CalRecycle

What's in California's Landfills:

Measuring Single-Use Packaging and Plastic Food Service Ware Disposal (2025)

Final Findings Report

December 2025

State of California

Gavin Newsom
Governor

California Environmental Protection Agency

Yana Garcia

Secretary

Department of Resources Recycling and Recovery (CalRecycle)

Zoe Heller
Director

Public Affairs Office
1001 I Street (MS 22-B)
P.O. Box 4025
Sacramento, CA 95812-4025
www.calrecycle.ca.gov/Publications/
1-800-RECYCLE (California only) or (916) 341-6300

Table of Contents

Executive Summary and Background 1
Table E-1. Estimated Disposal of Covered Material, By Material Class 2
Study Comparison Limitations 3
Overview of Changes 4
Main Report 4
Appendix 1 4
Appendix 2 4
Data Records Available Pursuant to the California Public Records Act 4
Methods 5
Overview 5
Estimating Composition of Landfilled Material in California 5
Landfill Selection 5
Sorting Categories 8
Vehicle Surveys 15
Sample Collection and Sorting 15
Additional Analysis Performed by Contractor Staff 15
Data Considerations 17
Additional Analysis Performed by CalRecycle 17
Summary of Findings 19
Estimates of Statewide Disposal of All Material 20
Table 4. Estimates of Statewide Landfill Disposal from each Sector 20
Estimates of Statewide Disposal of Covered Material 21
Table 5-A. Estimates of Statewide Disposal of Material Classes in 2024 21
Table 5-B. Estimates of Disposal by Material Class and Sector in 2024 22
Table 6. Estimates of Statewide Disposal by Covered Material Category in 2024 23
Additional Analysis: Spectroscopic Analysis of Hard-to-Identify Resins 29
Resin Composition Among Plastic Samples 29
Glossary of Terms 31
Abbreviations and Acronyms 34
Bibliography 35

Executive Summary and Background

Lawmakers enacted the Plastic Pollution Prevention and Packaging Producer Responsibility Act (Senate Bill 54, Allen, Chapter 75, Statutes of 2022) (the Act), establishing an extended producer responsibility (EPR) program to reduce single-use packaging and plastic single-use food service ware (covered material) in California. The Act requires all covered material to be recyclable or compostable, while also setting specific source reduction and recycling rate requirements for plastic covered material.

The Act requires the California Department of Resources Recycling and Recovery (CalRecycle) to conduct a material characterization study of covered material categories and determine the approximate amount of covered material disposed of in California landfills (Public Resources Code (PRC) section 42061(a)(2)-(3)).

In 2025, CalRecycle completed its first material characterization study to inform a baseline understanding and initial benchmark of covered materials disposed of in California landfills. CalRecycle contracted with Cascadia Consulting Group (Cascadia) to conduct the statewide study to characterize and measure the amount of covered material landfilled in California. Fieldwork, including hand-sorting samples at California landfills, took place from February through April 2025. CalRecycle and Cascadia designed a study that used representative, cost-effective sampling and analysis methods to gather data while minimizing disruption to facility operators. The material sorting list is based on the covered material categories list CalRecycle published on December 31, 2024. CalRecycle published the material characterization study preliminary findings on June 30, 2025 (DRRR-2025-1755). CalRecycle published revised preliminary findings from this study on September 30, 2025 (DRRR-2025-1757). The study presents estimates of covered materials disposed of and subject to the Act.

This final report provides estimates of the amount of covered material landfilled in California, by weight (tons) and as a proportion of total material landfilled statewide. It also incorporates statistical analysis CalRecycle conducted on the data.

This study estimates that 8,457,149 tons of covered material were disposed of in California in 2024, representing about 21.1% of the state's total landfill disposal. Table E-1 shows additional details on the estimated disposal of covered material categories (CMCs) by material class.

For this type of study, it is not possible to differentiate between certain types of items that may or may not be a covered material. This requires a case-by-case consideration outside the material characterization study context. To ensure consistent categorization of materials, sorting rules were established to inform the determinations of what category to sort disposed items into.

This report also presents methodology and analysis of:

- Resin types of plastic covered material that could not be readily identified in the field.
- Estimates of the weight of covered material are discarded together with food or other goods for certain covered materials.
- Weight-to-volume conversion factors for certain covered material.

The Act requires CalRecycle to revise the study in 2028, 2030, 2032, and every four years thereafter. CalRecycle will continue refining its methods and measure and quantify the disposal of covered materials under the Act.

For a brief overview of key tables and data, see the Summary of Findings section.

Table E-1. Estimated Disposal of Covered Material, By Material Class

This table shows the estimated annual disposal tonnage (column 2) and the percentage of total statewide material disposal (column 3) for covered material within each material class. Column 4 shows the covered material category (CMC) within each material class estimated to have the largest amount of material disposed of. Because item size and weight can vary within and between CMCs, some categories may include larger and heavier items that directly affect the estimated reported tonnage.

Material Class	Annual Disposal Estimate of Covered Material (tons)	Percentage of Total Estimated Covered Material Disposal	Highest Tonnage Covered Material Category in Material Class
Paper and Fiber	3,929,375	46.5%	Cardboard
Plastic	3,123,797	36.9%	Flexible and Film Items
Wood and Other Organic Materials*	811,999	9.6%	All Untreated Forms
Metal	432,265	5.1%	Non-aerosol Containers
Glass	154,149	1.8%	Bottles and Jars
Ceramic	5,564	0.1%	Small - Two or more sides measuring 2" or less

*Wooden pallets make up a significant portion of this category and likely represent the largest share by weight due to their widespread use in shipping and logistics. Nationally, pallets are often reused and repaired; however, data is not available on the characteristics and circumstances of this reuse. Under the Act, individual wooden pallets may be considered reusable, and therefore not covered material, if the requirements of PRC section 42041(af) are met.

For this type of study, it was not possible to differentiate between single-use and reused wooden pallets because that determination requires case-by-case consideration of facts outside the material characterization context. Due to this limitation, all wooden pallets were included in the analysis; given the study only considered wooden pallets that had been disposed of and could not possibly have been destined for additional uses.

For more detailed findings, refer to the Summary of Findings section. The findings presented are specific to covered material under the Act and do not provide granular information about other materials. Final data on other materials are included in Appendix 1.

Study Comparison Limitations

PRC section 42061(a)(2)-(3) requires CalRecycle to conduct a material characterization study to determine the amount of covered material disposed of in California landfills. This report focuses specifically on covered material sent for disposal and does not estimate overall statewide disposal. As such, it cannot be directly compared to previous studies.

CalRecycle developed the scope and design of this study to meet the Act's requirements. Because the findings are specific to the Act, results are not directly comparable to prior CalRecycle waste and material characterization studies. While sampling methodology may be consistent across studies, the material sorting categories for this study align with the December 31, 2024, covered material categories list. In some cases, individual material types from one study may have been grouped differently or categorized under broader or alternative classifications. As a result, previous studies cannot be directly compared on a one-to-one basis.

The statistical analysis methodology presented in this report differs from prior studies published by CalRecycle. For this study, CalRecycle used the Dirichlet distribution frequentist method to analyze the data. This method applies simulations to compositional data and small sample data sets. While CalRecycle used other statistical analyses for previous waste and material characterization studies, those methods are not suitable for this study because of the distribution of the data. The application of American Society for Testing and Materials (ASTM) D5231-92 (2024) does not provide guidance on the type of statistical extrapolation or modeling required for the analysis presented in this report. The ASTM standard is designed for direct measurement and reporting of waste composition from representative samples, without provisions for advanced statistical modeling or simulation-based analysis.

The Dirichlet distribution frequentist method is appropriate for analyzing compositional data and accounts for samples that may have been reported as zero at the time of sampling. While a specific material may have not been detected in a selected sample, a reported zero indicates concentrations below analytical detection limits and does not represent the complete absence of the material in the waste stream. Given the unique data set, along with rarity and low concentrations of certain materials in the waste stream, use of the Dirichlet distribution frequentist method improved the quality and representativeness of the data presented in these final findings.

