

2020-2021

Centralized Study on Availability of Recycling



**SUSTAINABLE PACKAGING
COALITION®**

About us



GreenBlue is an environmental nonprofit dedicated to the sustainable use of materials in society. We bring together a diversity of stakeholders to encourage innovation and best practices to promote the creation of a more sustainable materials economy.



The Sustainable Packaging Coalition is a membership-based collaborative that believes in the power of industry to make packaging more sustainable. Our mission is to bring packaging sustainability stakeholders together to catalyze actionable improvements to packaging systems and lend an authoritative voice to issues related to packaging sustainability. The Sustainable Packaging Coalition is a trademark project of GreenBlue.

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2020-21 SPC Centralized Study on Availability of Recycling

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Introduction

This study investigates residential recycling programs across 1,950 communities in the United States to gather information on the availability of curbside and drop-off collection programs and the acceptance of 32 types of packaging formats in those programs. This study is focused specifically on recycling programs that accept packaging materials, not programs targeted at other non-packaging recyclables such as e-waste.

Understanding the acceptance of packaging in residential recycling programs is one vital aspect in assessing the likelihood that a certain packaging type will be recycled. This information serves a variety of purposes, including guiding improvements to recycling systems, informing packaging decisions, and substantiating one aspect of packaging recyclability claims.

This study was commissioned by the Sustainable Packaging Coalition (SPC) and conducted by RRS, with support and strategic guidance from a review panel composed of representatives from local, state, and federal government agencies and recycling-focused NGOs:

- Michelle Balz, Solid Waste Manager, Hamilton County Recycling and Solid Waste District
- Liz Bedard, Technical Consultant, Association of Plastic Recyclers
- Aaron Burman, Vice President - Data & Analytics; The Recycling Partnership
- Swarupa Ganguli, Measurement Team Lead, Resource Conservation Branch; US Environmental Protection Agency
- Brooke Nash, Branch Chief, Municipal Waste Reduction Program; Massachusetts Department of Environmental Protection

The research methodology was developed and refined through an inclusive process with the SPC, RRS, and members of the review panel. The SPC wishes to express its sincere gratitude to members of the study review panel for their thoughtful guidance and thorough vetting of the study methodology and findings.

Key Findings

This study found that 91% of US residents have access to either curbside and/or drop-off recycling programs that accept packaging materials. This is a decrease from the 94% of US residents who had access to either curbside and/or drop off recycling programs in our 2016 Centralized Study on Availability of Recycling. Access to recycling programs varied by housing type; 23% of US residents who live in multi-family housing had no access to recycling programs, while only 3% of US residents who live in single family homes had no access to recycling programs that accept packaging materials.

US residents' access to recycling programs for specific packaging formats was also assessed. Package formats with the greatest amount of recycling access included: steel food cans (87%), aluminum beverage cans (with deposit 90%, without deposit 89%), corrugated boxes (88%), paperboard boxes (84%), PET bottles (beverage bottles with deposit 88%, other PET bottles without deposit 87%), and HDPE bottles (87%). Package formats with the least amount of recycling access included aluminum foil and foil packaging (37%) and rigid PS packaging (45%).

Methodology Overview

The research method is based on third-party verification, where researchers independently reviewed public-facing recycling program information for details on the program and items accepted. Two types of recycling programs were included: curbside recycling and drop-off recycling programs.

Curbside collection of recycling means that recycling is collected from homes after residents set out materials on the side of the street. In this study it is also used to refer to programs for apartment complexes where collection containers for recycling are located anywhere in the complex. Drop-off collection refers to a program where residents bring recyclables to a collection point away from their residence.

This study defines the **availability of recycling** as a resident having access to either one or more of the following services, measured separately in this study, at their place of residence:

- Curbside recycling provided automatically to their home by public or private service providers.
- Curbside recycling provided on an opt-in or subscription basis to their home by public or private service providers.
- A publicly or privately operated drop-off recycling location within the municipality where the resident resides. Residents living outside the community where the drop-off is located are considered to have drop-off recycling available if their own municipality, county, or other local government directs them to that drop-off location as the appropriate recycling outlet.

Approximately 1,400 communities were intentionally selected for direct measurement, consisting of the largest communities in each state, in total representing at least 50% of each state's population. An additional 500 communities were randomly selected using a stratified method aimed at ensuring that urban, rural, and suburban communities were evenly represented for a total of 1,950 communities. The findings from these randomly selected communities were extrapolated and combined with the findings from intentionally selected communities to provide a nationally representative snapshot of the availability of residential recycling programs and the acceptance of packaging in those programs. The data collection was done over a six-month period from September 2020 to February 2021, and thus the study findings are representative of that time period, while recognizing that programs and service availability in a given community are subject to change at any time. As the data was collected during the time period the novel COVID-19 pandemic interrupted many regular recycling programs, an assumption was made. The underlying assumption to handle the complicated timing of the study was that any changes to recycling collection due to the pandemic were temporary, and pre-pandemic material collections would resume when possible.

The methodology included a standardized framework for evaluating how a recycling program describes its acceptance of specific types of packaging. Each recycling program studied was assigned a 1-5 numerical rating for each of the 32 packaging categories, corresponding to how explicitly that item is communicated as being accepted or prohibited from collection. That numerical rating system was designed to accommodate the varying levels of specificity in recycling program guidelines and provide more granular information on the ways in which those programs communicate acceptance of packaging:

1. **Explicitly accepted:** the packaging type is specifically mentioned or conveyed through a photo or image as being accepted
2. **Implicitly accepted:** a broader category of packaging is accepted and/or similar items are accepted
3. **Unclear if accepted or prohibited:** program guidelines were assessed to be contradictory and/or ambiguous
4. **Implicitly prohibited:** a broader category of packaging is prohibited and/or similar items are prohibited
5. **Explicitly prohibited:** the packaging type is specifically mentioned or conveyed through a photo or image as being prohibited

For most packaging categories studied, explicit and implicit acceptance should both be considered to indicate that the packaging type is accepted in recycling programs. A full matrix of the acceptance criteria is included in the appendix.

How to Use the Study Findings

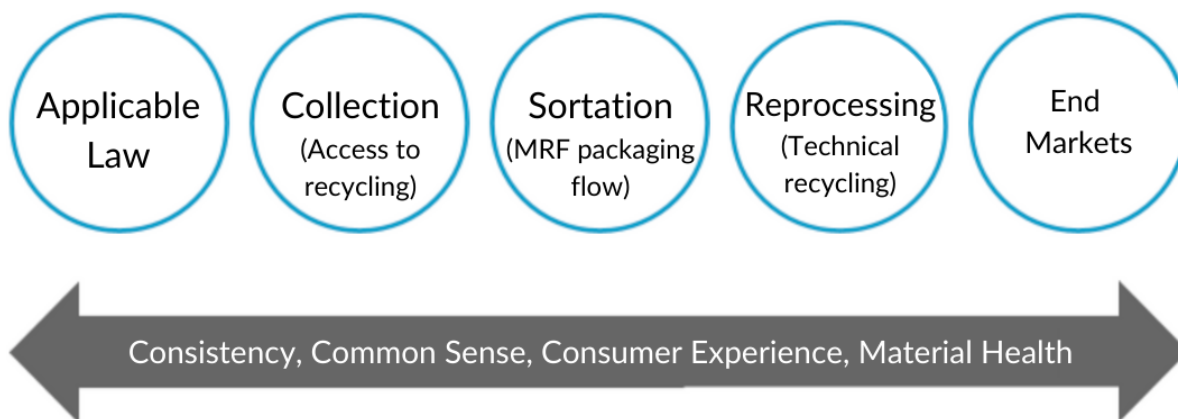
These study findings may be used to shed light on some aspects of the following two topics:

- **General findings on the availability of recycling programs that accept packaging in the United States.**
- **The percentage of US residents with recycling programs available for certain packages in the communities where they live.** This is often referred to as ‘access’ for recycling certain packages. This is only one aspect of packaging recyclability.

