottle Bill. Includes counts.
5	**Plastic: commingled-acceptable**	Deposit and non-deposit plastic bottles 6 ounces or larger with necks smaller than the base. Plastic Tubs six ounces 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 go in the category Other residuals.
6	**Plastic: other rigids**	All other rigid plastics, includes lids. Does not include mixed plastic material such as kitchenware or car parts, plastic beverage pouches or non-recyclable film. Includes counts.
7	**Plastic: carry-out bags**	Plastic grocery and retail carry-out bags as defined by Portland Bag Ban's definition[1].
8	**Plastic: other "recyclable" film and bags**	Plastic, newspaper bags, dry cleaner bags, pallet-wrap, shrink and 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.
9	**Plastic: other film**	Garbage bags, beverage pouches, shower curtains, chip bags, and all other film plastic not in the "recyclable" category.
10	**Metal: deposit containers**	Metal soft drink, water, and beer cans covered in 2016 under the Oregon bottle bill. Includes counts.

[1] A single-use plastic checkout bag is defined as a plastic bag that is provided by a retail establishment or food provider to a customer and is not a reusable bag. A single-use checkout bag does not include either of the following:

1. A bag provided by a pharmacist to contain prescription medication purchased by customers of the pharmacy;
2. A non-handled bag used to protect a purchased item from damaging or contaminating other purchased items when placed in a recycled paper bag or reusable bag; or,
3. A plastic cover designed and used for protecting garments on a hanger.

11	**Metal: commingled-acceptable**	Non-deposit steel and aluminum cans, aluminum foil and trays, empty aerosol cans, all other metal that are less than 30 inches long and weigh less than 30 pounds.
12	**Glass: deposit containers**	Glass soft drink, water, and beer bottles covered in 2016 under the Oregon bottle bill. Includes counts.
13	**Glass: other containers**	Non-deposit glass bottles and jars of all colors mixed in with other recycling.
14	**Yard Debris, food and compostable non-food waste**	Weeds, leaves, grass clipping, branches less than 4 inches in diameter, and other vegetation, including soil adhering to plant roots. All food such as vegetables, fruits, breads, meats pastas, coffee filters and tea bags. Paper towels, napkins, coffee filters, tea bags and compostable bags with food waste residue. Does not include large amounts of grease and oil.
15	**Diapers**	Diapers.
16	**Pet waste**	Pet waste.
17	**Covered electronics**	Desktops, laptops, monitors and televisions. Includes computer peripherals such as keyboards and mice.
18	**Other residuals**	All other non-recyclables.

APPENDIX C: CURBSIDE RECYCLING PROGRAM PERFORMANCE STUDY STATISTICAL ANALYSIS

Appendix C 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 figure or table and include analysis and outputs from the statistical software program deployed for this study (SPSS).

Background Data Calculations

The amount of material in each garbage bin sample that could have been put in a curbside recycling bin is calculated as a ratio by dividing the weight of the recyclables in each sample by the sample's total weight. The regional average is then calculated by taking the average of these sample ratios.

$$\frac{1}{n}\sum \frac{Weight\ of\ recyclables\ in\ sample * 100}{Weight\ of\ sample}$$

Sample Allocation and Average Sample Weight

The study drew samples from the cities of Beaverton, Gresham, Portland and unincorporated Clackamas and Washington County. The number of samples allocated per jurisdiction is proportionate to the number of units in the jurisdiction to ensure the sampling was representative of the Metro region as a whole. All garbage bin samples included in this study met the 175 pound minimum requirement for samples. It is important to note that the final set of samples included in the study is different than the original sample target. This difference is shown in the column titled "Difference from sample target."

Table 1: Sample allocation, size and weight

Jurisdiction	Number of units	Sample	Difference from sample target	Total weight of samples (lbs)	Average sample weight (lbs)
Beaverton	22,143	8	0	1,556	194.60
Gresham	18,378	7	0	1,426	203.78
Portland	111,661	40	-1	8,642	216.07
Washington County	55,282	21	0	4,154	197.81
Clackamas County	40,780	15	0	3,073	204.87
Total Sample	248,244	91	-1	18,851	207.18

Standard Deviation

The standard deviation of the amount of recyclables in the garbage bin samples was 6.93 pounds. 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.

Table 2: Descriptive statistics

	Sample size	Minimum	Maximum	Mean	Standard Deviation
Recyclables in Garbage	91	1.93%	35.39%	**14.56%**	6.92601

RECYCLABLES IN GARBAGE

The mean for the percentage of curbside recyclables found in garbage samples is 14.56%, 95% CI [13.12%, 16.01%]. To put this into context, on average the weight of these curbside recyclables is 30 pounds per sample.

Table 3 provides the mean for paper, cardboard, plastics, metal and glass 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 percent of recyclables in garbage.

Table 3: Recyclables in garbage container by material type*

Material	Lower	Mean	Upper
Paper	4.87%	**5.71%**	6.55%
Cardboard	2.08%	**2.56%**	3.03%
Plastics	1.64%	**1.97%**	2.30%
Metals	1.28%	**1.55%**	1.82%
Glass	2.27%	**2.78%**	3.29%

*The individual mean material percentages do not add up to the mean for the overall percentage of curbside recyclables found in garbage because the overall percentage of curbside recyclables is calculated by taking an average of the total curbside recyclables for all the samples.