Overview of Changes

This section summarizes how the final report updates the revised preliminary findings report (DRRR-2025-1757) published September 30, 2025.

Main Report

- Added text addressing wood and other organics covered material to Table E-1.
- Added introductory text to Table E-1 describing the presence and weight of material in the waste stream.
- Added description comparing statistical analysis applied to this study to previous CalRecycle waste and material characterization studies.
- Minor clarifying text.

Appendix 1

- Reorganized columns in Section 1.4. Table A5.
- Added minor clarifying text.
- Added text to Section 2.2 describing data and analysis assumptions.
- Added subsection headers and introductory text to Section 2.2.
- Added text addressing wood and other organics covered material to Tables A-7A and A-8.
- Added new tables to Section 2.2, Table A10-A, A10-B, A10-C, and A10-D, presenting results of the depackaging of covered material disposed of with food or nonfood (good) inside.

Appendix 2

- Included public comments received by CalRecycle from June 30, 2025, through November 12, 2025.

Data Records Available Pursuant to the California Public Records Act

Public records related to this report can be requested through the CalRecycle Public Records Portal and include records documenting analysis steps, often as scripts in the R Statistical Program:

- Estimates of statewide disposal, all materials
- Estimates of statewide disposal, covered material
- Percentage composition of each material type within covered material classes
- Composition estimates for material types within sectors

Methods

Overview

To estimate statewide disposal of covered material, two main steps were taken. First, sampling was conducted at 16 landfills across California to estimate the composition of landfilled materials by waste-generating sector. Second, the composition data were extrapolated to estimate statewide disposal using calendar year 2024 data submitted to CalRecycle's Recycling and Disposal Reporting System (RDRS).

A random sampling methodology was used to sample waste from various sectors to develop a waste composition profile for each sector. The four sectors considered in this study included: (1) franchised single-family residential; (2) franchised commercial and multi-family residential; (3) self-hauled; and (4) mixed waste (i.e., material from transfer trailers). Data from each sector was then combined based on their relative contributions to the overall waste stream using RDRS data. This produced statewide estimates of landfilled material by sorted material category.

For all sectors, only deliveries destined for landfill disposal were eligible for sampling, including construction and demolition (C&D) debris. Loads of disaster debris (e.g., storm deadfall and soil), universal waste, material sent for recycling or recovery, biosolids, designated waste, aggregates and soil set aside for beneficial use, alternative daily cover (ADC), and household hazardous waste (HHW) were not sampled and are excluded from the study.

For the purposes of this study and throughout the report "CalRecycle staff" refers to CalRecycle's field team, and "contractor staff" refers to the Cascadia-contracted field team.

The following sections provide additional information about the methodology used in each step. Appendix 1: Detailed Methodology (Section 1: Detailed Methodology) presents more detailed study design and methodology.

Estimating Composition of Landfilled Material in California

To gather the data needed to estimate overall waste composition in the state, samples of waste were collected at California landfills and sorted based on CMCs.

Landfill Selection

To maximize the collection of data representative of California, landfills that account for a higher proportion of the state's waste stream were prioritized for inclusion in the study. Additionally, to capture data across the four sectors, landfills with the largest annual inflow tonnage that received material from the four sectors were also prioritized. Participation by landfills in this study was voluntary. In total, 16 landfill sites participated (Table 1; Figure 1). The study was conducted over two sampling periods. Each period spanned roughly 14 calendar days, with approximately two days of sampling at each

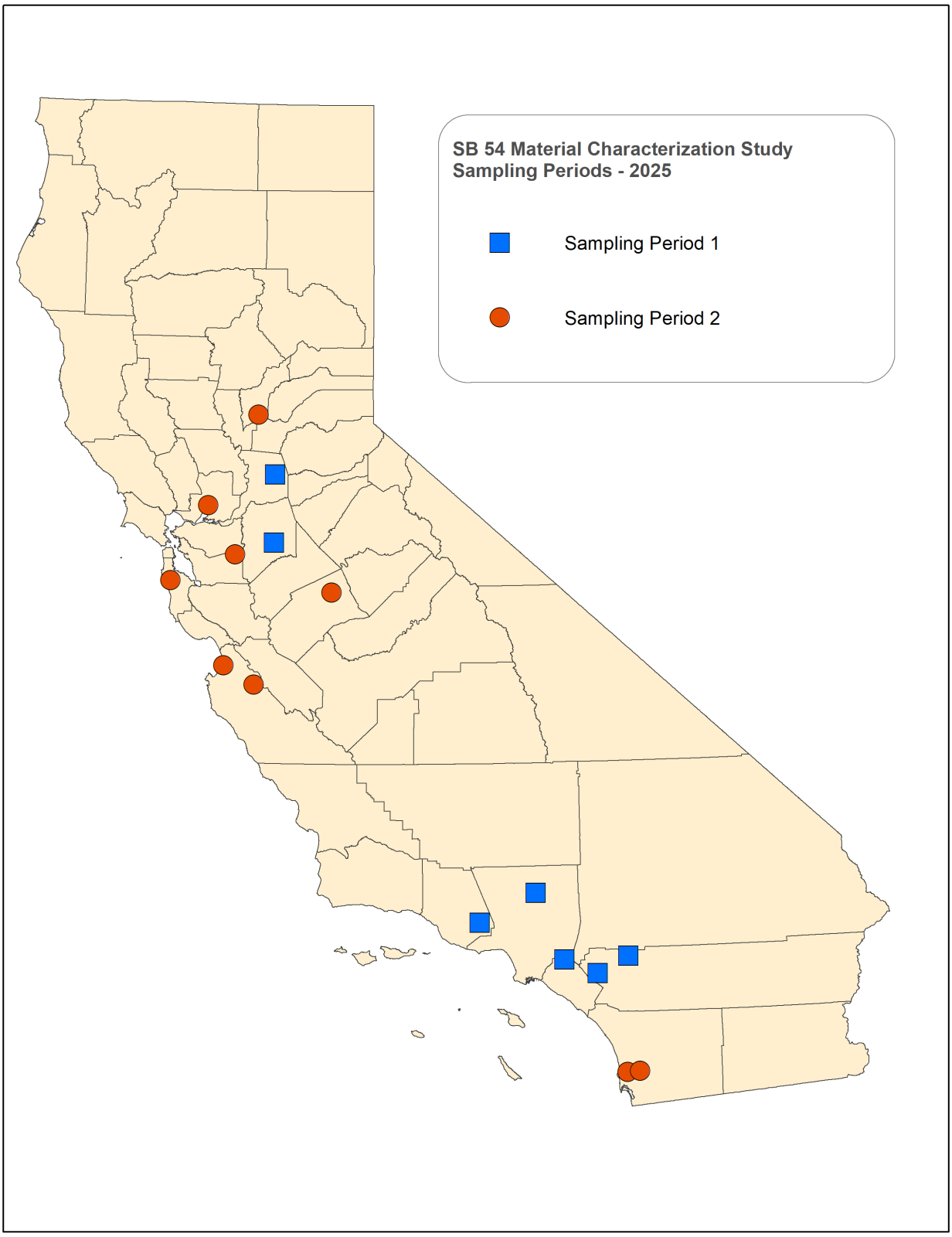
site. Appendix 1: Detailed Methodology (Section 1.2: Facility Selection and Sample Allocation) provides additional details.

Table 1. List of Participating Study Landfills

This table provides the facility name, county where the facility is located, and the CalRecycle Solid Waste Information System (SWIS) number.

