

## The Needed State of Collection, Processing, and End Markets

A Plastic Pollution Prevention and Packaging Producer Responsibility Act Needs Assessment Technical Report

February 2026



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# Executive Summary

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[The Plastic Pollution Prevention and Packaging Producer Responsibility Act](#) (Senate Bill (SB) 54, Allen, Chapter 75, Statutes of 2022) (the Act) established an extended producer responsibility (EPR) program to manage single-use packaging and single-use plastic food service ware (covered material) in California. The Act requires the Department of Resources Recycling and Recovery (CalRecycle) to conduct a needs assessment to aid its implementation. CalRecycle awarded a contract to investigate the actions and investments needed to meet the requirements of the Act with a focus on ensuring that all covered material is recyclable or compostable by 2032 and that plastic single-use packaging and plastic single-use food service ware (plastic covered material) achieve a 65% recycling rate.

This report evaluates actions and investments related to collection, processing, and end markets to achieve the requirements of the Act. The actions and investments identified in the report are not meant to be prescriptive. They are meant to illustrate how different strategies and investments provide opportunities across the entire system to achieve the requirements of the Act.

## Material Redesign Underpins System Needs and Costs

Material redesign will play a significant role in achieving the recyclability, compostability, and recycling rate requirements. Manufacturer material design choices drive the investments and actions needed for California's collection, processing, and recycling systems. Education and outreach to material design decisionmakers is essential to ensure choices reduce negative impacts throughout the covered material's lifecycle.

Redesigning materials with a holistic approach — simplifying, standardizing, and harmonizing the types of covered materials — can improve public health, protect the environment, and reduce system costs. Reducing the complexity of covered material in the market could:

- Simplify sorting for consumers and other generators, helping to address a lack of clarity on proper sorting reported in the study.
- Reduce the need for education and outreach around sorting, especially if a simplified material stream is coupled with accurate and standardized labeling.
- Reduce yield loss at processing and end market facilities due to simplified material streams and reduced contamination.

The contractor found that upgrading recycling processing facilities and expanding end markets are unlikely to enable all plastic covered material currently sold to be recoverable or give them viable end markets. Some materials face potential barriers because they lack viable processing technology, lack emerging end markets due to low volumes, or cannot be recovered in sufficient quantities. These materials were modeled to have design improvements in future years. Innovations in processing and end market

technology may allow for alternatives to redesigning out these materials. In cases where a plastic component was unnecessary for functionality, the modeled redesign removed it. The analysis identified that some covered material could be redesigned into similar forms, such as rigid or flexible single-use packaging, but with an alternative material that is recyclable or compostable.

## **Key Findings**

Actions taken in one stage of the value chain (e.g., collection, processing, and end markets) influence other stages. For example, covered material sent to end markets with lower loss rates may be able to sustain higher losses in processing or collection while still achieving the requirements of the Act. Potential actions to improve each stage of the value chain were identified. It may be most effective to consider how the actions influence each other, including how actions made in one part of the value chain can have positive effects throughout the system. These considerations may provide opportunities to maximize impacts while minimizing investments.

### **Collection of Covered Materials**

While the majority of the state population (approximately 87%) has full access to onsite curbside collection services, inclusive of materials collected for recycling and materials collected for organics recycling, there is clear regional disparity. The Current State of Collection Report identified convenient access as a primary factor for proper participation in recycling programs. This is an opportunity to maximize the amount of material that is properly collected (rather than littered or dumped) and ensure accurate sorting for clean recycling streams. To achieve a 65% recycling rate, minimizing contamination during collection is an effective strategy to prevent additional losses during processing and in end markets.

Access to onsite curbside collection does not guarantee participation. Additional or clearer information on what to recycle and compost was identified as essential to increase participation and improve proper sorting. To shift recycling behaviors among generators, this report describes educational strategies that utilize a three-pronged approach, including the use of informational messaging, emotional and empathetic messaging, and direct engagement that can be delivered through state or local resources. When coupled with educational messaging, contamination reduction initiatives are an effective strategy, often utilizing penalties such as container collection refusal or fees.