How these study findings should be viewed in relation to packaging recyclability

It is critical that these study findings always be framed in the full context of the recycling system, which should be understood as a series of processes that begins with the collection of packaging for recycling and culminates in the use of recycled content in a new manufacturing process.

This is recyclability



Access to recycling programs is only one element of recyclability. Applicable law, sortation, reprocessing and end markets are additional critical elements. For more detail on the definition of recyclability, visit the [How2Recycle Guide to Recyclability](#).

The availability of recycling programs (also known as ‘access to recycling’) and the items accepted in those programs are important pieces of information related to the element of collection, which is the first step in the definition of recyclability. While access to recycling programs is a necessary prerequisite for recyclability, it is only beginning. **This study therefore provides important but incomplete information to assess residential recycling programs and the recyclability of packaging in those programs.**

Recyclability claims are regulated as marketing claims by the Federal Trade Commission, and marketers are responsible for avoiding intentional and unintentional consumer deception by carefully and thoroughly

substantiating claims. The Federal Trade Commission’s *Guides for the Use of Environmental Marketing Claims*, commonly referred to as “the Green Guides”, states:

“A product or package should not be marketed as recyclable unless it can be collected, separated, or otherwise recovered from the waste stream through an established recycling program for reuse or use in manufacturing or assembling another item.”

Federal Trade Commission’s Green Guides § 260.12 (Guides for the Use of Environmental Marketing Claims, pursuant to Code of Federal Regulations, Title 16 Part 260).

Recyclability refers to the likelihood that a package will complete the entire recycling process if collected in the recycling programs available to a substantial majority of consumers, from collection through use as recycled content in the manufacture of a new product or package. This interpretation of recyclability is robust and rooted in the aim of avoiding consumer deception by accurately describing compatibility with the recycling system.

For more information on this topic, please see [The How2Recycle Guide to Recyclability](#).

While these study findings shed important light on the recyclability of packaging, they cannot be used in isolation to substantiate recyclability claims.

Companies are encouraged to become members of the [How2Recycle](#) program to understand the recyclability of their packaging. How2Recycle considers all elements of the recycling process in determining recyclability—availability of recycling, sortation, reprocessing, and end markets.

Limitations to consider when reviewing the study findings

The purpose of this study is to understand *what materials recycling programs intend to be entered into the recycling system*. It is important to note that this is only one aspect out of many that impact what materials actually end up getting recycled – that is, being used as feedstocks to make new products.

This study uses an objective and sophisticated assessment methodology to determine the acceptance of packaging in residential recycling programs. However, it must be acknowledged that the methodology is largely predicated on the presence or absence of keywords in consumer-facing recycling program instructions. These program instructions are far from standardized, and vary widely with respect to the level of depth, specificity, and word choice surrounding different categories of packaging. Some communities intentionally communicate accepted items using vague, broad categories in the interest of

simplicity and brevity; other communities provide a more comprehensive level of detail. For examples of some of the different types of public facing recycling communication, see the images below.



Further, there may be misalignment between the types of items communicated for acceptance in collection programs and the types of items that are targeted for recycling in downstream elements of the recycling process. Many communities operate their recycling programs by engaging waste haulers with contracts that specify the packaging types that must be accepted for collection. Those haulers are contractually obligated to *collect* certain items, but the MRFs that serve as the destinations for those collected items may not be contractually obligated to sort and sell them. This misalignment may happen in both directions: sometimes, items listed as acceptable in a collection program may not be sorted and sold by the receiving MRF; sometimes, items listed as being prohibited in a collection program may indeed be sorted and sold by the receiving MRF. Communities that cohabit the same MRFshed are also known to list different accepted and prohibited items. There are opportunities for future research and harmonization initiatives that improve the understanding of these disconnects and create better alignment. The scope of this study does not extend beyond analyzing the language in consumer-facing recycling program instructions, and while these study findings should be considered as the most accurate data on the acceptance of packaging in residential recycling collection programs, the study authors wish to acknowledge this discord and encourage future research.

It should also be recognized that there are many other important types of recycling collection programs that are not included in the scope of this study. Recycling receptacles serve additional opportunities for collection at workplaces, commercial institutions, public spaces, and on-the-go locations such as convenience stores. While these programs are important pieces of the recycling landscape, they are generally not considered to provide a reasonable extent of accessibility to the general public and therefore were intentionally excluded from this study. Store Drop-Off receptacles for polyethylene bags, films, and wraps were also not included in the scope of this study.

This study's methodology mirrors the SPC's 2015-16 Centralized Study on the Availability of Recycling; however, some of the assessment criteria have been adjusted and the findings may not be comparable between the two studies. Care should be taken in understanding the differences in assessment criteria

between the two studies before comparisons are made (see the Appendix for a category-by-category overview of the assessment criteria in this study).

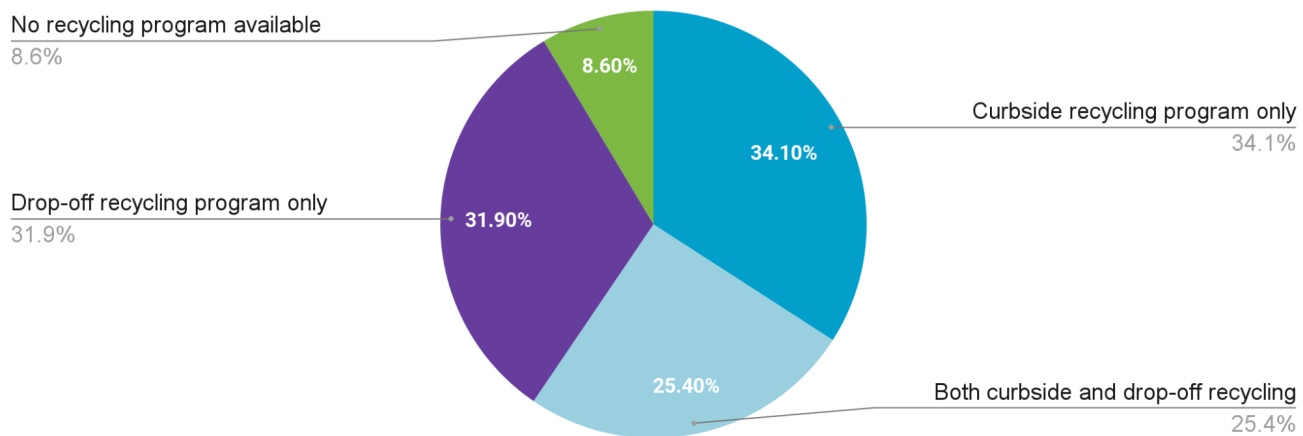
The study findings are nationally representative across the United States and have undergone a statistical analysis to ensure confidence when viewed through a national lens. This study was not aimed at providing state-level findings and was not constructed to provide statistical validity at the state level. The community-by-community findings are not included in this report and will not be made available.

Additionally, taken in the larger context of the past two years, the results presented in this report represent a specific moment of time shortly before and after an enormous shock to recycling systems with the unprecedented effects of the COVID-19 pandemic. While this was accounted for in the data collection process by examining what was accepted at the site before COVID-19, that data provides important insight into the state of recycling access across the United States pre-pandemic, and the long term effects of changes in recycling systems due to the pandemic are not able to be fully captured as they are presently unfolding.

Lastly, it is hoped that the study findings will be used to guide constructive improvements to our recycling systems. This snapshot of the US recycling landscape sheds important light on topics such as the accessibility of recycling programs, the language used to communicate the items accepted by those programs, and it serves as a proxy indicator for the robustness of our downstream recycling infrastructure. The recycling landscape is ripe for a number of improvements and this study should serve as a resource for industry, government, and NGO stakeholders pursuing those improvements.

General Findings on the Availability of Recycling Programs

Across the US as a whole, recycling programs were found to be available to 91.4% (+/- 1%) of the population. This is a decrease from the 2016 access rate of 94% (+/- 1%), meaning fewer US residents have access to recycling programs in 2021 than in 2016. Conversely, this indicates that 8.6% of the population was found to have no recycling program available, an increase from the 6% with no recycling program access in 2016. The type of recycling programs available to residents are shown in the graph below. Note that for the 'curbside recycling program only', that includes subscription curbside in areas where this is the method of single-family service provision. It is believed that much of the change in access to curbside recycling for multi-family housing dwellers is an artifact of changing the method of determining access for multi-family housing units. Previously, multi-family housing in areas with commercial recycling services subscription available was included as access to curbside recycling, whereas in this study's methodology was updated to include only residentially targeted services.