Analysis Output

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Recyclables in Garbage	91	100.0%	0	.0%	91	100.0%

Descriptives

			Statistic	Std. Error
Recyclables in Garbage (percent)	Mean		14.5646	.72604
	95% Confidence Interval for Mean	Lower Bound	13.1222	
		Upper Bound	16.0071	
	5% Trimmed Mean		14.2557	
	Median		13.5008	
	Variance		47.970	
	Std. Deviation		6.92601	
	Minimum		1.93	
	Maximum		35.39	
	Range		33.46	
	Interquartile Range		8.92	
	Skewness		.701	.253
	Kurtosis		.432	.500

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Recyclables in Garbage (weight)	91	3.60	83.79	30.2241	15.57743
Valid N (listwise)	91				

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Paper	91	100.0%	0	.0%	91	100.0%
Cardboard	91	100.0%	0	.0%	91	100.0%
Plastics	91	100.0%	0	.0%	91	100.0%
Metal	91	100.0%	0	.0%	91	100.0%
Glass	91	100.0%	0	.0%	91	100.0%

Descriptives

			Statistic	Std. Error
Paper (percent)	Mean		5.708937626283	.4218317807960
	95% Confidence Interval for Mean	Lower Bound	4.870895166916	
		Upper Bound	6.546980085650	
	5% Trimmed Mean		5.413619754654	

	Median		4.625629034718	
	Variance		16.193	
	Std. Deviation		4.0240187210480	
	Minimum		.5090497738	
	Maximum		19.4544833414	
	Range		18.9454335677	
	Interquartile Range		4.8092520573	
	Skewness		1.132	.253
	Kurtosis		.909	.500
Cardboard (percent)	Mean		2.555153436595	.2379409695159
	95% Confidence Interval for Mean	Lower Bound	2.082442170268	
		Upper Bound	3.027864702923	
	5% Trimmed Mean		2.287929948572	
	Median		1.949980726935	
	Variance		5.152	
	Std. Deviation		2.2698121844439	
	Minimum		.0000000000	
	Maximum		11.4720862384	
	Range		11.4720862384	
	Interquartile Range		2.2195139249	
	Skewness		1.991	.253
	Kurtosis		4.654	.500
Plastics (percent)	Mean		1.965639892618	.1643906959187
	95% Confidence Interval for Mean	Lower Bound	1.639049082308	
		Upper Bound	2.292230702929	
	5% Trimmed Mean		1.799964529087	
	Median		1.784917447568	
	Variance		2.459	
	Std. Deviation		1.5681872918509	
	Minimum		.0000000000	
	Maximum		9.5139607032	
	Range		9.5139607032	
	Interquartile Range		1.5382050656	
	Skewness		2.576	.253
	Kurtosis		10.066	.500
Metal (percent)	Mean		1.554799048989	.1351758144176
	95% Confidence Interval for Mean	Lower Bound	1.286248699966	
		Upper Bound	1.823349398011	
	5% Trimmed Mean		1.413518602624	

	Median		1.341948310139	
	Variance		1.663	
	Std. Deviation		1.2894950845641	
	Minimum		.0000000000	
	Maximum		6.5241844769	
	Range		6.5241844769	
	Interquartile Range		1.1940990573	
	Skewness		1.864	.253
	Kurtosis		4.414	.500
Glass (percent)	Mean		2.780118216019	.2588363296633
	95% Confidence Interval for Mean	Lower Bound	2.265894669668	
		Upper Bound	3.294341762370	
	5% Trimmed Mean		2.554614376807	
	Median		2.048947068867	
	Variance		6.097	
	Std. Deviation		2.4691412161667	
	Minimum		.0000000000	
	Maximum		11.0326086957	
	Range		11.0326086957	
	Interquartile Range		3.1802786758	
	Skewness		1.311	.253
	Kurtosis		1.446	.500

ORGANICS IN GARBAGE

The mean for the percentage of the two materials considered compostable that were found in garbage samples, called organics, is 19.09%, 95% CI [17.19%, 20.99%]. To put this into context, the mean weight of these materials combined is 40 pounds per sample.

Table 4 provides the mean of each individual compostable material (yard debris, compost and food) at a 95% confidence interval (CI).

Table 4: Organics in garbage container by material type*

Material	Lower	Mean	Upper
Food	15.86%	**17.62%**	19.38%
Yard debris	.80%	**1.47%**	2.14%

*The individual mean material percentages do not add up to the mean for the overall percentage of compostables found in garbage because the overall percentage of compostables is calculated by taking an average of the total compostables for all the samples.