Facility Name	County	SWIS Number
Altamont Landfill & Resource Recovery	Alameda	01-AA-0009
Antelope Valley Recycling & Disposal Facility	Los Angeles	19-AA-5624
Badlands Landfill	Riverside	33-AA-0006
Corinda Los Trancos Landfill (Ox Mtn)	San Mateo	41-AA-0002
El Sobrante Landfill	Riverside	33-AA-0217
Forward Landfill	Alameda	39-AA-0015
Highway 59 Landfill	Merced	24-AA-0001
Johnson Canyon Sanitary Landfill	Monterey	27-AA-0005
Kiefer Landfill	Sacramento	34-AA-0001
Monterey Peninsula Landfill	Monterey	27-AA-0010
Olinda Alpha Sanitary Landfill	Orange	30-AB-0035
Potrero Hills Landfill	Solano	48-AA-0075
Recology Ostrom Road Landfill	Yuba	58-AA-0011
Simi Valley Landfill & Recycling Center	Ventura	56-AA-0007
Otay Landfill	San Diego	37-AA-0010
West Miramar Sanitary Landfill	San Diego	37-AA-0020

Figure 1. Map of participating study landfills by sampling period



Sorting Categories

In accordance with the Act, CalRecycle developed covered material categories (CMCs), published July 1, 2024. These categories classify covered material by material type and form. Recyclability and compostability determinations for those categories were added in the December 31, 2024, updated publication. Each CMC is a combination of one material from one of six classes (ceramic, glass, metal, paper and fiber, plastic, or wood or other organic material) and a particular type and form of that material (e.g. CMC Code 24_M4P identifies Class: Metal, Type: Aluminum, and Form: Aerosol Can with a Plastic Component). The categories apply individually to each detachable component of covered material. In addition to the six material classes, one additional material class—miscellaneous—was used for this study. It included a category for covered material discarded with a good still inside (e.g., partially filled bottle of lotion, a meal discarded in a plastic takeout container, or sausages discarded in their wrapper).

To enable identification and sort items based on CMCs, 83 material sorting categories were established. These were based on how materials are found at landfills (e.g., broken or contaminated) and the feasibility of material identification and sorting in the field. During the study, contractor staff sorted each sample into one of the 83 categories from the Material Characterization Study Sorting List (Table 2) to provide material type composition data for each sample. The complete material sorting list, with definitions and examples for each category, is provided in Appendix 1 (Section 1.1, Table A1).

Generally, each of the 83 material sorting categories included only one of the following types of materials:

- covered material (i.e., single-use packaging and single-use plastic food service ware covered under the Act),
- potentially reusable alternatives to covered material (e.g., reusable milk jug), and
- all other material that is not covered under the Act.

Materials not covered under the Act were itemized into either a remainder category according to material class or sorted into the miscellaneous class. Remainder categories served as a catch-all for items, specific to class, that were not covered material. The miscellaneous class contained categories for hazardous materials, small items measuring 2 inches or smaller in at least two dimensions (i.e., mixed residue), and discarded covered material with a good inside.

Material sorting categories that included covered material not predominantly made of plastic were generally a combination of two CMCs—one for that material type without a plastic component and one for the same material type with a plastic component. For example, “Glass Bottles and Jars that are covered material” was a single sorting category but included two CMCs: one for Glass Bottles and Jars with a plastic component (CMC Code 24_G1P) and one for Glass Bottles and Jars without a plastic component (CMC Code 24_G1N). In these scenarios, the combined CMC Code reflected in the material sorting list is a combination of the two CMCs, such as Code 24_G1N/P.

The material types are specifically defined in Appendix 1: Detailed Methodology (Section 1.1: Sorting Categories List and Sorting Guidance, Table A1). Table A1

provides the sorting rules used in the field to determine the inclusion or exclusion of each item in the sorting categories. Additional details on sample sorting and characterization are provided in Appendix 1: Detailed Methodology (Section 1.7: Sample Characterization).

Table 2. Material Characterization Study Sorting List

This table is a complete list of categories used to sort samples for the study. Each sorting category is a combination of material class, material type, and form. The first column in the table is a numeric count. It is not ordered sequentially; instead, it is the same ordering in the CMCs list published December 31, 2024. The second column describes the material class (glass, ceramic, metal, paper and fiber, plastic, wood and other organic materials). The third column describes the material type, and the fourth column describes the form of the covered materials in that CMC. The fifth column, labeled Combined CMC Code, includes the specific code that identifies which CMCs are included within each sorting category. These codes refer to the CMCs list published December 31, 2024, pursuant to the Act. All sorting categories with a corresponding code starting with the "24_" prefix are specific to covered material. Additionally, in the Combined CMC Code column, the alphanumeric material code ends with an "N" and/or a "P" indicating whether the item contains an inseparable plastic component (P) or contains no plastic component (N). An "N/P" indicates that the material form contains two covered material categories, one with and one without inseparable plastic components. Entries in the Combined CMC Code column with the following text mean:

- "Potential reuse": categories for packaging and food service ware that may be reusable or refillable,
- "Mixture": categories in which a covered material was jointly discarded with other material (e.g., food discarded in original packaging), and
- "n/a": remainder categories for materials other than covered material.

The complete material sorting list with definitions and examples for each category is provided in Appendix 1 (Section 1.1, Table A1).

Count	Class	Type	Form	Combined CMC Code
1	Glass	Glass	Bottles and Jars	24_G1N/P
2	Glass	Glass	Other Forms	24_G2N/P
4	Glass	Glass	Small – Two or more sides measuring 2" or less	24_G3N/P
3	Glass	Glass	Potentially Reusable Packaging and Food Service Ware	Potential Reuse
5	Glass	Glass	Remainder/Composite Glass	n/a
6	Ceramic	Ceramic	All Forms	24_C1N/P
8	Ceramic	Ceramic	Small – Two or more sides measuring 2" or less	24_C2N/P
7	Ceramic	Ceramic	Potentially Reusable Packaging and Food Service Ware	Potential Reuse

Count	Class	Type	Form	Combined CMC Code
9	Ceramic	Ceramic	Remainder/Composite Ceramic	n/a
10	Metal	Aluminum	Non-aerosol Containers	24_M1N/P
11	Metal	Aluminum	Foil Sheets	24_M2N/P
12	Metal	Aluminum	Foil Molded Containers	24_M3N/P
13	Metal	Aluminum	Aerosol Cans	24_M4P
14	Metal	Aluminum	Other Forms	24_M5N/P
15	Metal	Tin/Steel/Bimetal	Non-aerosol Containers	24_M6N/P
16	Metal	Tin/Steel/Bimetal	Aerosol Cans	24_M7P
17	Metal	Tin/Steel/Bimetal	Other Forms	24_M8N/P
18	Metal	Other Non-Ferrous	All Other Forms	24_M9N/P
19	Metal	Other Ferrous	All Other Forms	24_M10N/P
21	Metal	Metal	Small – Two or more sides measuring 2” or less	24_M12N/P
20	Metal	Metal	Potentially Reusable Packaging and Food Service Ware	Potential Reuse
22	Metal	Metal	Remainder/Composite Metal	n/a
23	Paper/Fiber	Kraft Paper	All Forms	24_PF1N/P
24	Paper/Fiber	Molded Fiber	All Forms	24_PF14N/P
25	Paper/Fiber	Multi-Material Laminate	Aseptic Cartons	24_PF15P
26	Paper/Fiber	Multi-Material Laminate	Gable-top Cartons	24_PF5P
29	Paper/Fiber	Multi-Material Laminate	Other Forms	24_PF7P
27	Paper/Fiber	OCC (Old Corrugated Cardboard)	Waxed Cardboard	24_PF8N/P
28	Paper/Fiber	OCC	Cardboard	24_PF9N/P
30	Paper/Fiber	Paperboard	All Forms	24_PF10N/P
31	Paper/Fiber	White Paper	All Forms	24_PF11N/P