For nearly a third of US residents (31.9%), drop-off recycling is the only recycling program available to them.

The total percent of US residents that have access to curbside recycling (both curbside only access and both curbside and drop off access) is 59.5% (+/-2%). While this is significantly less than the 2016 Study, which found 73% (+/-2%) of US residents had access to curbside recycling, it is believed to primarily be due to a methodological change of no longer including commercial recycling services as curbside programs available for multi-family housing. Drop off recycling program access increased from 2016 to 2021, with a change from 21% (+/- 3%) to 31.9% (+/- 2%). As convenience of the recycling program is related to

participation rates of the program, these changes are important to note as curbside recycling is more convenient than drop off recycling.¹

Availability of program types was found to vary between residents of single- and multi-family dwellings, with single family home dwellers being more likely to have access to curbside programs. Single family housing typically refers to a detached dwelling in which one household resides. However, in recycling programs, “single family services” are often offered to residents in buildings with up to 2-8 residential units. Multi-family housing refers to buildings with more than one residential unit. For recycling program purposes, the definition of multi-family may vary from one community to another.

Multi-family residents were less likely to have curbside recycling available, and also more likely to have no services available at all.

Note that as discussed in the Methodology Detail, for the purposes of this study, multi-family residents that receive services via private commercial hauling services were not considered to have service available because it cannot be determined how many residents actually have recycling available at their residence. This discrepancy in access to more convenient curbside recycling is likely to have a negative impact on recycling program *usage* for dwellers of multi-family housing.

While the majority of US residents do live in single family homes, (Approximately 70% of the occupied dwellings are single-family homes while approximately 25% are multi-family dwellings)² recycling rate goals are unlikely to be met without the participation of multi-unit dwellers (who disproportionately have access to only drop off recycling programs). Dwellers of multi-family housing units are also less likely to have a vehicle than dwellers of single family homes³. Thus, they are more likely to only have access to drop off recycling that requires a vehicle to efficiently recycle their packaging waste and more likely to have increased barriers to drop off recycling.

Convenience is a major driver of consumer behavior. Thus, understanding differences in access to convenient, easy to access recycling programs can inform the likelihood that consumers will take an active role in using the recycling programs available to them.

¹ Hilary Nixon and Jean-Daniel M. Saphores. "How effective are current household recycling policies? Results from a national survey of US households" Resources Conservation and Recycling (2014): 1-10.

² Information sourced from the American Household Survey Table Creator (Variable 1 Units by Structure Type, Variable 2 Tenure with 2019 data)

https://www.census.gov/programs-surveys/ahs/data/interactive/ahstablecreator.html?s_areas=00000&s_year=2019&s_tablename=TABLE1&s_bygroup1=1&s_bygroup2=1&s_filtergroup1=1&s_filtergroup2=1

³ National Multifamily Housing Commission. (2020). *Household Characteristics*. NMHC.

<https://www.nmhc.org/research-insight/quick-facts-figures/quick-facts-resident-demographics/household-characteristics/>

	Recycling access for residents of multi-family dwellings	Recycling access for residents of single family dwellings
Curbside recycling program only (including subscription curbside in areas where this is the method of single-family service provision)	19.1%	39.6%
Drop-off recycling program only	46.0%	26.3%
Both curbside and drop-off recycling programs	11.6%	30.7%
No recycling program available	23.3%	3.4%

In some areas, both curbside recycling and waste collection services for single-family homes are provided by individual subscription rather than contracted for or provided by municipalities themselves. In a subscription-based program, residents hire curbside recycling services on an individual basis from their choice of private service provider. These services may be bundled with the cost of regular trash collection, or priced separately.

These areas are included in the totals for curbside recycling in the tables above. Looking at curbside service provision in more depth, the study found that the majority of single-family curbside services were provided via community-level contracts or municipal departments. Previous studies have found that participation is lower when curbside programs are opt-in or by subscription (as opposed to community level contracts or municipal collection). Potential reasons include subscription cost as a deterrent and a lack of awareness of the availability of the programs. The percentage of curbside services provided via subscription is shown below.

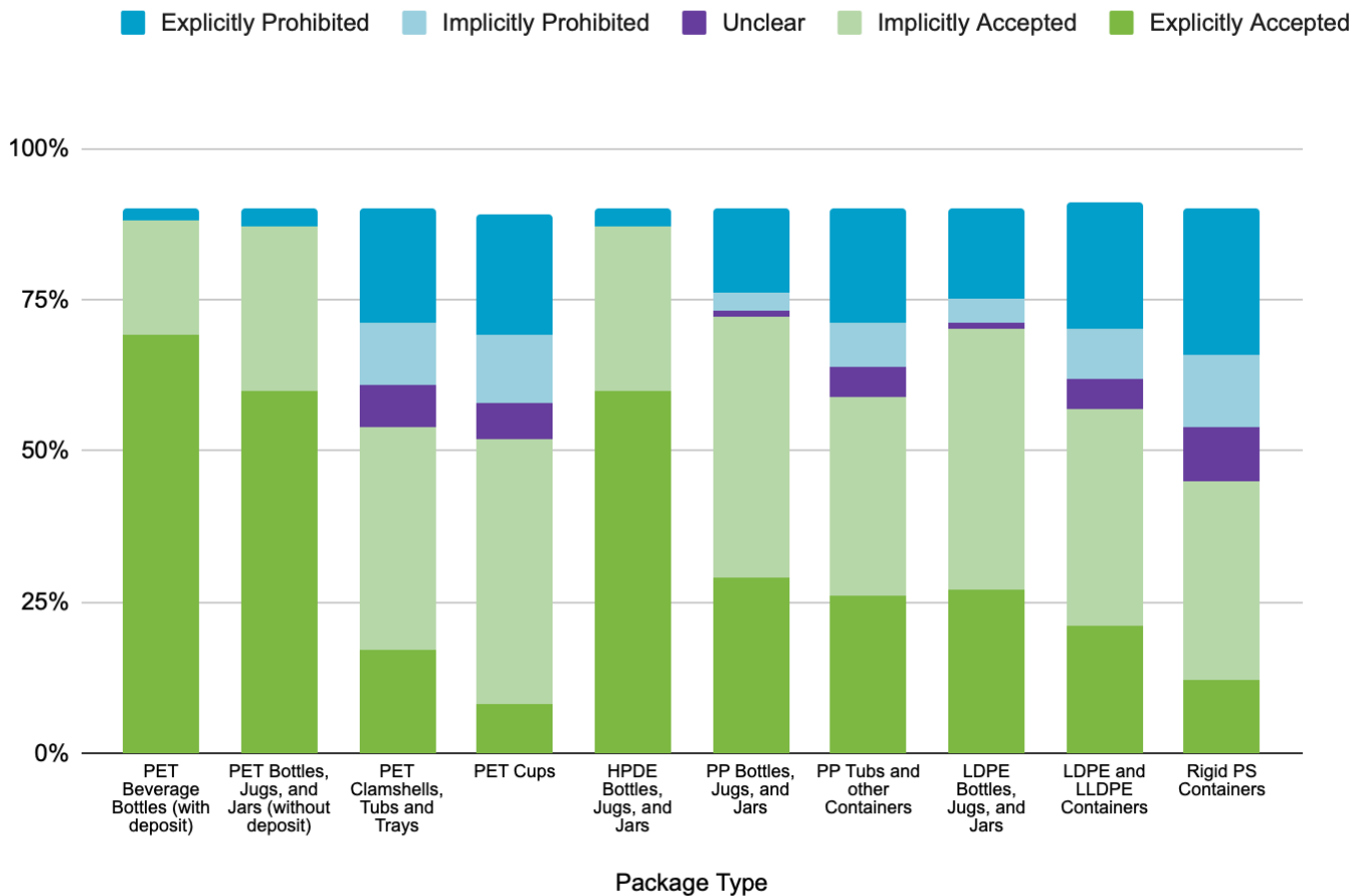
	Percent of residents receiving single-family curbside recycling services
Subscription collection	12.6%
Contracted or municipal collection	87.4%

One clear theme present in this data is that the US recycling system’s recovery from the 2017 implementation of Chinese import restrictions is ongoing. When the findings of this study are compared to previously collected data from 2016, access to recycling for most package materials and formats declined. While this data provides important insight into the current state of recycling access across the United States, the long term changes in recycling programs due to the implementation of the National Sword policy is still in flux and recycling access needs to be regularly reassessed.