Analysis Output

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Organics	91	100.0%	0	.0%	91	100.0%

Descriptives

			Statistic	Std. Error
Organics (percent)	Mean		19.0882	.95608
	95% Confidence Interval for Mean	Lower Bound	17.1888	
		Upper Bound	20.9876	
	5% Trimmed Mean		18.8588	
	Median		18.3769	
	Variance		83.182	
	Std. Deviation		9.12043	
	Minimum		1.64	
	Maximum		50.15	
	Range		48.52	
	Interquartile Range		13.15	
	Skewness		.468	.253
	Kurtosis		.359	.500

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Organics (weight)	91	100.0%	0	.0%	91	100.0%

Descriptives

			Statistic	Std. Error
Organics (weight)	Mean		39.8442	2.26517
	95% Confidence Interval for Mean	Lower Bound	35.3440	
		Upper Bound	44.3443	

	5% Trimmed Mean	38.5272	
	Median	38.8000	
	Variance	466.922	
	Std. Deviation	21.60837	
	Minimum	3.20	
	Maximum	134.60	
	Range	131.40	
	Interquartile Range	25.71	
	Skewness	1.217	.253
	Kurtosis	3.213	.500

HOUSEHOLD HAZARDOUS WASTE (HHW) AND COVERED ELECTRONICS IN GARBAGE

Table 5 provides the mean and confidence intervals for HHW and covered electronics. To put these numbers into context, the mean weight of HHW is .34 pounds and for covered electronics 1.19 pounds per sample. All of these statistics are at a 95% confidence interval (CI).

Table 5: HHW and covered electronics in garbage container

Material	Lower	Mean	Upper
HHW	.06%	**.16%**	.25%
Covered electronics	.07%	**.52%**	.97%

Analysis Output

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Covered electronics (weight)	91	.0000	43.2000	1.188681	5.2468958
HHW (weight)	91	.0000	5.3000	.337582	1.0004658
Valid N (listwise)	91				

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Non Curbside Recycling (percent)	91	100.0%	0	.0%	91	100.0%

Descriptives

			Statistic	Std. Error
Non Curbside Recycling (percent)	Mean		22.6626	1.11246
	95% Confidence Interval for Mean	Lower Bound	20.4525	
		Upper Bound	24.8727	
	5% Trimmed Mean		22.3051	
	Median		20.4274	
	Variance		112.618	
	Std. Deviation		10.61218	
	Minimum		1.84	
	Maximum		69.76	
	Range		67.92	
	Interquartile Range		15.38	
	Skewness		.983	.253
	Kurtosis		3.015	.500

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Total Weight of Recycling	91	3.60	83.79	30.2241	15.57743
Valid N (listwise)	91				

APPENDIX D: CONTAMINANTS IN RECYCLING STUDY STATISTICAL ANALYSIS

Appendix D 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 figure or table and include analysis and outputs from the statistical software program deployed for this study (SPSS).

Background Data Calculations

The amount of materials in each recycling bin sample that are 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.

$$\frac{1}{n}\sum \frac{Weight\ of\ contaminants\ in\ sample * 100}{Weight\ of\ sample}$$

Sample Allocation and Average Sample Weight

This study drew samples from the cities of Beaverton, Gresham, Portland and unincorporated Clackamas and Washington County. The number of samples allocated per jurisdiction is proportionate to the number of units in the jurisdiction to ensure the sampling was representative of the Metro region as a whole. All recycling samples meet the 125 pound minimum requirement. The average sample weight was 172 pounds. Three samples were combined into a single sample as they were from apartment complexes that had substantially fewer units than the other apartment complexes included in this study. Consequently, these smaller apartment complexes generated smaller amounts of recyclables which challenged the ability to meet the minimum requirement with one sample. As a group, their combined sample weight met the 125 pound minimum requirement. It is important to note that the final set of samples collected is different than the original target. This difference is shown in the column titled "Difference from sample target."

Table 1: Sample allocation, size and weight

Jurisdiction	Number of units	Sample target	Difference from sample target	Total weight of the samples (lbs)	Average sample weight (lbs)
Beaverton	22,143	8	0	1,417	177.27
Gresham	18,378	6	-1	1,068	178.08
Portland	111,661	39	-2	6,291	161.40
Washington County	55,282	20	-1	3,725	186.41
Clackamas County	40,780	15	0	2,592	172.86
Total	248,244	88	-3	15,093	171.62

Standard Deviation

The standard deviation of the amount of contaminants in the recycling sample was 12.88 pounds. 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.

Table 2: Descriptive statistics

	Sample size	Minimum	Maximum	Mean	Standard Deviation
Percent Contamination in Recycle Samples	88	1.10%	67.93%	21.14%	12.88

CONTAMINANTS IN THE RECYCLING

The mean for the percentage of all contaminants in recycling samples is 21.14%, 95% CI [18.41%, 23.87%]. To put this into context, the average weight of all contamination materials in recycling samples is 37 pounds.

Table 3 provides the mean sample weight 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
Paper: not compostable or accepted in commingled	1.98%	**2.67%**	3.36%
Plastic: other rigids	1.91%	**2.33%**	2.75%
Carry-out bags	.08%	**.11%**	.14%
Plastic: other recyclable film and bags	.32%	**.43%**	.55%
Plastic: other film	.30%	**.42%**	.54%
Glass: deposit containers	1.01%	**1.51%**	2.00%
Glass: other containers	2.51%	**3.31%**	4.11%
Yard debris, food, compostable paper combined	2.34%	**3.17%**	4.00%
Diapers	.11%	**.40%**	.70%
Pet waste	.02%	**.14%**	.30%
Covered electronics	.01%	**.42%**	.84%
Other residuals	4.12%	**6.23%**	8.33%

*The individual mean material percentages do not add up to the mean for the overall percentage of contaminants found in recycling because the overall percentage of contaminants is calculated by taking an average of the total contaminants for all the samples.