Community-specific education and outreach, supplemented by statewide campaigns, including the use of mobile and web applications, and consistent and clear product labeling, will encourage proper sorting and reduce contamination. These initiatives can build foundational knowledge and help make recycling a standard practice and build foundational knowledge of proper recycling among all generators.

### **Processing Covered Materials**

By 2032, the contractor estimates that approximately 8.4 million tons of covered materials will need to be managed by recycling processing facilities in the state, after accounting for material design changes. This report assesses the feasibility of

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upgrading the existing infrastructure, and the potential for new facilities. Options evaluated include improvements to existing infrastructure and development of new infrastructure to address covered material with a plastic component that are not currently recovered by most facilities.

Some types of covered material were found to currently have sufficient processing infrastructure, including most metals and some paper and fiber covered material. Upgraded and new infrastructure may be most effective by focusing on recovering covered material with a plastic component that are not currently recovered by most facilities, such as small format plastics, aseptic and gable top cartons, flexible and film plastics, and mixed plastics #3 through #7.

Potential upgrades were also evaluated for organics processing facilities (OPFs). By 2032, the contractor modeled that approximately 667,900 tons of covered material would be managed by OPFs, limited to the following covered material: old corrugated cardboard (OCC), kraft paper, mixed paper, molded pulp, and untreated wood. As part of the evaluation, OPF operators were surveyed to characterize statewide processing conditions for organic covered material and identify what types of tools and support they would need to accept more types of covered material in the future. Most facility operators surveyed indicated they were unable to accept plastic covered material under current conditions and without further investment.

### **End Markets for Plastic Covered Materials**

End markets will also likely require investments to accept additional materials and potentially recycle new material types. These investments can be further supported through initiatives such as long-term contracts with end markets to support market stability. The contractor estimated that the plastics material class may require the most substantial investments in new and expanded end market capacity to meet the requirements of the Act. The identified investments are largely to upgrade existing infrastructure and/or to build new capacity.

It is estimated that there is enough available end market capacity in the U.S. and Canada to manage increases in rigid plastics collected and sorted, requiring at a minimum one new facility. The vast majority of capacity is available but that this capacity likely needs to be upgraded to handle additional grades. For some plastic covered material, including flexible and film plastics, it is likely that new end markets are needed.

For most covered material not within the plastic material class, such as glass, metal, and paper and fiber, adequate end market capacity currently exists, and necessary infrastructure investment and system changes are primarily related to effectively collecting and properly processing the material, rather than to new end market development. However, new facilities are likely needed to manage some paper and fiber CMCs such as aseptic and gable-top cartons. Small format covered materials have existing end market capacity, but they need additional infrastructure and technology to sort and clean them effectively.

## **Key Actions, Investments, and Opportunities**

### **Key Action: Increase access to and participation in collection of covered materials, especially in areas that currently have limited access.**

Increasing access to collection services may be most effective by using different strategies based on different characteristics of generators. Rural areas have the most limited access to onsite curbside collection; however, expanding access to onsite curbside collection may be infeasible or overly expensive in some areas. There are likely more cost-effective strategies to increase access to collection, including the expansion of existing drop-off locations (e.g., expanding collected material types or operating hours), developing new drop-off locations, and investment in alternative collection systems. Drop-off locations are likely to be a more cost-effective solution for many jurisdictions and regions with no or partial access to onsite curbside collection, specifically those with lower population densities.

### **Key Action: Reduce contamination in all material streams.**

Reducing contamination in all material streams will improve the quality of material reaching processing and end market facilities. This includes minimizing nonrecyclable items in the recycling stream, minimizing noncompostable items in the organics recycling stream, and minimizing the amount of recyclable and compostable materials in the landfill stream. Education and outreach are essential for promoting proper sorting and reducing contamination.