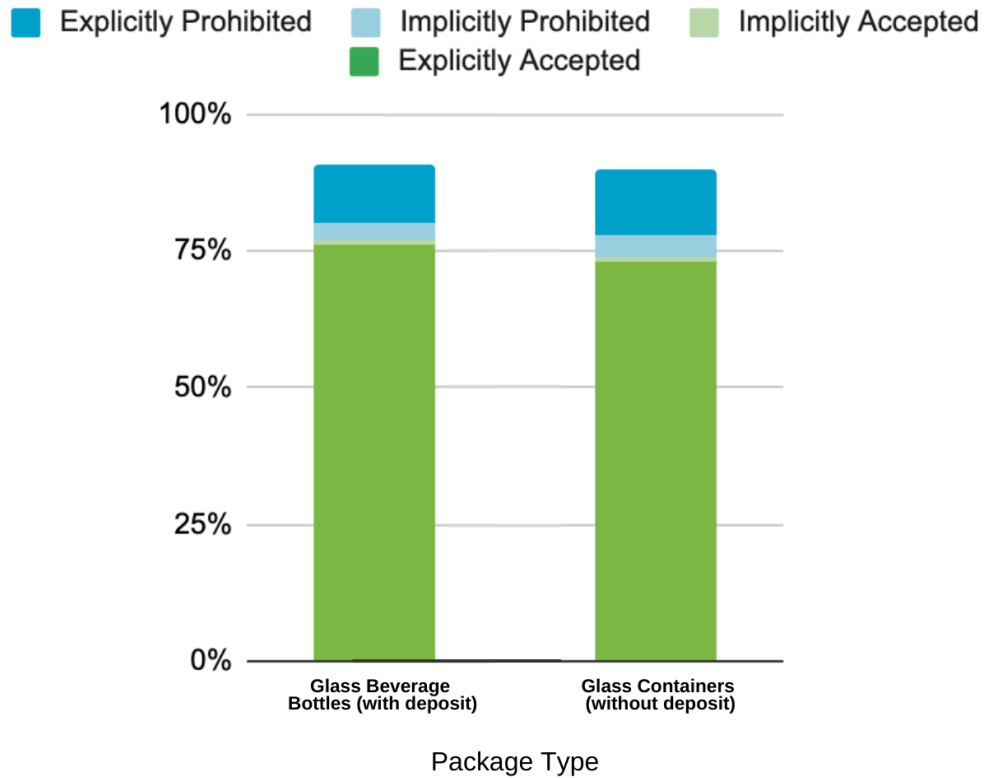
Findings on the Availability of Recycling Programs for Specific Package Types

The following percentages do not add to 100% because 9% of US residents do not have access to a recycling program. Thus, for the 9% with no recycling access there cannot be acceptance or prohibition of specific packaging materials and formats. Additionally, the percentages have been rounded to the nearest whole number.

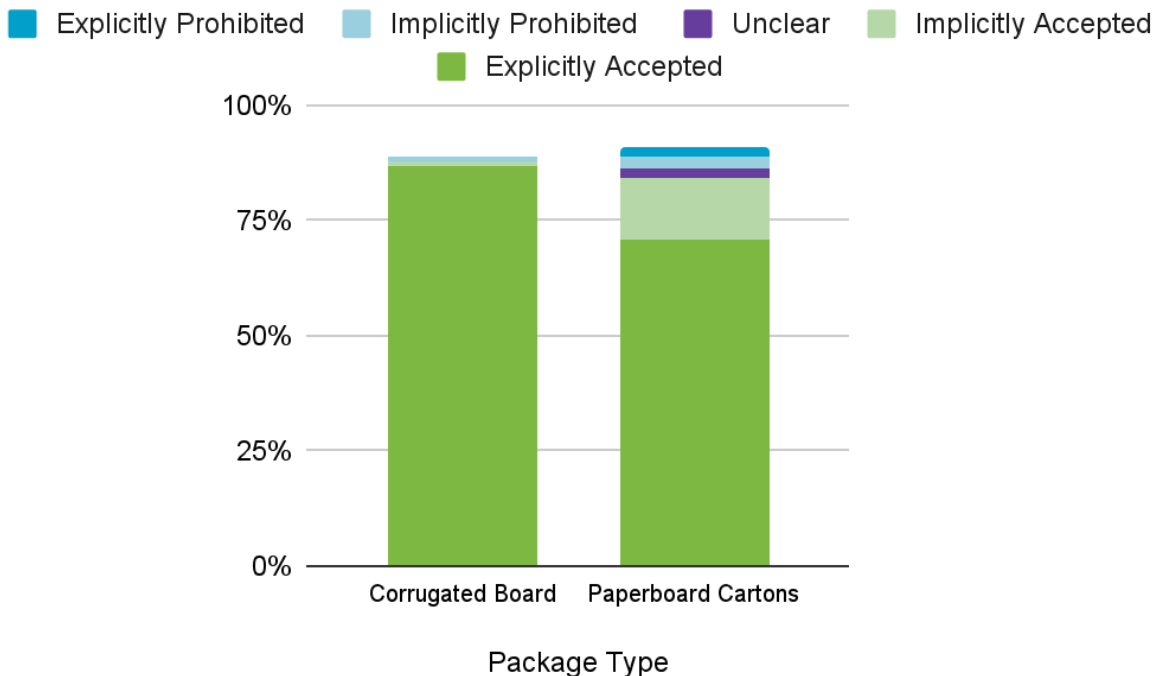
Percentage of US population with recycling programs available for plastic packaging formats