Analysis Output

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Contamination	88	100.0%	0	.0%	88	100.0%

Descriptives

			Statistic	Std. Error
Contamination (percent)	Mean		21.1364	1.37286
	95% Confidence Interval for Mean	Lower Bound	18.4077	
		Upper Bound	23.8651	
	5% Trimmed Mean		20.3456	
	Median		20.5006	
	Variance		165.857	
	Std. Deviation		12.87856	
	Minimum		1.10	
	Maximum		67.93	
	Range		66.83	
	Interquartile Range		15.91	
	Skewness		.912	.257
	Kurtosis		1.253	.508

Descriptive Statistics

	N	Minimum	Maximum	Mean
TotalGarbage (weight)	88	1.74	140.54	37.1257
Valid N (listwise)	88			

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent

Paper: not compostable or accepted in commingled	88	100.0%	0	.0%	88	100.0%
Plastic: other rigids	88	100.0%	0	.0%	88	100.0%
Carry-out bags	88	100.0%	0	.0%	88	100.0%
Plastic: other recyclable film and bags	88	100.0%	0	.0%	88	100.0%
Plastic: other film	88	100.0%	0	.0%	88	100.0%
Glass: deposit containers	88	100.0%	0	.0%	88	100.0%
Glass: other containers	88	100.0%	0	.0%	88	100.0%
Yard debris, food and compostable non-food waste	88	100.0%	0	.0%	88	100.0%
Diapers	88	100.0%	0	.0%	88	100.0%
Pet waste	88	100.0%	0	.0%	88	100.0%
Covered electronics	88	100.0%	0	.0%	88	100.0%
Other residuals	88	100.0%	0	.0%	88	100.0%

Descriptives

			Statistic	Std. Error
Paper: not compostable or accepted in commingled (percent)	Mean		2.669972345443816	.345621644531252
	95% Confidence Interval for Mean	Lower Bound	1.983011902477212	
		Upper Bound	3.356932788410421	
	5% Trimmed Mean		2.195906784298341	
	Median		1.657790579683255	
	Variance		10.512	
	Std. Deviation		3.242218416890954	
	Minimum		.0000000000000000	
	Maximum		19.5130100655724000	
	Range		19.5130100655724000	
	Interquartile Range		2.0807397699059798	
	Skewness		3.120	.257
	Kurtosis		11.957	.508
Plastic: other rigids (percent)	Mean		2.328498372311012	.212172279790007
	95% Confidence Interval for Mean	Lower Bound	1.906782991876850	
		Upper Bound	2.750213752745174	
	5% Trimmed Mean		2.114281817192705	
	Median		1.790998232909465	
	Variance		3.962	
	Std. Deviation		1.990352409849434	
	Minimum		.0000000000000000	
	Maximum		9.9679063620917500	

	Range		9.9679063620917500	
	Interquartile Range		2.2551823609639460	
	Skewness		1.626	.257
	Kurtosis		3.346	.508
Carry-out bags (percent)	Mean		.110357533989890	.014824342076282
	95% Confidence Interval for Mean	Lower Bound	.080892548909969	
		Upper Bound	.139822519069810	
	5% Trimmed Mean		.092676935468573	
	Median		.060689626857524	
	Variance		.019	
	Std. Deviation		.139064655407210	
	Minimum		.0000000000000000	
	Maximum		.7921733275240620	
	Range		.7921733275240620	
	Interquartile Range		.1419202286489643	
	Skewness		2.297	.257
	Kurtosis		7.138	.508
Plastic: other recyclable film and bags (percent)	Mean		.430812721670284	.058071085047003
	95% Confidence Interval for Mean	Lower Bound	.315390152110023	
		Upper Bound	.546235291230546	
	5% Trimmed Mean		.346391788524020	
	Median		.270118444845779	
	Variance		.297	
	Std. Deviation		.544755064989017	
	Minimum		.0000000000000000	
	Maximum		3.3476035664853400	
	Range		3.3476035664853400	
	Interquartile Range		.3498958600544838	

	Skewness		3.534	.257
	Kurtosis		15.032	.508
Plastic: other film (percent)	Mean		.416686627232791	.061746821696005
	95% Confidence Interval for Mean	Lower Bound	.293958133068035	
		Upper Bound	.539415121397547	
	5% Trimmed Mean		.336431447299530	
	Median		.247021844412130	
	Variance		.336	
	Std. Deviation		.579236531203894	
	Minimum		.0000000000000000	
	Maximum		4.3654258274466200	
	Range		4.3654258274466200	
	Interquartile Range		.3545083169325982	
	Skewness		4.230	.257
	Kurtosis		24.840	.508
Glass deposit containers (percent)	Mean		1.508562950069796	.248623732528390
	95% Confidence Interval for Mean	Lower Bound	1.014396360296886	
		Upper Bound	2.002729539842704	
	5% Trimmed Mean		1.175062919410195	
	Median		.595638067019522	