Decisions made early in the product lifecycle on material design and labeling will also influence requirements for education and outreach. Simplified packaging reduces confusion, minimizing the need for complex educational campaigns and behavior-change strategies. Recycling is simplified with fewer steps required to sort, deliver, and prepare materials for recycling.

### **Key Action: Increase capacity for recycling processing facilities to sort covered materials.**

In addition to accepting more covered material, recycling processing facilities will likely need to expand the types of covered material that they sort. Currently, hard-to-recover materials that are unlikely to be fully replaced in packaging applications, such as certain types of flexible and film plastics, may benefit from secondary processing to improve recovery. Based on feedback from interested parties and the contractor's experience with new facility construction in California, timing will be challenging for new facilities to be operational prior to 2032. Given the time needed for securing investment, design, permitting, construction, and hiring staff, planning for any new facilities should be prioritized early.

### **Key Action: Upgrade existing end markets to receive more material types and increase overall capacity with new facilities.**

Upgrading existing end markets and developing new ones will enable the recovery of a wider range of covered material, especially for flexible and film plastics. An example of expanding existing end markets includes upgrading Grade A PET end market facilities

in California, which currently accept mostly California Redemption Value (CRV) material, to also process Grade B PET bales, which contain a much higher proportion of covered material.

Small format items are another challenge to process and recover for end markets, which often end up at glass end market facilities in the form of contamination.

Upgrades required for end markets will be influenced by changes to material design, collection, and processing. A less complex and less contaminated inflow of material to end markets can both reduce system costs and reduce the environmental and public health impacts.

**Key Action: Facilitate stable markets for covered material and feedstock derived from covered material.**

Sustainable collection, processing, and recycling will depend on maintaining stable and sufficient market values for covered material and feedstock derived from covered material. This will ensure that all stages of the supply chain are able to sustain operations and standards necessary to meet the requirements of the Act. Market value and stability can be facilitated through the use of long-term contracts across the supply chain – between processors and end markets for the processed covered material, as well as between end markets for covered material and those that use feedstock derived from it. Additionally, market value and stability can be facilitated through strategies such as subsidizing the processing and recycling of covered material.

# 1 Introduction

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## 1.1 Background

The Plastic Pollution Prevention and Packaging Producer Responsibility Act (Senate Bill (SB) 54, Allen, Chapter 75, Statutes of 2022) (The Act), established an extended producer responsibility (EPR) program to manage single-use packaging and single-use plastic food service ware (covered material) in California. The Department of Resources Recycling and Recovery (CalRecycle) is required to conduct a statewide needs assessment to aid its implementation and investigate the actions and investments needed to meet the requirements of the Act.

The law requires that by 2032:

- Single-use plastic packaging and single-use plastic food service ware (plastic covered material) be source reduced by 25%.
- Covered material be recyclable or eligible to be labeled compostable.
- Plastic covered material achieve a 65% recycling rate.

Additionally, interim milestones require plastic covered material to achieve a 30% recycling rate by 2028 and a 40% recycling rate by 2030.

## 1.2 Study Overview

The Collection, Processing, and End Market Needs Assessment Study (CPEM Study) was conducted under contract (DRR24043) and is one component of the statewide needs assessment. The CPEM Study findings are divided into an analysis of the current state and the needed state of collection, processing, and end markets as they pertain to covered material and meeting the requirements under the Act. The CPEM Study includes three reports for the current state (collection, processing, and end markets) and one combined report for the needed state.

The CPEM Study spans the full value chain for the recovery of material that may be covered and addresses the following:

- **Collection:** Where material is collected for recycling and organics recycling, including curbside and alternative collection systems.
- **Processing:** Where the material is sorted, segregated, and prepared to meet specifications for sale to end markets.
- **End Markets:** Where the material is recovered to be used in lieu of virgin material to produce new or reconstituted products.