Count	Class	Type	Form	Combined CMC Code
32	Paper/Fiber	Other/Mixed Paper	All Forms	24_PF12N/P
34	Paper/Fiber	Paper/ Fiber	Small – Two or more sides measuring 2” or less	24_PF16N/P
33	Paper/Fiber	Other/ Mixed Paper	Potentially Reusable Packaging and Food Service Ware	Potential Reuse
35	Paper/Fiber	Other/Mixed Paper	Remainder/Composite Mixed Paper	n/a
36	Plastic	PET (#1)	Bottles, Jugs, and Jars (Clear/Natural)	24_P1P
37	Plastic	PET (#1)	Bottles, Jugs, and Jars (Pigmented/Color)	24_P2P
38	Plastic	PET (#1)	Other Rigid Containers, Cups, Lids Plates, Trays, Tubs	24_P38P
39	Plastic	PET (#1)	Other Rigid Items	24_P39P
40	Plastic	PET (#1)	Flexible and Film Items	24_P5P
41	Plastic	HDPE (#2)	Bottles, Jugs, and Jars (Clear/Natural)	24_P6P
42	Plastic	HDPE (#2)	Bottles, Jugs, and Jars (Pigmented/Color)	24_P7P
43	Plastic	HDPE (#2)	Pails and Buckets	24_P8P
44	Plastic	HDPE (#2)	Other Rigid Items	24_P40P
45	Plastic	HDPE (#2)	Flexible and Film Items	24_P10P
46	Plastic	PVC (#3)	Rigid Items	24_P11P
47	Plastic	PVC (#3)	Flexible and Film	24_P12P
48	Plastic	LDPE (#4)	Bottles, Jugs, and Jars	24_P13P
49	Plastic	LDPE (#4)	Other Rigid Items	24_P14P
50	Plastic	LDPE (#4)	Clear Non-Bag Film	24_P15P
51	Plastic	LDPE (#4)	Other Flexible and Film Items	24_P16P
52	Plastic	PP (#5)	Bottles, Jugs, and Jars	24_P17P
53	Plastic	PP (#5)	Other Rigid Containers, Cups, Lids, Plates, Trays, and Tubs	24_P41P
54	Plastic	PP (#5)	Utensils	24_P19P
55	Plastic	PP (#5)	Other Rigid Items	24_P20P
56	Plastic	PP (#5)	Clear Non-Bag Film	24_P21P
57	Plastic	PP (#5)	Other Flexible and Film Items	24_P22P

Count	Class	Type	Form	Combined CMC Code
58	Plastic	PS (#6)	Expanded/Foamed Hinged Containers, Plates, Cups, Tubs, Trays, and Other Foamed Containers	24_P23P
59	Plastic	PS (#6)	Other Expanded/Foamed Forms	24_P42P
60	Plastic	PS (#6)	Utensils	24_P27P
61	Plastic	PS (#6)	Solid Hinged Containers, Plates, Cups, Tubs, Trays, and Other Solid Forms	24_P43P
62	Plastic	PS (#6)	Flexible and Film Items	24_P29P
63	Plastic	Plastics and Polymers Designed for Compostability	Rigid Items	24_P44P
64	Plastic	Plastics and Polymers Designed for Compostability	Flexible and Film Items	24_P45P
65	Plastic	Multi-Material Laminate	Pouches and Envelopes	24_P46P
66	Plastic	Multi-Material Laminate	Other Forms	24_P33P
67	Plastic	Other/ Mixed Plastics	Textiles (non-organic/synthetic)	24_P34P
68	Plastic	Other/ Mixed Plastics	Rigid Items	24_P35P
69	Plastic	Other/ Mixed Plastics	Flexible and Film Items	24_P36P
71	Plastic	Plastic	Small – Two or more sides measuring 2” or less	24_P47P
70	Plastic	Plastic	Potentially Reusable Packaging and Food Service Ware	Potential Reuse
72	Plastic	Plastic	Remainder/Composite Plastic	n/a
73	Wood and Other Organic Materials	Wood	All Untreated Forms	24_WO1N/P

Count	Class	Type	Form	Combined CMC Code
74	Wood and Other Organic Materials	Wood	All Treated or Painted Forms	24_WO2N/P
75	Wood and Other Organic Materials	Other/Mixed Organic	Textiles	24_WO3N/P
76	Wood and Other Organic Materials	Other/Mixed Organic	Other Forms	24_WO4N/P
79	Wood and Other Organic Materials	Wood and Other Organic	Small – Two or more sides measuring 2” or less	24_WO6N/P
78	Wood and Other Organic Materials	Other/Mixed Organic	Potentially Reusable Packaging and Food Service Ware	Potential Reuse
77	Wood and Other Organic Materials	Other/Mixed Organic	Food Discarded in Original Packaging or Food Service Ware	Mixture
80	Wood and Other Organic Materials	Other/Mixed Organic	Remainder/Composite Organic	n/a
81	Miscellaneous	Miscellaneous	Nonfood Discarded in Original Packaging	Mixture
83	Miscellaneous	Miscellaneous	Mixed Residue	n/a
82	Miscellaneous	Miscellaneous	Remainder Miscellaneous	n/a

Vehicle Surveys

As part of data collection, contractor staff conducted surveys at facilities to gather information on the sector of incoming vehicles, select specific vehicles for sampling, and collect additional data on the selected vehicles, such as the net weight of the load. The vehicle survey data were used to estimate the contribution of each waste sector at each participating facility to the overall waste sector throughout the state.

More details on the vehicle surveys, the data collected and analyzed, and the vehicle selection process for sampling can be found in Appendix 1: Detailed Methodology (Section 1.5: Vehicle Surveys).

Sample Collection and Sorting

Contractor staff collected 313 waste samples across all sectors at the 16 landfills for composition analysis. An additional four samples were collected that did not meet the specifications for inclusion in the overall waste composition analysis but were still considered in the additional analyses completed by contractor staff (see section Additional Analysis Performed by Contractor Staff).

Contractor staff randomly identified residential route trucks, franchised commercial route trucks, self-hauled loads, and transfer trailers, and collected one sample weighing at least 200 pounds from each. If, during a sampling day, the expected commercial route vehicles or transfer trailers were anticipated to be fewer than needed to meet sampling targets, contractor staff collected two samples from such vehicles. Double sampling was not allowed from residential route trucks. Table 3 shows the sample distribution among the four sectors.

Table 3. Distribution of Samples by Waste-Generating Sector

Sector	Period 1	Period 2	Total
Franchised Single-family Residential (RES)	36	47	83
Franchised Commercial and Multi-family Residential (COM)	69	71	140
Self-haul (SH)	31	31	62
Mixed Waste (MIX)	14	14	28
Total	150	163	313

Additional Analysis Performed by Contractor Staff

To collect additional data on the amount and type of covered material, contractor staff completed additional analyses on (1) covered material made of plastic with an unknown resin type, (2) covered material disposed of with a good inside, and (3) weight-to-volume conversion factors for sorting categories that include covered material. This section describes those additional analyses.

Covered Material Made of Plastic of Hard-to-Identify Resin Type

Contractor staff sorted covered material made primarily of plastic that could not be readily identified in the field as a resin type #1 through #6 into one of two categories: (1) Other/Mixed Plastics Rigid Items (Count 68 in the material sorting list). or (2) Other/Mixed Plastics Flexible and Film Items (Count 69 in the material sorting list). As

with other sorting categories, the weights of materials in these categories were recorded. Throughout the study, contractor staff collected a selection of items from these categories for further analysis. They applied the Cone and Quarter method (illustrated in Appendix 1: Section 1.7: Sample Characterization, Figure B2) to generate a random selection of material in those categories for resin identification analysis. Contractor staff sent the items to an off-site lab, Stina Inc., for analysis using resin spectroscopy to identify the plastic resin type: PET (#1), HDPE (#2), PVC (#3), LDPE (#4), PP (#5), PS (#6), and other or unknown resins. A total of 1,090 covered material items of unknown resin type were analyzed.

Due to collection methods and differing nomenclature, the resin analysis results were not associated with specific samples, facilities, or sectors. As a result, the findings are presented as stand-alone results. The results of the resin analysis are described in Appendix 1 Section Additional Analysis: Spectroscopic Analysis of Hard-to-Identify Resins, Tables 7-A and 7-B – Resin Composition Among Plastic Samples.