	Variance		5.440	
	Std. Deviation		2.332297346634573	
	Minimum		.000000000000000	
	Maximum		15.596224677716400	
	Range		15.596224677716400	
	Interquartile Range		1.963386948247285	
	Skewness		3.284	.257
	Kurtosis		15.273	.508
Glass: other containers (percent)	Mean		3.309658808369545	.404584591336566
	95% Confidence Interval for Mean	Lower Bound	2.505503124025827	
		Upper Bound	4.113814492713263	
	5% Trimmed Mean		2.881592652199438	
	Median		1.970992476130090	
	Variance		14.405	
	Std. Deviation		3.795339886773506	
	Minimum		.000000000000000	
	Maximum		24.753127057274500	
	Range		24.753127057274500	
	Interquartile Range		3.886820797859479	
	Skewness		2.583	.257

	Kurtosis		10.870	.508
Yard debris, food, compostable paper combined (percent)	Mean		3.170546254439749	.419718729738809
	95% Confidence Interval for Mean	Lower Bound	2.336309831273025	
		Upper Bound	4.004782677606473	
	5% Trimmed Mean		2.631643328868168	
	Median		1.812675807066665	
	Variance		15.502	
	Std. Deviation		3.937310689319963	
	Minimum		.0000000000000000	
	Maximum		21.2426299993614000	
	Range		21.2426299993614000	
	Interquartile Range		3.6501614885876617	
	Skewness		2.519	.257
	Kurtosis		8.185	.508
Diapers (percent)	Mean		.399532932304616	.147281576556814
	95% Confidence Interval for Mean	Lower Bound	.106794851014861	
		Upper Bound	.692271013594372	
	5% Trimmed Mean		.168499689946791	
	Median		.000000000000000	
	Variance		1.909	

	Std. Deviation		1.381623655627441	
	Minimum		.0000000000000000	
	Maximum		10.9436954797780000	
	Range		10.9436954797780000	
	Interquartile Range		.0000000000000000	
	Skewness		5.767	.257
	Kurtosis		40.117	.508
Pet waste (percent)	Mean		.141463886133736	.082048141876958
	95% Confidence Interval for Mean	Lower Bound	-.021615680149866	
		Upper Bound	.304543452417338	
	5% Trimmed Mean		.006199921802525	
	Median		.000000000000000	
	Variance		.592	
	Std. Deviation		.769679795447824	
	Minimum		.0000000000000000	
	Maximum		5.8476980144010500	
	Range		5.8476980144010500	
	Interquartile Range		.0000000000000000	
	Skewness		6.396	.257
	Kurtosis		42.384	.508

Covered electronics (percent)	Mean		.424030362068273	.207658122763811
	95% Confidence Interval for Mean	Lower Bound	.011287357523771	
		Upper Bound	.836773366612775	
	5% Trimmed Mean		.039023314451408	
	Median		.000000000000000	
	Variance		3.795	
	Std. Deviation		1.948005863333452	
	Minimum		.0000000000000000	
	Maximum		13.1620678718681000	
	Range		13.1620678718681000	
	Interquartile Range		.0000000000000000	
	Skewness		5.350	.257
	Kurtosis		29.226	.508
Other residuals (percent)	Mean		6.226291015825208	1.060507402912854
	95% Confidence Interval for Mean	Lower Bound	4.118417719109550	
		Upper Bound	8.334164312540866	
	5% Trimmed Mean		4.737418205244286	
	Median		2.091702373915010	
	Variance		98.971	
	Std. Deviation		9.948441272063734	

	Minimum	.0000000000000000	
	Maximum	58.0004350032625000	
	Range	58.0004350032625000	
	Interquartile Range	6.4934249726808680	
	Skewness	2.730	.257
	Kurtosis	9.083	.508

FILM PLASTICS

Film plastics in this study were carry-out shopping bags, other recyclable film, and non-recyclable film. Table 4 provides average percentage of film plastics included in this study and count when available. The mean count of carry-out bags is 11 per sample and the average weight of the carry-out bags is .2 pounds.

Table 4: Plastic film in the recycling container by material type

Material	Lower	Mean	Upper	Mean count
Plastic: carry-out bags	.08%	**.11%**	.14%	11
Plastic: other recyclable film	.32%	**.43%**	.55%	n/a
Plastic: non-recyclable film	.29%	**.42%**	.54%	n/a

Analysis Output

Case Processing Summary

Percent	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Plastic: carry-out bags	88	100.0%	0	.0%	88	100.0%
Plastic: other recyclable film	88	100.0%	0	.0%	88	100.0%
Plastic: non-recyclable film	88	100.0%	0	.0%	88	100.0%

Descriptives

			Statistic	Std. Error
Plastic carry-out bags (percent)	Mean		.110357533989890	.014824342076282
	95% Confidence Interval for Mean	Lower Bound	.080892548909969	
		Upper Bound	.139822519069810	
	5% Trimmed Mean		.092676935468573	
	Median		.060689626857524	
	Variance		.019	
	Std. Deviation		.139064655407210	
	Minimum		.0000000000000000	
	Maximum		.7921733275240620	
	Range		.7921733275240620	
	Interquartile Range		.1419202286489643	
	Skewness		2.297	.257
	Kurtosis		7.138	.508
Plastic: other recyclable film and bags (percent)	Mean		.430812721670284	.058071085047003
	95% Confidence Interval for Mean	Lower Bound	.315390152110023	
		Upper Bound	.546235291230546	
	5% Trimmed Mean		.346391788524020	
	Median		.270118444845779	
	Variance		.297	
	Std. Deviation		.544755064989017	
	Minimum		.0000000000000000	
	Maximum		3.3476035664853400	
	Range		3.3476035664853400	
	Interquartile Range		.3498958600544838	
	Skewness		3.534	.257
	Kurtosis		15.032	.508
Plastic: other film (percent)	Mean		.416686627232791	.061746821696005
	95% Confidence Interval for Mean	Lower Bound	.293958133068035	
		Upper Bound	.539415121397547	
	5% Trimmed Mean		.336431447299530	
	Median		.247021844412130	
	Variance		.336	
	Std. Deviation		.579236531203894	
	Minimum		.0000000000000000	
	Maximum		4.3654258274466200	
	Range		4.3654258274466200	