## 1.3 Needed State Report

This report identifies the actions and investments needed to meet the recyclability, compostability, and recycling rate requirements under the Act (i.e. the needed state). The report provides recommendations for the redesign of certain covered materials

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based on the identification of processing and end market barriers to become recyclable or compostable and how that informs the need for material redesign.

The report estimates the amounts and types of covered material that will need to be managed through collection programs, processing facilities, and end markets to meet the requirements of the Act, in addition to the associated actions, investments, and opportunities.

More specifically, this report focuses on:

- **Collection Programs**
  - Required expansions in the collection of covered materials, including the associated costs of enhancing collection services.
  - Measures to increase participation in collection programs to improve the capture rate of covered materials.
  - Environmental and public health implications resulting from expanded collection of covered materials.
- **Processing of Covered Materials**
  - Required increases in processing capacity at recycling and organics processing facilities, including the associated costs of expanding processing capacity.
  - Impacts of contamination on processing facilities and strategies to reduce outbound contamination.
  - Environmental implications of expanded processing capacity.
- **End Markets**
  - Needed development of new end markets and expansions of existing markets, including funding requirements associated with increased end market capacity.
  - Analysis of potential new end market locations and the associated cost implications.
  - Methods and costs for reducing contamination in recovered materials.
  - Marketability of recovered materials.
  - Environmental impacts of expanded end market capacity.
  - Approaches for assessing characteristics of responsible end markets to ensure sustainability and compliance.

## 1.4 Brief Approach and Methodology

This analysis relied heavily upon the Current State of Collection Report, Current State of Processing Report, and Current State of End Markets Report, among other data sources, as further described within Appendix A.

### 1.4.1 Overall Approach

The contractor first categorized every covered material category (CMC) into one of the following groups:

- Plastic covered material, which is subject to the 30% (by 2028), 40% (by 2030), and 65% (by 2032) recycling rate requirements of the Act.
- Nonplastic covered material, which is not subject to the recycling rate requirements of the Act, that have been deemed recyclable or compostable by CalRecycle as of the December 31, 2024.
- Nonplastic covered material, which is not subject to the recycling rate requirements of the Act, that have not been deemed recyclable or compostable by CalRecycle as of the December 31, 2024 CMC List update.

After categorizing the CMCs, the contractor evaluated the critical path barriers for achieving the requirements of the Act and explored potential solutions. The contractor identified CMCs that were not included in the tonnage flow model based on the evaluation of barriers and solutions. Solutions were not explored for covered materials that are not subject to the Act's recycling rate requirements and that are currently deemed recyclable or compostable because they were assumed to not need any further changes to meet the recyclability, compostability, or recycling rate requirements.

The contractor then created a tonnage flow model in order to estimate baseline tonnage flows of covered material from collection to processing to end markets as well as estimated tonnage flows in milestone years. The contractor estimated the amount of material that would be collected in all material streams, including material sent directly to markets. Based on the estimated amount collected and proxy recycling rates, the contractor then estimated the weight of each covered material category (CMC) that responsible end markets would need to accept in order to meet the proxy recycling rates across all milestone years. Based on the estimated amount to be accepted by end markets, the contractor also evaluated the weight of CMCs that must be sent to processing facilities prior to reaching end markets.

The tonnage flow model accounts for population growth, redesign of materials including shifting entire CMCs to another CMC, estimated tonnage reduction due to source reduction requirements for plastic covered material, processing loss, and end market loss to account for their potential impacts through all stages of material flow on the amount of covered material that needs to be collected, processed, delivered to end markets and converted by end markets to meet the proxy recycling rates.

The proxy recycling rates were used by the contractor to allow for estimations of tonnage flows given available data. These recycling rates are designated "proxy"

because they are not the official rates that CalRecycle published pursuant to Public Resources Code (PRC) section 42061(b)(1), and the rates were calculated solely for the purposes of this study. For a further description of the proxy recycling rate see section 2.2.