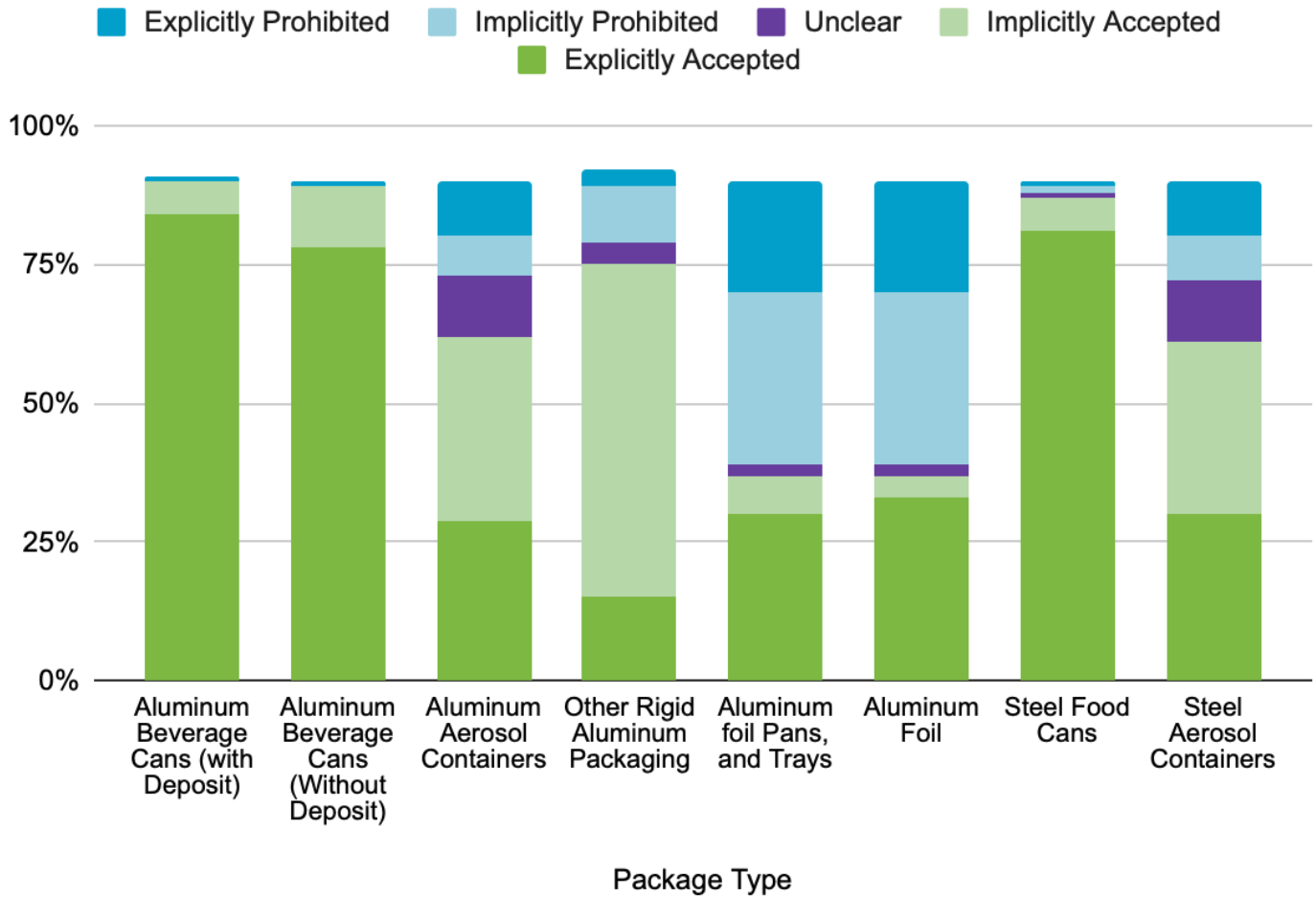
Percentage of US population with recycling programs available for glass recycling



Percentage of US population with recycling programs available for paper packaging recycling



Percentage of US population with recycling programs available for metal packaging recycling



Package Type	Explicitly Accepted	Implicitly Accepted	Total Accepted	Unclear	Implicitly Prohibited	Explicitly Prohibited
PET Beverage Bottles (with deposit)	69%	19%	88%	<1%	<1%	2%
PET Bottles, Jugs, and Jars (without deposit)	60%	27%	87%	<1%	<1%	3%
PET Clamshells, Tubs and Trays	17%	37%	54%	7%	10%	19%
PET Cups	8%	44%	52%	6%	11%	20%
HDPE Bottles, Jugs, and Jars	60%	27%	87%	<1%	<1%	3%

LDPE Bottles, Jugs, and Jars	27%	43%	70%	1%	4%	15%
LDPE and LLDPE Containers	21%	36%	57%	5%	8%	21%
PP Bottles, Jugs, and Jars	29%	43%	72%	1%	3%	14%
PP Tubs and other Containers	26%	33%	59%	5%	7%	19%
Rigid PS Containers	12%	33%	45%	9%	12%	24%
Glass Beverage Bottles (with deposit)	76%	<1%	76%	1%	3%	11%
Glass Containers (without deposit)	73%	<1%	74%	1%	4%	12%
Corrugated Boxes	87%	1%	88%	<1%	1%	<1%
Paperboard Boxes	71%	13%	84%	2%	3%	2%
Aluminum Beverage Cans (with Deposit)	84%	6%	90%	<1%	<1%	1%
Aluminum Beverage Cans (Without Deposit)	78%	11%	89%	<1%	<1%	1%
Aluminum Aerosol Containers	29%	33%	62%	11%	7%	10%
Aluminum Food Cans	15%	60%	75%	4%	10%	3%
Aluminum Foil Pans, and Trays	30%	7%	37%	2%	31%	20%
Aluminum Foil	33%	4%	37%	2%	31%	20%
Steel Food Cans	81%	6%	87%	1%	1%	1%
Steel Aerosol Containers	30%	31%	61%	11%	8%	10%

Access to recycling programs trended down across all of the packaging format categories studied in both 2016 and 2021 with conclusive findings. Refer to the full 2015-2016 Centralized Study on Availability of Recycling report for more detail on historic availability of recycling program rates for specific packaging formats.

Methodology Detail

This study's goal was to assess what materials and items recycling programs intend for residents to enter into the recycling system. The methodology used to determine this consisted of third-party review and categorization of program guidance provided to residents. Based on the prevalence of acceptance of each of the study material categories, the *availability of recycling programs* for each category, expressed as a percentage of the total US population, was estimated.

Summary of communities and programs surveyed

The project team selected two samples of recycling programs for research.

- The first group consisted of a comprehensive, non-random census of recycling programs representing the largest communities in each state. This group is used to provide direct coverage of at least 50% of the population of each state and the US as a whole (focusing on the largest recycling programs in each state, approximately 1,400 communities with a population over 4,000).
- The second group consisted of a random sample of programs representing approximately 500 smaller communities. The community database was stratified so that the sample included at least some representation from each state, but was otherwise randomly drawn. The aim of this stratification was to fully capture the variation in recycling policies, requirements, and materials banned from landfill disposal across state lines.
- By combining data from these two groups, the study was geographically inclusive and represented a range of community types, including incorporated, unincorporated, rural, suburban, and urban communities. The direct coverage of larger communities gave a smaller margin of error for the study as a whole, after incorporating this data with the results from the random sample.

Both the random and non-random samples were drawn from a custom data set of over 8,000 recycling programs and 41,000 “geographies” as defined by the US Census Bureau. These geographies correspond to the local governments in each state that provide recycling services, taking into account that the relevant geographic unit (e.g. city, county, town, township, village, or unincorporated community) tends to vary from state to state. Each recycling program in the database was related to one or more geographies; for example, a county-wide recycling program corresponded with all the geographies in that county, while a single-city recycling program corresponded with that city only. Herein, these geographies are also referred to in shorthand as communities.

The lists of geographies in each state were taken from the US 2010 Decennial Census, which is the most recent national data set with comprehensive data on all geographies in the study. For each geography, demographic data on households and population was also sourced from the 2010 Decennial Census. In the states where the Census “Place summary level” is used (corresponding to incorporated cities, towns, and unincorporated communities), the population in the unincorporated county area that lies outside of the municipal boundaries is not included in the Census data by default. Therefore, additional geographies have been constructed to encompass the remainder of each county that lies outside of the boundaries of the defined places. The population in these remainders is equal to the total population of the county less the population contained in the defined places, or parts of defined places, within the county.

Since recycling services often differ for residents of single-family versus multi-family housing, data was also obtained from the US Census American Community Survey (ACS)’s 2014 5-year estimates on the percent of each community’s population in single family homes, 2-4 unit structures, and structures with 5 or more units. For smaller geographies where this data was unavailable, percentages from the county level were applied. The definition of a “single-family home” can vary for the purposes of recycling service provisions and “single-family” programs typically include structures of 2-4 units as well, and in some cases up to 6- or 8-unit structures. For this reason, it was part of the study’s research process to check how each recycling program defined multi-family units, their inclusion in the recycling program, and the type of service provided, if any. The total population served by the program was then estimated from the ACS data on the breakdown of housing units. Programs that did not specify the type of unit serviced were assumed to include permanent 1, 2, 3, and 4-unit structures. Residents housed in mobile homes, vans, etc., were not assumed to be included in the recycling program unless specified.

Research process

Initial Research

The research method for this study consisted of third-party verification in which the research team of 10 researchers independently reviewed public-facing recycling program information and materials and evaluated them for details on the program and items accepted. Data collection and coding was reviewed within the team for consistency and clarity throughout the data collection process. This method of data gathering was selected over a survey method because it is accurate, transparent, and effective in obtaining data without potential low response rates. In addition, it yields findings that are consistent with what residents seeking information about their local program would find.