	Interquartile Range	.3545083169325982	
	Skewness	4.230	.257
	Kurtosis	24.840	.508

	N	Range	Minimum	Maximum	Mean	Std. Deviation
Plastic: carry-out bags (count)	88	61	0	61	10.51	12.905
Valid N (listwise)	88					

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Plastic: carry-out bags (weight)	88	.000	1.200	.19733	.250846
Valid N (listwise)	88				

DEPOSIT CONTAINERS

Deposit containers in this study were glass, metal and plastic containers with redeemable deposits as defined by the Oregon Bottle Bill. Table 5 provides mean percentage and count of the deposit containers. The mean count of all deposit containers is 50 and the average weight of all deposit containers is 4.63 pounds per sample. Glass deposit bottles are considered contaminants in this study because they should have been separated from the commingled recyclables and placed in a container designated for glass only.

Table 5: Deposit containers in the recycling bin by material type

Material	Lower	Mean	Upper	Mean count
Glass: deposit containers	1.01%	**1.51%**	2.00%	5
Metal: deposit containers	.46%	**.61%**	.75%	30
Plastic: deposit containers	.48%	**.58%**	.69%	15

Analysis Output

	N	Range	Minimum	Maximum	Mean	Std. Deviation
Plastic deposit containers (count)	88	80	0	80	15.23	13.576
Metal deposit containers (count)	88	291	0	291	30.06	38.673

Glass deposit containers (count)	88	60	0	60	5.03	8.213
Valid N (listwise)	88					

Descriptives

			Statistic	Std. Error
Glass deposit containers (count)	Mean		1.508562950069796	.248623732528390
	95% Confidence Interval for Mean	Lower Bound	1.014396360296886	
		Upper Bound	2.002729539842704	
	5% Trimmed Mean		1.175062919410195	
	Median		.595638067019522	
	Variance		5.440	
	Std. Deviation		2.332297346634573	
	Minimum		.000000000000000	
	Maximum		15.596224677716400	
	Range		15.596224677716400	
	Interquartile Range		1.963386948247285	
	Skewness		3.284	.257
	Kurtosis		15.273	.508
Metal deposit containers (count)	Mean		.606502535200407	.073581392882155
	95% Confidence Interval for Mean	Lower Bound	.460251549337009	
		Upper Bound	.752753521063805	
	5% Trimmed Mean		.517989589090360	
	Median		.380165277146723	
	Variance		.476	
	Std. Deviation		.690254649608435	
	Minimum		.000000000000000	
	Maximum		4.1884345163033700	
	Range		4.1884345163033700	
	Interquartile Range		.7146953642474314	
	Skewness		2.486	.257
	Kurtosis		8.553	.508
Plastic deposit containers (count)	Mean		.583643929529370	.054541175368894
	95% Confidence Interval for Mean	Lower Bound	.475237437678577	
		Upper Bound	.692050421380163	
	5% Trimmed Mean		.533101360142643	
	Median		.449212748240499	
	Variance		.262	

	Std. Deviation	.511641577019112	
	Minimum	.0000000000000000	
	Maximum	3.1497165255127000	
	Range	3.1497165255127000	
	Interquartile Range	.5499782281180065	
	Skewness	2.062	.257
	Kurtosis	6.661	.508

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Total Deposit Count	88	.00	328.00	50.3182	47.52556
Valid N (listwise)	88				

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Total Deposit Weight	88	.00	33.10	4.6323	4.96681
Valid N (listwise)	88				

ALL ACCEPTABLE CURBSIDE RECYCLABLES

The mean for the percentage of all acceptable curbside recyclables found in recycling container samples is 78.86%, 95% CI [76.13%, 81.59%]. To put this into a weight context, the mean weight for acceptable curbside recyclables found in the recycling container samples is 135 pounds. Table 6 provides the mean for recyclable cardboard, paper, plastics and metal.

Table 6: Acceptable recyclables in the recycling bin by material type*

Material	Lower	Mean	Upper
Cardboard	33.98%	**37.27%**	40.56%
Paper: other commingled-acceptable	30.21%	**33.39%**	36.57%
Plastic: deposit beverage containers	.48%	**.58%**	.69%
Plastic: commingled-acceptable	4.11%	**4.64%**	5.17%
Metal: deposit beverage containers	.46%	**.61%**	.75%
Metal: commingled-acceptable	2.02%	**2.37%**	2.72%

*The individual mean material percentages do not add up to the mean for the overall percentage of acceptable recyclables because the overall percentage of acceptable recyclables is calculated by taking the mean of the total acceptable recyclables for all the samples.