Covered Material Disposed of with the Good Inside (Depackaging Analysis)

Covered material disposed of with the good still inside (e.g., a partially filled bottle of lotion, a meal discarded in a plastic takeout container, or sausages discarded in their wrapper) was sorted into one of two categories: one for food discarded in covered material (as original packaging; Count 77 in the material sorting list), and one for all other goods discarded in covered material (as original packaging; Count 81 in the material sorting list). For a subset of materials in those two categories, contractor staff separated the covered material from the food or good. Contractor staff brushed, shook, scraped, spooned, and wiped the contaminant materials out of and off the covered packaging material, collecting the contaminants in a bin. To separate the covered material from the food or good, no water or liquid was used. After separation and dry cleaning, the weight of the covered material was recorded by material class. These data were used to estimate the proportional weight of the covered material in each of the two original categories. The results of the depackaging analysis are described in Appendix 1 Table A10-A to A10-D.

Weight-to-Volume Conversion Factors for Sorting Categories with Covered Material

To provide additional context to the measured weights of covered materials landfilled in California, contractor staff collected additional data to calculate weight-to-volume conversion factors for each sorting category that included covered material. For the 67 sorting categories, after sorting was completed, contractor staff weighed the sorted material in containers of known volume, yielding a weight-to-volume correlation. This information was then used to calculate a volume-to-weight conversion factor by sorting category. Contractor staff conducted this analysis throughout the study. The results are presented in Table A9-A in Appendix 1. Information on sorting categories that were rarely encountered and not analyzed is presented in Appendix 1, Table A9-B. For a more detailed methodology refer to Appendix 1 (Section 1: Sample Characterization: Covered Material Weight-to-Volume Conversion Factor).

Data Considerations

There are multiple methodological factors to consider when interpreting the findings of this study. Because of the nature of waste disposal and the relatively small proportion of material sampled compared to total statewide disposal, some rare types of covered material (e.g., single-use ceramic packaging) may not have been collected. Additionally, it is not uncommon for a self-haul load or an occasional commercial load to be a homogeneous material (i.e. a load of landscaping material from a landscaping contractor). When these loads were randomly selected, a sample was collected and visually characterized.

Analyzing waste disposal data poses unique challenges. Waste characterization is a compositional analysis, meaning collected data are interdependent. The waste stream is composed of a study-defined number of material types, and the analysis aims to understand what proportion of the stream is composed of each material type. Analytical methods in this report were updated to assume data followed a Dirichlet distribution, which is appropriate for compositional data. This method does not allow the composition of any material type to be zero in any sample. As such, analytical methods must correct for samples with missing material types. In this study, that correction was accomplished through randomization of samples (see Appendix 1; Additional Analysis; Composition Estimates). Additional details and explanations of these analyses can be found in Appendix 1: Section 1.

Additional Analysis Performed by CalRecycle

Quality Control Sort

CalRecycle staff conducted a quality control sort on all Remainder/Composite categories from the material sorting list to assess sorting accuracy. This process was executed as follows: (1) after contractor staff completed the initial sort into the 83 sorting categories, the materials in the Remainder/Composite categories were weighed; (2) for a subset of samples, CalRecycle staff then conducted a second sort of those materials to identify any additional covered material that had been missed. The weights of any additional covered material discovered were later incorporated into the data, as described in the following section.

Calculation of Composition Data

Calculating Final Material Composition

To calculate the final material composition, which combines data from the main sort and the quality control sort for a given sample (i.e., the percentage of each sorting category in a given sample), the following equation was applied:

$$S = \frac{[M + Q(i) + D(i)]}{T} \times 100$$

- *S* = percentage by weight of a specific sorting category within a given sample
- *M* = weight of material within a specific sorting category **from sort**

- *Q* = weight of a material within a specific material **class** from the **quality control sort**
- *i* = percentage by weight that a specific sorting category accounts for within a material class (see next subsection for more details)
- *D* = weight of material within a specific material class from the **depackaging analysis**
- *T* = Total weight of all material in the sample

Estimating Percentage (i)

Weight data on covered material disposed of, captured during the additional analysis on depackaging and the quality control sort, was collected at the material class level. To apply this weight to specific sorting categories, a study-wide estimate was made of the proportion each sorting category represented within its material class. Table A6 (Appendix 1, Section 2: Data Analysis) provides the average (mean) weight each sorting category accounted for within a material class over the entire study period. To estimate these proportions, the following equation was used to estimate *i* for each sample. These values were then averaged across the entire study.

$$\text{i} = \frac{Weight\ of\ a\ material\ type\ and\ form\ in\ the\ sample}{Weight\ of\ the\ sample} \times 100$$

This composition data, along with other information and data gathered during the study period, were used to extrapolate study findings to statewide levels, as detailed in the following subsections.

Estimating Disposal by Sector and Statewide

To establish confidence intervals for estimates of CMC proportions within sectors and statewide, modeling was conducted in R Statistical Program. First, CMC proportions were calculated within each sample. A CMC proportion is the proportion of total disposed-of material in a given sample, by weight, that the CMC accounts for. This is compositional data, describing the relative frequencies of the multiple components (in this case, CMCs and non-CMC remainder categories) which sum to a constant value of 1. These proportions are assumed to follow a Dirichlet distribution, a common model for compositional data. In a dataset following the Dirichlet distribution, events can be classified into three or more discrete options (e.g., a sample of disposed-of material can be classified as four different material types), and the occurrence of events is best understood as proportions (e.g., 30% of a sample is composed of material type “X”, by weight) that will sum to a value of 1 (or 100%).

A frequentist model was then applied, assuming the Dirichlet distribution, to estimate CMC proportions. A frequentist model is a statistical approach used to estimate the population-wide value of a parameter (such as the proportion of total disposal that is material type “X”) from a sample of the population. Using the Dirichlet distribution, CMC proportions were estimated based on properties such as arithmetic mean and density. Frequentist statistics were chosen for computational efficiency over other methods. This

produced estimates of the mean (average) and 95% confidence intervals for each CMC proportion within each sector.

Next, results for each CMC within each sector were scaled and summed to estimate statewide results. The statewide estimates for each CMC were calculated as:

$D = (C_R \times T_R) + (C_C \times T_C) + (C_M \times T_M) + (C_S \times T_S)$

- D = statewide estimate of the material category
- C_R = estimate from Residential sector data
- T_R = proportion of study-wide disposal tonnage from Residential sector
- C_C = estimate from Commercial sector data
- T_C = proportion of study-wide disposal tonnage from Commercial sector
- C_M = estimate from Mixed Waste sector data
- T_M = proportion of study-wide disposal tonnage from Mixed Waste sector
- C_S = estimate from Self Haul sector data
- T_S = proportion of study-wide disposal tonnage from Self Haul sector

Total statewide annual disposal tonnage for 2024 was retrieved from (RDRS) Report 8: Statewide Totals for Disposal and Disposal-Related Materials (May 2025). The resulting statewide proportion means (averages) for each CMC were multiplied by the total statewide disposal tonnage to estimate statewide annual disposal for each CMC in tons.

This modeling strategy was used to generate the data in Tables 5-A, 5-B, 6, and Appendix 1 Tables A7-A and A8. For more details, see Appendix 1 (Section 2.2: Additional Statistical Analysis: Composition Estimates).

Disposal Estimates by Sorting Category

The analysis produced four estimates for each of the sorting categories. This information is provided at both the statewide level and by sector. The four estimates include:

1. The average annual weight of landfilled material, expressed as the mean.
2. The proportion of overall disposal (% – by weight) of each sorting category, expressed as the mean.
3. The lower and upper bounds (2.5% and 97.5%) of the 95% confidence interval for the estimate of disposal proportion.

Summary of Findings

This section provides the statewide-level findings from the study. The first subsection presents the primary findings—specifically, estimates of the proportions and amounts of covered material landfilled in California by sorting category. The second subsection presents findings from an additional analysis to identify the resin types of covered material for plastic items where the resin type could not be identified in the field.