For each community in the sample, project staff conducted a web search for recycling program information provided by the local unit of government on their official web page or other resource, typically as directed by the community. Based on the guidance available to residents, the project staff recorded information on the recycling program’s characteristics and the items accepted into a custom project database. Data sources including screenshots and URLs of web data sources were documented to enable data validation and future program updates. The information was coded according to the rules and assumptions described below (see *Framework for Determining Availability of Recycling*). All data entered by project staff were reviewed on an ongoing basis by the project managers to resolve questions and spot-check for accuracy.

The data collection was done between October 2020 and March 2021, and thus the study findings are representative of that time period, while recognizing that programs and service availability in a given community are subject to change at any time. This study occurred during a period impacted by the COVID-19 pandemic. For programs temporarily suspended due to the pandemic, data on the materials accepted by the program prior to its suspension was collected, under the assumption that the program would eventually resume. Where service changes were permanent, or unclear whether they were, the program was noted as no longer available.

Data Collection and Determination of Program Availability

The Project Team used the following criteria and assumptions to evaluate the availability of recycling services and translate the information provided by each community into the defined study variables.

- **Curbside Recycling:** Curbside recycling services available at the place of residence were characterized based on the type of service provider (e.g. private subscription versus organized collection by a municipality or its contractor).
 - Curbside recycling services were also characterized by whether they are made available solely to residents of single-family dwellings, or available to some or all residents of multi-family dwellings.
 - Where services were available to multi-family residents, it was noted whether the program was available to all multi-family residents or only to those in structures with less than a given number of units. Where the program did not specify a limit, it was assumed to be provided to single-family dwellings and multi-family dwellings with four or fewer units in the structure; in the US, services to multi-family dwellings with more than four units are typically considered commercial recycling and performed by the private sector.
 - Programs were also coded to indicate where multi-family services were provided via a separate curbside or on-premise program, distinct from single-family services.
- **Drop-Off Recycling:** Drop-off services available to residents were identified and characterized based on information provided to residents on the program website.
 - All residents who live in a municipality operating or providing a drop-off, or where a drop-off open to the general public is located within the municipality limits, were considered to have **drop-off recycling** available. Residents living outside the community where the drop-off is located were considered to have drop-off recycling available if their own municipality, county, or other local government directs them to that drop-off location as the appropriate recycling outlet.
 - The study did not include research on private drop-offs specific to one type of material (e.g. Store Drop-Off for polyethylene bags and film, or manufacturer drop-off locations for foam polystyrene).
 - The study considered all residents of states with beverage container deposit systems to have drop-off access available for deposit-eligible containers. The results of this analysis are shown separately from those for non-deposit containers. The results for deposit containers include both access to regular curbside and drop-off recycling for

the category to which the container belongs, as well as access provided only through the deposit return system.

Data Analysis

At the conclusion of the data collection period all data were exported to Excel for analysis. The Project Team used statistical extrapolation to calculate the rate of availability of recycling for each commodity included in the study and to describe the level of confidence in these results. Results from the census of large programs were applied directly to the population included in the large program group. Results from the random sample of small communities were extrapolated to the remaining population not covered by the direct census. The two sets of results were combined based on the percentage of total US population that each represented.

Recycling Program Assessment Criteria

Framework for determining “availability of recycling” for specific materials

The methodology included development of a standardized framework for evaluating how a recycling program describes its acceptance of specific materials. Identified materials were rated based on how explicitly that item is included or excluded from the program’s descriptive guidelines. This system was used to account for some of the variation in how recyclables are described by public programs and to reduce the variation in individual interpretation by researchers as a factor in the study.

The following ratings were defined to determine whether each item in the study was accepted or prohibited in the particular recycling program, and whether the program includes the item implicitly or explicitly:

- **Explicitly accepted** – characterizes or pictures the item as accepted into recycling program.
- **Implicitly accepted** - proxy item (similar use or material) as accepted into recycling program.
- **Unclear or contradictory** information.
- **Implicitly prohibited** - proxy item (similar use or material) is characterized as prohibited in recycling program; or program excludes item but does not explicitly mention as prohibited.
- **Explicitly prohibited** - characterizes or pictures the item as prohibited in the recycling program.

Examples of language that would result in each rating, by study material, is shown in the matrix below. Note that these are examples, but not requirements for program wordings, since not all programs use the same terms to describe the study materials. The project team used the matrix as a guidance document, but additional interpretation was necessarily required.

The project team rated the resident guidance language of each recycling program to characterize its acceptance/exclusion of the materials in both recycling guidelines (such as images, lists, or PDF flyers) and lookup tools/apps/waste wizards (such as ReCollect or Recycle Coach) where applicable. Where both types of guidance were found, the two items were scored separately and then combined into a single rating in the data analysis process. Both of these data sources were weighted equally except in cases where the program indicated one source was the most definitive.

These individual ratings were then translated to a determination of “availability of recycling” based on the level of explicit and implicit acceptance for each study material. Where a study material was found to be explicitly accepted in programs serving at least 10% of the total US population, this was considered to be evidence that implicit acceptance of the item should also be considered availability. For study materials that were not found to have this level of explicit acceptance, the study does not consider that there is sufficient certainty around whether the material is intended to be entered into the recycling system, and therefore these materials are considered to have inconclusive findings.⁴

Statistical analysis

The study combined a direct census approach for over half the US population with a stratified random sample approach for the remainder. For the combined total population, the following procedure was used to calculate a margin of error for the study’s findings. The standard error of proportion was calculated for the random sample using the equation where p is the sample proportion and n is the sample size. Next, a z-score was calculated to correspond to a 95% confidence interval (CI), meaning that there is a 95% probability that repeated random samples would result in findings within the margin of error identified. The margin of error for the small random sample is equal to: $z\text{-score} * \text{standard error of proportion}$. This margin of error was applied to the population group extrapolated from the random sample, thus identifying an upper and lower bound of the population in this group with availability of recycling programs. Finally, the ratio of this band of uncertainty compared to the total population was calculated to determine a margin of error for the entire US population for each of the study variables below.

VARIABLE	MARGIN OF ERROR (%) CI=95%
<i>Population with Recycling Programs Available (All Programs)</i>	1
<i>Population with Curbside-Only Recycling Programs Available</i>	2
<i>Population with Drop-Off Only Programs Available</i>	2
<i>Population with Both Curbside and Drop-Off Programs Available</i>	1

⁴ Note of clarification added 3/2022: Inconclusive finding as a result category is relevant to the confidence of the accuracy of results presented in this report; it is not indicative of a level of acceptance. “Inconclusive finding” does not determine whether or not a packaging format is under the threshold of acceptance for being considered recyclable; it is a determination that further study is required for the desired level of certainty in the actual acceptance rate. When a packaging format’s finding was inconclusive either further research was conducted to examine if there is a false construct responsible for a lack of clarity in the messaging from recycling programs, or if other sources of credible data should be relied on to assess the acceptance rate of specific package formats.

<i>Population with Recycling Programs Available for Each Material</i>	<i>MARGIN OF ERROR (%) CI = 95%</i>
<i>Glass NonDeposits</i>	<i>1.5</i>
<i>PET Bottle Jug Jar</i>	<i>1.3</i>
<i>HDPE Bottle Jug Jar</i>	<i>1.3</i>
<i>LDPE Bottle Jug Jar</i>	<i>1.5</i>
<i>PP Bottle Jug Jar</i>	<i>1.5</i>
<i>PET Cups</i>	<i>1.6</i>
<i>LDPE Tubs</i>	<i>1.5</i>
<i>PP Tubs</i>	<i>1.5</i>
<i>PET Containers</i>	<i>1.6</i>
<i>Rigid PS Containers</i>	<i>1.6</i>
<i>Paperboard Cartons</i>	<i>1.4</i>
<i>Corrugated Board Boxes</i>	<i>1.3</i>
<i>Steel Food Cans</i>	<i>1.3</i>
<i>Steel Aerosol Cans</i>	<i>1.7</i>
<i>Aluminum Beverage Cans</i>	<i>1.3</i>
<i>Aluminum Aerosol Cans</i>	<i>1.7</i>
<i>Aluminum Food Cans</i>	<i>1.5</i>
<i>Aluminum Foil Trays and Containers</i>	<i>1.0</i>
<i>Aluminum Foil</i>	<i>1.0</i>
<i>Glass Containers w/ Deposit</i>	<i>1.5</i>
<i>PET Deposit Containers</i>	<i>1.2</i>
<i>Aluminum Deposit Containers</i>	<i>1.2</i>

Comparison with 2015-16 Centralized Study on Availability of Recycling

This study uses a comparable methodology to the SPC's previous 2015-16 *Centralized Study on Availability of Recycling*. Updates and changes to the methodology from the previous study are listed below.