Analysis Output

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Percent Recyclables in Recycling	88	100.0%	0	.0%	88	100.0%
Cardboard	88	100.0%	0	.0%	88	100.0%
Paper: Other commingled-acceptable	88	100.0%	0	.0%	88	100.0%
Plastic deposit beverage containers	88	100.0%	0	.0%	88	100.0%
Plastic: other recyclable film and bags	88	100.0%	0	.0%	88	100.0%
Metal deposit containers	88	100.0%	0	.0%	88	100.0%
Metal: Commingled-acceptable	88	100.0%	0	.0%	88	100.0%

Descriptives

			Statistic	Std. Error
Recyclables in Recycling (percent)	Mean		78.8636	1.37286
	95% Confidence Interval for Mean	Lower Bound	76.1349	
		Upper Bound	81.5923	
	5% Trimmed Mean		79.6544	
	Median		79.4994	
	Variance		165.857	
	Std. Deviation		12.87856	
	Minimum		32.07	
	Maximum		98.90	
	Range		66.83	
	Interquartile Range		15.91	
	Skewness		-.912	.257
	Kurtosis		1.253	.508
Cardboard (percent)	Mean		37.269007561946420	1.65574808 7915279
	95% Confidence Interval for Mean	Lower Bound	33.978028950181440	
		Upper Bound	40.559986173711394	
	5% Trimmed Mean		36.653422832958740	
	Median		34.504079544056250	
	Variance		241.252	
	Std. Deviation		15.532293851710670	
	Minimum		8.60339785881727	

	Maximum		83.11141142334750	
	Range		74.50801356453024	
	Interquartile Range		18.82991826266036	
	Skewness		.623	.257
	Kurtosis		.405	.508
Paper: other commingled-acceptable(percent)	Mean		33.389788082065410	1.600394024269579
	95% Confidence Interval for Mean	Lower Bound	30.208831665622213	
		Upper Bound	36.570744498508600	
	5% Trimmed Mean		32.792539085552720	
	Median		32.627975222111850	
	Variance		225.391	
	Std. Deviation		15.013026706722542	
	Minimum		8.97966002589483	
	Maximum		73.00147228522540	
	Range		64.02181225933057	
	Interquartile Range		22.69277663909613	
	Skewness		.494	.257
	Kurtosis		-.303	.508
Plastic: deposit containers (percent)	Mean		.583643929529370	.054541175368894
	95% Confidence Interval for Mean	Lower Bound	.475237437678577	
		Upper Bound	.692050421380163	
	5% Trimmed Mean		.533101360142643	
	Median		.449212748240499	
	Variance		.262	
	Std. Deviation		.511641577019112	
	Minimum		.0000000000000000	
	Maximum		3.1497165255127000	
	Range		3.1497165255127000	
	Interquartile Range		.5499782281180065	
	Skewness		2.062	.257
	Kurtosis		6.661	.508
Plastic: commingled-acceptable	Mean		4.639879236432724	.266075944237782
	95% Confidence Interval for Mean	Lower Bound	4.111024486134188	
		Upper Bound	5.168733986731258	
	5% Trimmed Mean		4.558510804858004	
	Median		4.261588172242745	
	Variance		6.230	

	Std. Deviation		2.496013604325587	
	Minimum		.000000000000000	
	Maximum		10.727093846202700	
	Range		10.727093846202700	
	Interquartile Range		3.170975946957785	
	Skewness		.569	.257
	Kurtosis		-.156	.508
Metal deposit containers(percent)	Mean		.606502535200407	.073581392882155
	95% Confidence Interval for Mean	Lower Bound	.460251549337009	
		Upper Bound	.752753521063805	
	5% Trimmed Mean		.517989589090360	
	Median		.380165277146723	
	Variance		.476	
	Std. Deviation		.690254649608435	
	Minimum		.0000000000000000	
	(percent)Maximum		4.1884345163033700	
	Range		4.1884345163033700	
	Interquartile Range		.7146953642474314	
	Skewness		2.486	.257
	Kurtosis		8.553	.508
Metal: commingled-acceptable	Mean		2.374764844966957	.176204542514350
	95% Confidence Interval for Mean	Lower Bound	2.024539237011895	
		Upper Bound	2.724990452922018	
	5% Trimmed Mean		2.261648898756816	
	Median		2.120678176901105	
	Variance		2.732	
	Std. Deviation		1.652945126323571	
	Minimum		.0000000000000000	
	Maximum		7.7825159914712190	
	Range		7.7825159914712190	
	Interquartile Range		2.0409861880183380	
	Skewness		1.016	.257
	Kurtosis		1.019	.508

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Acceptable Recycling (weight)	88	100.0%	0	.0%	88	100.0%

Descriptives

			Statistic	Std. Error
Acceptable Recycling (weight)	Mean		134.4911	3.90795
	95% Confidence Interval for Mean	Lower Bound	126.7237	
		Upper Bound	142.2586	
	5% Trimmed Mean		132.9703	
	Median		130.9750	
	Variance		1343.940	
	Std. Deviation		36.65978	
	Minimum		66.24	
	Maximum		262.72	
	Range		196.48	
	Interquartile Range		50.27	
	Skewness		.739	.257
	Kurtosis		1.432	.508

APPENDIX E: Per-unit Multifamily Generation Rate Analysis

Appendix E provides a summary of the data and analysis staff produced for the figures and tables in this study. The first section provides background on how data was collected, the number of samples, and the calculations used in the study. The remaining sections are organized by figure or table and include analysis and outputs from the statistical software program deployed for this study (SPSS).