The findings in this section, including the data tables, summarize data collected during the study regarding covered material, as well as data generated through statistical modeling. Data tables reflecting results from the additional analyses of potentially

reusable and Remainder/Composite categories can be found in Appendix 1. During the study, 4,613 pounds of covered material items were collected and sorted as the basis for these estimates. The quality control sort identified additional covered material in 118 samples, totaling 237 pounds. The depackaging analysis identified additional covered material in 93 samples, totaling 173 pounds. In total, the Remainder/Composite (quality control) sort and depackaging analysis identified an additional 6% of covered material items by weight.

Estimates of Statewide Disposal of All Material

In 2024, an estimated 40,035,748 tons of material were sent for disposal in California landfills. Table 4 shows the disposal estimates for each sector based on vehicle surveys and RDRS statewide total disposal tonnage (RDRS data accessed May 2025). For each sector, the percentage of disposal from that sector and the total disposal (tons) for 2024 are shown. The sum of the percentages in the second column may not equal exactly 100% due to rounding.

Table 4. Estimates of Statewide Landfill Disposal from each Sector

Sector	Percentage of Disposal Tonnage Originating from Sector	2024 Disposal Estimate (Tons)
Franchised Commercial	26.6%	10,629,343
Franchised Residential	12.6%	5,023,433
Mixed	49.8%	19,919,907
Self-Haul	11.2%	4,463,065
Total	100%	40,035,748

Estimates of Statewide Disposal of Covered Material

In 2024, an estimated 8,457,149 tons of covered material were disposed of in California landfills. Covered material accounted for 21.1% of total statewide disposal. By material class, paper and fiber was the most landfilled covered material, with an estimated 3,929,375 tons disposed of, followed by plastic, with an estimated 3,123,797 tons.

Table 5-A shows estimates of covered material landfilled in California in 2024, by material class, including weight (in tons) and each class's proportion of the total landfilled waste stream.

Table 5-A. Estimates of Statewide Disposal of Material Classes in 2024

Material Class	Average (mean) Annual Statewide Disposal (tons)	Percentage of Total Statewide Disposal	95% Confidence Interval for Percentage of Total Statewide Disposal	Proportion of Covered Material Disposal
Ceramic	5,564	0.01%	0.00% - 0.08%	0.07%
Glass	154,149	0.39%	0.10% - 1.12%	1.82%
Metal	432,265	1.08%	0.13% - 4.04%	5.11%
Plastic	3,123,797	7.80%	2.44% - 19.96%	36.94%
Paper and Fiber	3,929,375	9.81%	5.66% - 16.24%	46.46%
Wood and Other Organic Materials	811,999	2.03%	1.07% - 3.71%	9.60%
Total	8,457,149	21.12%	9.41% - 45.15%	100%

Table 5-B shows estimated proportions of disposal by material class and sector. Column 3 provides the estimated proportion of total disposal for all material in a material class, including material not covered under the Act. Column 4 provides the estimated proportion of total disposal for covered material within each material class, with total disposal including both covered and noncovered material. Column 5 provides the estimated proportion of total covered material disposal for each covered material within each material class. Any rows with "n/a" for CMC disposal estimates indicate that covered material in that material class was not observed within the relevant sector.

Table 5-B. Estimates of Disposal by Material Class and Sector in 2024

Material Class	Sector	For Material Type, Estimated Proportion of Total Disposal (by Weight)	For CMC only, Estimated Proportion of Total Disposal (by Weight)	For CMC only, Estimated Proportion of CMC Disposal (by Weight)
Ceramic	Franchised Commercial	0.43%	0.03%	0.13%
Glass	Franchised Commercial	1.46%	0.35%	1.52%
Metal	Franchised Commercial	4.52%	0.99%	4.29%
Paper and Fiber	Franchised Commercial	17.11%	9.62%	41.70%
Plastic	Franchised Commercial	15.15%	7.89%	34.20%
Wood and Other Organic Materials	Franchised Commercial	25.45%	4.19%	18.16%
Ceramic	Franchised Residential	0.21%	0.04%	0.22%
Glass	Franchised Residential	2.47%	0.80%	4.37%
Metal	Franchised Residential	3.88%	1.29%	7.04%
Paper and Fiber	Franchised Residential	19.24%	7.97%	43.50%
Plastic	Franchised Residential	14.62%	8.17%	44.60%
Wood and Other Organic Materials	Franchised Residential	29.28%	0.05%	0.27%
Ceramic	Mixed	0.43%	n/a	n/a
Glass	Mixed	1.29%	0.39%	1.68%
Metal	Mixed	3.73%	1.22%	5.24%

Material Class	Sector	For Material Type, Estimated Proportion of Total Disposal (by Weight)	For CMC only, Estimated Proportion of Total Disposal (by Weight)	For CMC only, Estimated Proportion of CMC Disposal (by Weight)
Paper and Fiber	Mixed	18.37%	11.34%	48.73%
Plastic	Mixed	16.25%	8.94%	38.42%
Wood and Other Organic Materials	Mixed	17.96%	1.38%	5.93%
Ceramic	Self-haul	2.08%	n/a	n/a
Glass	Self-haul	0.11%	n/a	n/a
Metal	Self-haul	5.84%	0.42%	4.17%
Paper and Fiber	Self-haul	6.76%	5.57%	55.37%
Plastic	Self-haul	3.54%	2.10%	20.87%
Wood and Other Organic Materials	Self-haul	12.30%	1.97%	19.58%

Table 6. Estimates of Statewide Disposal by Covered Material Category in 2024

Table 6 shows estimates of the amounts of covered material landfilled in California in 2024, by sorting category. The table includes weight (in tons), the proportion of the total waste stream, and the proportion of covered material disposed of.

Materials within certain CMCs were rarely found in samples, including: Ceramic all forms (24_C1N/P); Glass Other Forms (24_G2N/P); Plastic LDPE Bottles, Jugs, and Jars (24_P17P); Plastic PS Flexible and Film (24_P29P); Plastic PET Flexible and Film (24_P5P); Other/Mixed Organic Textile (24_WO3N/P); and Other/Mixed Organic Other Forms (24_WO4N/P). Since these items were rarely detected during sampling, it indicates their presence is likely rare in statewide disposal.

Each row of the table contains data for a covered material sorting category. The first four columns identify the sorting category by combined CMC code, material class, material type, and material form. The fifth column is the annual average (mean) statewide disposal estimate in tons. The sixth column is the proportion of total statewide disposal that each sorting category accounts for. All sorting categories with a corresponding code starting with “24_” are categories specific to covered material that was published in the CMCs list released Jan. 1, 2025. Additionally, in the code column, the alphanumeric material code ends with an “N” and/or a “P” indicating whether the item contains an inseparable plastic

component (P) or contains no plastic component (N). An “N/P” indicates that the material form contains two covered material categories, one with and one without inseparable plastic components.

Confidence intervals for these estimates were calculated (Section 2: Data Analysis: Additional Analysis: Composition Estimates) and are presented in Appendix 1 (Section 2: Table A8).