- This study has established a quantitative threshold for when to combine “explicit” and “implicit” acceptance of a material into a combined measurement of availability of recycling; it requires that 10% of the US population served by programs explicitly accepting a study material. In the previous study, this decision was made on a material-by-material basis with input from the SPC, study sponsors, and the project team.
- This study considers residents of multi-family dwellings to have recycling programs available to them only when curbside or drop-off recycling options provided to these residents could be definitively documented. Therefore, the measurements of recycling availability *do not* include residents of multi-family dwellings where service is provided only via private commercial recycling services, either on a voluntary basis or due to statutory mandates. The previous study, in contrast, also included multi-family residents in areas where commercial recycling services were available from area hauling companies.
- Unlike the 2015-16 study, this study does not distinguish between **municipal or contracted** curbside recycling programs that are opt-in (free and fee-based), versus automatic/universal. While this continues to be an important aspect to consider in understanding recycling programs, it was not a focus of the current research.
- This study has the same criteria for what counts as implicit acceptance at a conceptual level, but there have been some specific clarifications for particular packaging categories in the 2021-21 study. See the appendix for further detail.

Directions for further research

Some significant questions for further research are outside the boundaries of this study; for example, the level of participation in recycling programs, ease or convenience of access to recycling, whether availability of recycling services is equivalent to those for trash, and more. There are opportunities for future research and harmonization initiatives that improve the understanding of the disconnects between what is communicated by recycling programs and what is actually sorted and sold by the MRFs to create better alignment. Furthermore, research into the sortation, reprocessing and end market phases of the recycling system is not within the scope of this study, but ongoing learning about these topics will be valuable to the body of knowledge around the current state of US recycling systems.

Appendix

US Population's Access to Recycling Programs by Program Type	
	Percent of US population
Total Access to Curbside Recycling Programs	59.5%
Curbside recycling program only (including subscription curbside in areas where this is the method of single-family service provision)	34.1%
Both curbside and drop-off recycling programs	25.4%
Total Access to Drop-off Recycling Programs	57.3%
Drop-off recycling program only	31.9%
Both curbside and drop-off recycling programs	25.4%
No recycling program available	8.6%

Inconclusive findings

The following packaging categories were studied, but the findings were inconclusive, and thus not included in this report. See prior section (“Framework for determining “availability of recycling” for specific materials”) for an explanation of what makes findings in this study inconclusive.

- PP Cups⁵
- PP coffee pods
- HDPE tubes
- Frozen food boxes
- Molded fiber protective packaging
- Molded fiber food packaging and bowls
- Molded fiber non-food packaging and trays

⁵ Note of clarification added 3/2022: additional research using both expert interview and bale audits was conducted in 2021 to examine acceptance of PP Cups, Tubes, and Containers. The findings of this research support the hypothesis that a false construct was responsible for a lack of clarity around acceptance of PP Cups in the 2020-21 Centralized Study of Availability of Recycling. The executive summary of the report can be found [here](#).

- Paper cups
- Paper ice cream tubs and cartons
- All paper spiral-wound canisters
- Metal-bottomed spiral-wound canisters

For a discussion of how the How2Recycle program interprets inconclusive results, visit [this article](#).

Matrix of language examples used to rate program instructions

The following matrix was used by researchers to guide the evaluation of recycling program communications. Slight changes to packaging format terminology between the matrix and the body of the report have been made for clarity.

	Explicit Acceptance	Implicit Acceptance	Unclear or Contradictory	Implicit Prohibition	Explicit Prohibition
Glass packaging					
Glass packaging	<ul style="list-style-type: none"> - Glass bottles and jars - All glass containers - Glass beer bottles - Glass soda bottles - All glass 	<ul style="list-style-type: none"> - All beverage containers - All bottles and/or jars - Glass containers 	<ul style="list-style-type: none"> - Item or similar items not mentioned or pictured - Contradictory guidance in different places 	Detailed material list that does not include glass containers in the glass category or does not include glass at all	<ul style="list-style-type: none"> - No glass - No bottles
Plastic bottle/jugs/jars					
PET bottles, jugs & jars	<ul style="list-style-type: none"> - #1/PET plastic bottles, jugs, or jars - #1/PET plastic containers - #1/PET water and/or soda bottles - All bottles, jugs, jars, or containers 	<ul style="list-style-type: none"> - #1/PET plastics - Plastic - Rigid plastic - Plastics 1-7 - Bottles, jugs, or jars - Plastic bottles, jugs, jars, or containers - Water and/or soda bottles 	Not mentioned; All recyclables; non-specific lists like "paper, cardboard, and other recyclables"	Detailed plastic list that does not include plastic bottles	<ul style="list-style-type: none"> - No plastic - No bottles - No plastic bottles - No #1 plastic - No plastic containers
HDPE bottles, jugs & jars	<ul style="list-style-type: none"> - #2/HDPE plastic bottles, jugs, or jars - #2/HDPE plastic containers - #2/HDPE milk jugs - #2/HDPE detergent bottles - All bottles, jugs, jars, or containers 	<ul style="list-style-type: none"> - #2/HDPE plastics - Plastic - Rigid plastic - Plastics 1-7 - Bottles, jugs, or jars - Plastic bottles, jugs, jars, or containers - Milk jugs - Detergent bottles 	Not mentioned; All recyclables; non-specific lists like "paper, cardboard, and other recyclables"	Detailed plastic list that does not include plastic bottles	<ul style="list-style-type: none"> - No plastic - No bottles - No plastic bottles - No #2 plastic - No plastic containers