Background Data Calculations

Metro partnered with collection companies to weigh garbage, commingle recyclables and glass generated by multifamily residents during a seven day period. The data was collected from July 2016 through March 2017 and was used to create a snapshot of per unit material generation rates for each material stream. Bins sampled include all glass, commingle and garbage receptacles on site. This includes roll carts, tubs, cages, drop boxes and compactors. There was no separating of material sub streams within the container. For example if a discard was in the garbage bin, it was for all purposes treated as garbage.

The per unit generation rates were calculated by summing each site's total or estimated weekly sample weight per material type (garbage, mixed recyclables and glass). These totals per site were then divided by the number of occupied units per site. The occupied unit value for each site was calculated by multiplying the total number of units at the site by an estimate of the vacancy rate for that jurisdiction. The estimated vacancy rate was pulled from regional data published by Multifamily NW, an association of residential property managers and vendors. The regional per-unit generation rate for each material type is the average of all the sites' per unit generation rates.

Sample Allocation

The study drew samples from the cities of Beaverton, Gresham, Portland, Wilsonville and Washington County. Since the availability of equipment, service area sprawl and proximity to a local transfer stations varies greatly by hauler, Metro worked with companies one-on-one to develop a list of sample sites and therefore some were not selected randomly.

Table 1: Sample size

Collection company	Jurisdiction	Number of sites	Number of units
Waste Management	City of Beaverton	7	1332
Trashco	City of Portland (Downtown)	8	1300
Gresham Sanitary Service*	City of Gresham	7	1434
Pride*	Washington County	6	993
Waste Connections*	City of Portland (NE)	8	1009
Republic Services*	Clackamas County/Wilsonville	6	1439
Total Sample		42	7507

*Site specific data is available for this hauler's sites.

Standard Deviation

The standard deviation for each of the generation rates per unit by material varied from 12.34 (garbage) to 4.45 (commingling) and .91 (glass). The standard deviation is used to calculate the confidence interval. A low standard deviation value indicates the data points are closer to the mean. A high standard deviation value indicates there is a wider spread of the data points from the mean.

Table 2: Descriptive statistics

	Sample size	Minimum	Maximum	Mean	Standard Deviation
Garbage per residence for one week (lbs)	42	25.2409	32.9295	**29.0852**	12.33633
Commingle per residence for one week (lbs)	42	4.7397	7.5156	**6.1276**	4.45400
Glass per residence for one week (lbs)	41	.8412	1.4171	**1.1292**	.91229

MATERIAL GENERATION PER RESIDENCE FOR ONE WEEK

Table 3 provides the mean weight (in pounds) for garbage, commingle, and glass per residence for one week. 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 weight of each material per residence for one week of generation.

Table 3: Generation per residence for one week by material

Material	Lower	Mean	Upper
Garbage per residence for one week (lbs)	25.2409	**29.0852**	32.9295
Commingle per residence for one week (lbs)	4.7397	**6.1276**	7.5156
Glass per residence for one week (lbs)	.8412	**1.1292**	1.4171

Analysis Output

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Unit Weekly Garbage Generation	42	100.0%	0	.0%	42	100.0%

Descriptives

			Statistic	Std. Error
Unit Weekly Garbage Generation	Mean		29.085186	1.9035369
	95% Confidence Interval for Mean	Lower Bound	25.240915	
		Upper Bound	32.929457	
	5% Trimmed Mean		28.809185	
	Median		30.087796	
	Variance		152.185	
	Std. Deviation		12.3363292	
	Minimum		7.9787	
	Maximum		53.5780	
	Range		45.5993	
	Interquartile Range		24.1673	
	Skewness		.062	.365
	Kurtosis		-1.028	.717

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Unit Weekly Commingle Generation	42	100.0%	0	.0%	42	100.0%

Descriptives

			Statistic	Std. Error
Unit Weekly Commingle Generation	Mean		6.127619	.6872676
	95% Confidence Interval for Mean	Lower Bound	4.739654	
		Upper Bound	7.515584	
	5% Trimmed Mean		5.588312	
	Median		5.077709	
	Variance		19.838	
	Std. Deviation		4.4540030	
	Minimum		.7049	

	Maximum	22.2725	
	Range	21.5676	
	Interquartile Range	3.5143	
	Skewness	2.022	.365
	Kurtosis	4.955	.717

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Unit Weekly Glass Generation	41	97.6%	1	2.4%	42	100.0%

Descriptives

			Statistic	Std. Error
Unit Weekly Glass Generation	Mean		1.1292	.14248
	95% Confidence Interval for Mean	Lower Bound	.8412	
		Upper Bound	1.4171	
	5% Trimmed Mean		1.0675	
	Median		.9837	
	Variance		.832	
	Std. Deviation		.91229	
	Minimum		.01	
	Maximum		3.58	
	Range		3.57	
	Interquartile Range		1.15	
	Skewness		1.082	.369
	Kurtosis		.432	.724