Combined CMC Code	Material Class	Material Type	Material Form	Estimated Average (mean) Annual Statewide Disposal (tons)	Estimated Proportion of Total Statewide Disposal
24_G1N/P	Glass	Glass	Bottles and Jars	130,502	0.33%
24_G2N/P	Glass	Glass	Other Forms	9,249	0.02%
24_G3N/P	Glass	Glass	Small - Two or more sides measuring 2" or less	14,398	0.04%
24_C1N/P	Ceramic	Ceramic	All Forms	1,172	0.00%
24_C2N/P	Ceramic	Ceramic	Small - Two or more sides measuring 2" or less	4,391	0.01%
24_M1N/P	Metal	Aluminum	Non-aerosol Containers	24,454	0.06%
24_M2N/P	Metal	Aluminum	Foil Sheets	66,305	0.17%
24_M3N/P	Metal	Aluminum	Foil Molded Containers	32,213	0.08%
24_M4P	Metal	Aluminum	Aerosol can	19,392	0.05%
24_M5N/P	Metal	Aluminum	Other Forms	24,533	0.06%
24_M6N/P	Metal	Tin/Steel/Bimetal	Non-aerosol Containers	137,393	0.34%
24_M7P	Metal	Tin/Steel/Bimetal	Aerosol Can	38,929	0.10%
24_M8N/P	Metal	Tin/Steel/Bimetal	Other Forms	44,148	0.11%
24_M9N/P	Metal	Other Nonferrous	All Forms	11,762	0.03%
24_M10N/P	Metal	Other Ferrous	All Forms	19,579	0.05%
24_M12N/P	Metal	Metal	Small - Two or more sides measuring 2" or less	13,557	0.03%
24_PF1N/P	Paper and Fiber	Kraft Paper	All Forms	289,887	0.72%
24_PF14N/P	Paper and Fiber	Molded Fiber	All Forms	163,462	0.41%

Combined CMC Code	Material Class	Material Type	Material Form	Estimated Average (mean) Annual Statewide Disposal (tons)	Estimated Proportion of Total Statewide Disposal
24_PF15P	Paper and Fiber	Multi-Material Laminate	Aseptic Cartons	57,344	0.14%
24_PF5P	Paper and Fiber	Multi-Material Laminate	Gable-top Cartons	84,452	0.21%
24_PF7P	Paper and Fiber	Multi-Material Laminate	Other Forms	549,429	1.37%
24_PF8N/P	Paper and Fiber	OCC	Waxed Cardboard	109,451	0.27%
24_PF9N/P	Paper and Fiber	OCC	Cardboard	2,042,929	5.10%
24_PF10N/P	Paper and Fiber	Paperboard	All Forms	487,428	1.22%
24_PF11N/P	Paper and Fiber	White Paper	All Forms	18,512	0.05%
24_PF12N/P	Paper and Fiber	Other/Mixed Paper	All Forms	112,428	0.28%
24_PF16N/P	Paper and Fiber	Paper and Fiber	Small - Two or more sides measuring 2" or less	14,054	0.04%
24_P1P	Plastic	PET (#1)	Bottles, Jugs, and Jars (Clear/Natural)	80,445	0.20%
24_P2P	Plastic	PET (#1)	Bottles, Jugs, and Jars (Pigmented/Color)	42,204	0.11%
24_P38P	Plastic	PET (#1)	Other Rigid Containers, Cups, Lids, Plates, Trays, and Tubs	204,712	0.51%
24_P39P	Plastic	PET (#1)	Other Rigid Items	24,929	0.06%
24_P5P	Plastic	PET (#1)	Flexible and Film Items	9,568	0.02%
24_P6P	Plastic	HDPE (#2)	Bottles, Jugs, and Jars (Clear/Natural)	99,816	0.25%

Combined CMC Code	Material Class	Material Type	Material Form	Estimated Average (mean) Annual Statewide Disposal (tons)	Estimated Proportion of Total Statewide Disposal
24_P7P	Plastic	HDPE (#2)	Bottles, Jugs, and Jars (Pigmented/Color)	94,893	0.24%
24_P8P	Plastic	HDPE (#2)	Pails and Buckets	62,945	0.16%
24_P40P	Plastic	HDPE (#2)	Other Rigid Items	50,724	0.13%
24_P10P	Plastic	HDPE (#2)	Flexible and Film Items	48,778	0.12%
24_P11P	Plastic	PVC (#3)	Rigid Items	16,679	0.04%
24_P12P	Plastic	PVC (#3)	Flexible and Film Items	18,125	0.05%
24_P13P	Plastic	LDPE (#4)	Bottles, Jugs, and Jars	8,850	0.02%
24_P14P	Plastic	LDPE (#4)	Other Rigid Items	19,351	0.05%
24_P15P	Plastic	LDPE (#4)	Clear Non-Bag Film	263,481	0.66%
24_P16P	Plastic	LDPE (#4)	Other Flexible and Film Items	290,978	0.73%
24_P17P	Plastic	PP (#5)	Bottles, Jugs, and Jars	14,411	0.04%
24_P41P	Plastic	PP (#5)	Other Rigid Containers, Cups, Lids, Plates, Trays, and Tubs	371,670	0.93%
24_P19P	Plastic	PP (#5)	Utensils	28,091	0.07%
24_P20P	Plastic	PP (#5)	Other Rigid Items	67,550	0.17%
24_P21P	Plastic	PP (#5)	Clear Non-Bag Film	15,639	0.04%
24_P22P	Plastic	PP (#5)	Other Flexible and Film Items	31,560	0.08%
24_P23P	Plastic	PS (#6)	Expanded/Foamed Hinged Containers, Plates, Cups, Tubs, Trays, and Other Foamed Containers	62,525	0.16%
24_P42P	Plastic	PS (#6)	Other Expanded/Foamed Forms	68,405	0.17%
24_P27P	Plastic	PS (#6)	Utensils	27,176	0.07%

Combined CMC Code	Material Class	Material Type	Material Form	Estimated Average (mean) Annual Statewide Disposal (tons)	Estimated Proportion of Total Statewide Disposal
24_P43P	Plastic	PS (#6)	Solid Hinged Containers, Plates, Cups, Tubs, Trays, and Other Solid Forms	75,115	0.19%
24_P29P	Plastic	PS (#6)	Flexible and Film Items	11,189	0.03%
24_P44P	Plastic	Plastics and Polymers Designed for Compostability	Rigid Items	25,519	0.06%
24_P45P	Plastic	Plastics and Polymers Designed for Compostability	Flexible and Film Items	15,247	0.04%
24_P46P	Plastic	Multi-Material Laminate	Pouches and Envelopes	58,962	0.15%
24_P33P	Plastic	Multi-Material Laminate	Other Forms	72,604	0.18%
24_P34P	Plastic	Other/Mixed Plastics	Textiles	25,786	0.06%
24_P35P	Plastic	Other/Mixed Plastics	Rigid Items	117,993	0.29%
24_P36P	Plastic	Other/Mixed Plastics	Flexible and Film Items	650,085	1.62%
24_P47P	Plastic	Plastic	Small - Two or more sides measuring 2" or less	47,791	0.12%
24_WO1N/P	Wood and Other Organic Materials	Wood	All Untreated Forms	703,062	1.76%
24_WO2N/P	Wood and Other Organic Materials	Wood	All Treated or Painted Forms	87,378	0.22%

Combined CMC Code	Material Class	Material Type	Material Form	Estimated Average (mean) Annual Statewide Disposal (tons)	Estimated Proportion of Total Statewide Disposal
24_WO3N/P	Wood and Other Organic Materials	Other/Mixed Organic	Textiles	6,386	0.02%
24_WO4N/P	Wood and Other Organic Materials	Other/Mixed Organic	Other Forms	5,369	0.01%
24_WO6N/P	Wood and Other Organic Materials	Wood and Other Organic Materials	Small - Two or more sides measuring 2" or less	9,804	0.02%

Additional Analysis: Spectroscopic Analysis of Hard-to-Identify Resins

Resin Composition Among Plastic Samples

This section presents the results from resin analysis performed on covered material that was sorted but whose dominant plastic type could not be readily distinguished by resin type in the field. Contractor staff sorted a total of 1,090 items from the following categories: Count 68 – Other/Mixed Plastics Rigid Items (527 individual items) and Count 69 – Other/Mixed Plastics Flexible and Film Items (563 individual items). These items were sent to Stina Inc. for identification using resin spectroscopy.

The resin analysis results showed two key findings: (1) among the Other/Mixed Plastics Rigid items, HDPE (#2) and LDPE (#4) were the most prevalent resin types, together accounting for nearly 50% of the 527 items analyzed (Table 7-A); and (2) among the Other/Mixed Plastics Flexible and Film items, Other or Unknown Resins and PP (#5) were the most prevalent resin types, also making up nearly 50% of the 563 items analyzed (Table 7-B).