LDPE/LLDPE bottles, jugs & jars	<ul style="list-style-type: none"> - #4/LDPE plastic bottles, jugs, or jars - #4/LDPE plastic containers - All bottles, jugs, jars, or containers 	<ul style="list-style-type: none"> - #4/LDPE plastics - Plastic - Rigid plastic - Plastics 1-7 - Bottles, jugs, or jars - Plastic bottles, jugs, jars, or containers 	Not mentioned; All recyclables; non-specific lists like "paper, cardboard, and other recyclables"	Detailed plastic list that does not include plastic bottles	<ul style="list-style-type: none"> - No plastic - No bottles - No plastic bottles - No #4 plastic - No plastic containers
PET non-bottle rigids					
PET packaging, trays, clamshells	<ul style="list-style-type: none"> - #1/PET plastic trays, clamshells, and/or containers - Clear plastic containers (berry baskets, produce baskets, etc) 	<ul style="list-style-type: none"> - #1/PET plastics - All plastic - Rigid plastic - Plastic containers, trays, and/or clamshells - Plastic 1-7 - Plastic take-out container 	<ul style="list-style-type: none"> - Item or similar items not mentioned or pictured - Contradictory guidance in different places 	a detailed list that does not include plastic containers	<ul style="list-style-type: none"> - No non-bottle plastic - No plastic - No #1 plastic - No rigid plastic - No plastic tubs - No plastic containers, trays, or clamshells
PET cups	<ul style="list-style-type: none"> - #1/PET cups - Clear plastic cups 	<ul style="list-style-type: none"> - #1/PET plastics - All plastic - Rigid plastic - Plastic containers - Plastics 1-7 - Plastic cups 	<ul style="list-style-type: none"> - Item or similar items not mentioned or pictured - Contradictory guidance in different places 	<ul style="list-style-type: none"> a detailed list that does not include plastic containers - no foodservice 	<ul style="list-style-type: none"> - No non-bottle plastic - No plastic - No #1 plastic - No rigid plastic - No plastic cups - No plastic containers
PP Packaging					
PP bottles, jugs & jars	<ul style="list-style-type: none"> - #5/PP plastic bottles, jugs, or jars - #5/PP plastic packaging - All bottles, jugs, jars, or containers 	<ul style="list-style-type: none"> - #5/PP plastics - Plastic - Rigid plastic - Plastics 1-7 - Bottles, jugs, or jars - Plastic bottles, jugs, jars, or containers 	Not mentioned; All recyclables; non-specific lists like "paper, cardboard, and other recyclables"	Detailed plastic list that does not include plastic bottles	<ul style="list-style-type: none"> - No plastic - No bottles - No plastic bottles - No #5 plastic - No plastic containers
PP cups	<ul style="list-style-type: none"> - #5/PP plastic cups - Clear plastic cups 	<ul style="list-style-type: none"> - #5/PP plastics - All plastic - Rigid plastic - Plastic containers - Plastics 1-7 - Plastic cups 	<ul style="list-style-type: none"> - Item or similar items not mentioned or pictured - Contradictory guidance in different places 	<ul style="list-style-type: none"> a detailed list that does not include plastic containers - no foodservice 	<ul style="list-style-type: none"> - No non-bottle plastic - No plastic - No #5 plastic - No rigid plastic - No plastic cups - No plastic containers
PP tubs and containers	<ul style="list-style-type: none"> - #5/PP tubs and/or containers - All plastic containers - All plastic tubs - Yogurt, margarine, salsa, etc tubs - Dairy tubs 	<ul style="list-style-type: none"> - #5/PP plastics - All plastic - Rigid plastic - Plastic containers - Plastic 1-7 - Plastic tubs 	<ul style="list-style-type: none"> - Item or similar items not mentioned or pictured - Contradictory guidance in different places 	a detailed list that does not include plastic containers	<ul style="list-style-type: none"> - No non-bottle plastic - No plastic - No #5 plastic - No rigid plastic - No plastic tubs - No plastic containers

Other non-bottle rigid plastic packaging					
LDPE/LLDPE tubs	<ul style="list-style-type: none"> - #4/LDPE tubs and/or containers - All plastic containers - All plastic tubs 	<ul style="list-style-type: none"> - #4/LDPE plastics - All plastic - Rigid plastic - Plastic containers - Plastic 1-7 - Plastic tubs 	Not mentioned; All recyclables; non-specific lists like "paper, cardboard, and other recyclables"	Detailed plastic list that does not include plastic containers	<ul style="list-style-type: none"> - No non-bottle plastic - No plastic - No #4 plastic - No rigid plastic - No plastic tubs - No plastic containers
Rigid PS packaging	<ul style="list-style-type: none"> - #6/PS plastic containers - Yogurt containers 	<ul style="list-style-type: none"> - #6 plastic - All plastic - Rigid plastic - Plastic containers - Plastic 1-7 	Not mentioned; All recyclables; non-specific lists like "paper, cardboard, and other recyclables"	Detailed plastic list that does not include plastic containers	<ul style="list-style-type: none"> - No plastic - No plastic containers - No #6 plastic - No rigid plastic - No plastic tubs - No plastic containers - No yogurt containers
Boxes and cartons					
Corrugated cardboard	<ul style="list-style-type: none"> - Cardboard boxes - Corrugated cardboard - Brown cardboard - All cardboard - Shipping boxes - Boxes 	<ul style="list-style-type: none"> - All fiber or paper products - Paper 	<ul style="list-style-type: none"> - Item or similar items not mentioned or pictured - Contradictory guidance in different places 	- Detailed material list that does not include corrugated cardboard	<ul style="list-style-type: none"> - No cardboard - No boxes - No paper/fiber products
Boxboard cartons	<ul style="list-style-type: none"> - Cardboard boxes - Boxboard - Paperboard - Cereal boxes, cracker boxes, pasta boxes, or shoe boxes 	<ul style="list-style-type: none"> - Paper products - Food boxes 	<ul style="list-style-type: none"> - Item or similar items not mentioned or pictured - Contradictory guidance in different places 	Detailed material list that does not include boxboard cartons in the fiber category	<ul style="list-style-type: none"> - No paperboard - No non-corrugated cardboard - No boxboard - No cardboard - No boxes - No paper/fiber products
Aluminum packaging and foil packaging					
Aluminum beverage cans	<ul style="list-style-type: none"> - Aluminum cans - Aluminum beverage cans - Aluminum drink cans 	<ul style="list-style-type: none"> - Beverage containers - Cans - Metal - Metal cans - Containers - Aluminum 	Not mentioned; All recyclables; non-specific lists like "paper, cardboard, and other recyclables"	Detailed material list that does not mention aluminum beverage cans in the metal category	<ul style="list-style-type: none"> - No cans - No aluminum cans - No metal

Aluminum aerosol containers	<ul style="list-style-type: none"> - Aerosol cans - Aluminum aerosol cans - Cooking oil spray cans - Spray cans - Specific examples (e.g. empty whipped cream cans, empty spray paint cans) 	<ul style="list-style-type: none"> - Aluminum cans - Metal - Aluminum 	Not mentioned; All recyclables; non-specific lists	Food & drink cans only	- No aerosol cans
Aluminum non-UBC rigid containers e.g. cat food cans	<ul style="list-style-type: none"> - Cat food cans - Sardine cans - Pet food cans 	<ul style="list-style-type: none"> - Metal cans - Aluminum - Metal - Aluminum cans 	<ul style="list-style-type: none"> - Item or similar items not mentioned or pictured - Contradictory guidance in different places 	<ul style="list-style-type: none"> - Detailed list of types of metal that are and are not accepted that does not include this item - Aluminum beverage cans are the only accepted type of aluminum mentioned (e.g. "soda cans, beer cans") 	<ul style="list-style-type: none"> - No aluminum - No metal - Beverage cans only
Aluminum rigid foil food pans/trays	<ul style="list-style-type: none"> - Aluminum trays - Aluminum pie tins - Aluminum baking tins - Foil trays - Aluminum foil containers 	<ul style="list-style-type: none"> - Aluminum foil wrap - Aluminum - Metal 	<ul style="list-style-type: none"> - Item or similar items not mentioned or pictured - Contradictory guidance in different places 	<ul style="list-style-type: none"> - Detailed list of types of metal that are and are not accepted that does not include this item - Aluminum beverage cans are the only accepted type of aluminum mentioned (e.g. "soda cans, beer cans") 	<ul style="list-style-type: none"> - No aluminum foil - No foil - No aluminum besides cans
Aluminum foil	<ul style="list-style-type: none"> - Aluminum foil wrap - Aluminum foil - Tinfoil - Foil 	<ul style="list-style-type: none"> - Aluminum - Metal - Aluminum foil pans/trays 	<ul style="list-style-type: none"> - Item or similar items not mentioned or pictured - Contradictory guidance in different places 	<ul style="list-style-type: none"> - Detailed list of types of metal that are and are not accepted that does not include this item - Aluminum beverage cans are the only accepted type of aluminum mentioned (e.g. "soda cans, beer cans") 	<ul style="list-style-type: none"> - No aluminum foil - No foil - No aluminum besides cans
Steel packaging					
Steel cans	<ul style="list-style-type: none"> - Metal cans - Bi-metal cans - Steel cans - Soup cans - Tin cans - Fruit and vegetable cans 	<ul style="list-style-type: none"> - Metal food and beverage cans - Ferrous metals - Metal - Steel - Cans 	Not mentioned; non-specific list	Detailed material list that does not mention steel food cans in the metal category	<ul style="list-style-type: none"> - No metal - No cans - No steel cans
Steel aerosol containers	<ul style="list-style-type: none"> - Aerosol cans - Steel aerosol cans - Spray cans - Specific examples (e.g. empty shaving cream cans) 	<ul style="list-style-type: none"> - Tin cans - Steel cans - Metal - Steel 	Not mentioned; All recyclables; non-specific lists	Food & drink cans only	- No aerosol cans