Tables 7-A and 7-B contain information from the study sort and resin analysis of hard-to-identify resins. The first column lists the resin type; the second column shows the number of instances the resin was found; and the third column indicates the percentage of resin prevalence. The sum of the percentages in the third column may not equal exactly 100% due to rounding. Within the sort, multiple CMCs within each resin type are summed for the material forms “Rigid Items (Table 7-A)” and “Flexible and Film Items (Table 7-B).”

Table 7-A. Resin Composition Among Other/Mixed Plastics Rigid Samples

Resin Type	Number of Items in which this Resin was Identified	Percent of Items in which this Resin was Identified
PET (#1)	93	17.7%
HDPE (#2)	108	20.5%
PVC (#3)	10	1.9%
LDPE (#4)	141	26.8%
PP (#5)	100	19.0%
PS (#6)	0	0.0%
Other/Unknown	54	10.3%
Non-Plastic	21	4.0%

Table 7-B. Resin Composition Among Other/Mixed Plastics Flexible and Film Samples

Resin Type	Number of Items in which this Resin was Identified	Percent of Items in which this Resin was Identified
PET (#1)	93	16.5%
HDPE (#2)	60	10.7%
PVC (#3)	13	2.3%
LDPE (#4)	19	3.4%
PP (#5)	193	34.3%
PS (#6)	36	6.4%
Other/Unknown	99	17.6%
Non-Plastic	50	8.9%

Glossary of Terms

Additional Analysis: Refers to additional sorting and analysis performed by the contractor for the following:

- Covered material made primarily of plastic that could not be readily identified in the field as being composed of resin types #1 through #6 was sorted into one of two categories: (1) rigid items (Count 68 in the material sorting list) composed of other or unidentifiable plastic resin types, and (2) flexible and film items (Count 69 in the material sorting list) composed of other or unidentifiable plastic resin types. These samples were sent to an off-site laboratory for resin identification.
- Covered material disposed of with the good still inside (Count 81 in the material sorting list) or with food still inside (Count 77 in the material sorting list) was depackaged to obtain the weight of covered material without any contents.
- Weight-to-volume conversion factors for certain covered material were determined by sorting category.

Confidence Interval: A confidence interval refers to a range of values that will contain the true value. Confidence intervals always have an associated probability level. Unless otherwise noted, this report calculates confidence intervals at the 95% level. The 95% confidence intervals provided in this report have the following interpretation: If the dataset underlying a confidence interval was recreated many times and a new confidence interval was created for each dataset, then 95% of those intervals would contain the true value. This interpretation differs slightly from assuming that any one confidence interval has a 95% probability of containing the true value. However, if we assume that the process generating datasets is consistent, we can interpret the specific confidence intervals in this report as indicating a 95% probability that the true value lies within the 95% confidence interval. This assumption is common in scientific literature.

Contractor Staff: Refers to field staff under contract with CalRecycle to perform sampling and sorting. This includes primary contractor staff and any subcontractor staff.

Covered Material: Single-use packaging and single-use plastic food service ware covered under the Act (PRC section 42041(e)(1)).

Covered Material Categories: Categories that include covered material of a similar type and form. Additional details regarding the covered material categories can be found on the Act Covered Material Categories List webpage.

Dirichlet Distribution: In statistics, a distribution is a function that shows the probability of observing events. The Dirichlet distribution shows such probabilities for proportional events. That is, if the types of observable events can be classified into three or more discrete options (e.g., a sample of disposed-of material can be divided into four different material types), and if the occurrence of events is best understood as proportions (e.g., 30% of a weight sample is material type “X”), then the Dirichlet distribution will model the probability of observing such proportions.

Frequentist Model: A statistical approach used to estimate the population-wide value for a parameter (such as the proportion of the total landfill disposal stream that is

material type “X”) from a sample of the population. The approach works by finding the value of the population-wide parameter that maximizes the probability of observing the original data.

Landfilled: Material destined for final deposition in a landfill with no further processing. The following types of material were excluded from the study: (1) disaster debris (e.g., storm deadfall and soil), (2) universal waste, (3) material sent for recycling or recovery, (4) biosolids, (5) designated waste, (6) aggregates and soil set aside for beneficial use, (7) alternative daily cover, and (8) household hazardous waste.

Mean: The arithmetic average of a set of numbers.

Maximum Likelihood: A method of estimating the attributes, or parameters, of an assumed probability distribution, given the observed data.

Multivariate Normal Distribution: A generalization of the one-dimensional normal distribution to problems of higher dimensions. The normal distribution is a type of probability distribution for a random variable.

Sectors: A unique portion of the total waste stream that is determined by its particular generation, collection, or composition characteristics. Sectors are identified according to the source, or generator, of the waste (franchised residential (single-family) or franchised commercial), as well as how materials are delivered to waste sites (commercially collected (mixed waste) or self-hauled).

- **Franchised Commercial and Multi-family Residential (COM)** materials are hauled by contracted or municipally operated vehicles in packer trucks and drop-boxes. At least 80% of the material is generated at institutional, commercial, or industrial buildings such as businesses, schools, government offices, and other institutions, or multifamily residential buildings serviced with dumpsters. This is one of the four sectors of the waste stream collected for this study.
- **Franchised Single-family Residential (RES**) materials are hauled by contracted or municipally operated vehicles in packer trucks. At least 80% of the material is generated at residential buildings serviced with carts. This is one of the four sectors of the waste stream collected for this study.
- **Mixed Waste (MIX)** is commingled material either hauled in transfer trailers by contracted or municipally operated vehicles from a transfer station, or as loads of material recovery facility (MRF) residuals. This stream does not include loads from community drop-off locations. These loads do not come directly from a collection route or property; therefore, the generating sector is often unidentifiable. This is one of the four sectors of the waste stream collected for this study.
- **Self-haul (SH)** materials are hauled by vehicles not operated by a franchise or municipality, including waste from residential or nonresidential sources. Self-haul customers do not have a permit to operate as waste haulers. Municipal haulers, such as city road crews and parks departments, bringing waste from cleanups, are also included in this stream. This is one of the four sectors of the waste stream collected for this study.

Sort: For this study, material sent to landfills for disposal was categorized based on the study sorting list. Each of the 83 sorting categories included only one of the following: (1) covered material (i.e., single-use packaging and single-use plastic food service ware covered under the Act); (2) potentially reusable alternatives to covered material (e.g., reusable milk jug); or (3) all other material not covered under the Act, classified as Remainder/Composite. Sorting was conducted by contractor staff. Materials in the Remainder/Composite categories were subject to additional quality control sorting by CalRecycle staff.

Material Sorting List: The list of material categories used by contractor staff to conduct the study. It was aligned with covered material categories.

Abbreviations and Acronyms

ADC – Alternative Daily Cover

ASTM – American Society for Testing and Materials

CalRecycle – California Department of Resources Recycling and Recovery

C&D – Construction and Demolition

CMC – Covered Material Category

COM – Franchised Commercial and Multi-Family Residential

EPR – Extended Producer Responsibility

HDPE – High-Density Polyethylene

HHW – Household Hazardous Waste

Lbs. - Pounds

LDPE – Low-Density Polyethylene

MIX – Mixed Waste

MRF – Material Recovery Facility

OCC – Old Corrugated Containers or Cardboard

PET – Polyethylene Terephthalate

PP – Polypropylene

PRC – Public Resources Code

PS – Polystyrene

PVC – Polyvinyl Chloride

RDRS – Recycling and Disposal Reporting System

RES – Franchised Single-Family Residential

SB – California State Senate Bill

SH – Self-Haul

SWIS – CalRecycle's Solid Waste Information System

The Act - Senate Bill 54 (SB 54), the Plastic Pollution Prevention and Packaging Producer Responsibility Act (Allen, Chapter 75, Statutes of 2022)

Bibliography

1. California Department of Resources Recycling and Recovery. (2025). Recycling and Disposal Reporting System (RDRS) Report 8: Statewide Totals for Disposal and Disposal-Related Materials. Retrieved May 2025, from https://www2.calrecycle.ca.gov/RecyclingDisposalReporting/Reports/StatewideTotalDisposalMaterials