In the modeling conducted by the contractor, it was assumed that covered material capture and recovery will likely need to be optimized at each stage of the process to achieve the requirements of the Act. However, it is also acknowledged that material design and the type of plastic covered material entering the market will significantly impact the capture rates required and how difficult those capture rates are to achieve.

To inform modeling of actions and funding needed to meet the Act's requirements for each milestone year, the contractor used a combination of public engagement, desktop research, modeling, surveys, and listening sessions. A more robust description of how these sources and tools were utilized are included in Appendix A. Appendix C contains details on the Collection Survey, which was distributed to local jurisdictions throughout the state, and Appendix D focuses on the Community Recycling and Composting Survey, which was distributed to community-based organizations (CBOs), environmental justice groups (EJ groups), and California Native American Tribes (Tribes). In providing possible solutions for achieving the requirements of the Act, the contractor considered the timing of each intervention and the feasibility of achievement by milestone years.

#### **1.4.2 Collection Methodology**

The contractor estimated the tonnage of covered materials collected in each of the Act's milestone years (2028, 2030, and 2032), accounting for population growth, redesign of materials including shifting entire CMCs to another CMC, improvements in sorting behavior due to education and outreach and estimated tonnage reduction due to source reduction requirements for plastic covered material. This analysis was limited to residential and commercial tons collected through onsite curbside collection, direct haul by businesses, and certain alternative collection programs. This analysis did not consider tons collected through self-haul or drop-off facility programs due to data limitations but does discuss costs to increase local jurisdiction drop-off programs and types of alternative collection programs in sections 2.2.2 and 2.2.3, respectively.

Using the amount of material collected, the amount of material that is estimated as needing to be collected for recycling to meet the requirements of the Act, depending on the CMC in question, was then projected based on proxy recycling rate targets for milestone years. The amount of material that was projected as needing to be collected in the recycling stream was divided by the amount of all plastic covered material collected to estimate the projected collection rate for each milestone year. These collection rate projections are based on the methodology from Appendix A, section 2.F and integrate the impacts of the proposed design improvements for covered materials as further discussed in section 2.1. For further details on the calculation of collection rates in the curbside material collected for recycling stream see Appendix A, section 2.F.6.

Using the amount collected in all streams in 2024 as the basis, the contractor also estimated the amount collected in each material stream: recycling, organics recycling, and solid waste in each milestone year. The weight collected in each material stream was adjusted to account for education and outreach in future years that will improve proper sorting as well as material redesign choices. The contractor compared this amount to the projected amount that needs to be collected to identify whether further strategies are likely needed to increase the projected capture rate for certain CMCs.

The contractor estimated the statewide costs of providing access to onsite curbside collection for nonparticipating generators using information on areas of the state currently without full access to onsite curbside collection. For areas in which the contractor was not able to estimate statewide costs, the contractor provided more limited cost information about drop-off programs, alternative collection programs, and improving participation in curbside collection. The contractor also estimated statewide incremental costs of collection for covered and noncovered material combined. The contractor calculated the incremental costs based on movement of CMCs between collection streams using the Current State of Collection Report's cost per ton collected by region and material stream, accounting for inflation up to each milestone year.

### **1.4.3 Processing Methodology**

#### **1.4.3.1 Recycling Processing Facilities**

Based on the tonnage flow model, the contractor estimated the amount of material, by CMC processing group, that will reach recycling processing facilities in each of the milestone years. Based on these estimates and using data collected by direct engagement with facility operators through site visits and interviews, the contractor estimated potential costs associated with the improvements that may be needed for existing facilities to capture additional covered materials. Operators provided insight into potential operational improvements and limitations, including current facility conditions, equipment and technology utilization, feedstock characteristics (source control), staffing levels, site limitations, and marketability of recovered materials.

Using operator input, the contractor identified two primary types of improvements: capital and operational. Capital improvements include equipment upgrades, supporting infrastructure, and building modifications, while operational improvements primarily involve additional staffing. See Appendix A, section 3.A for more details.

Based on the tonnage flow model outputs, the contractor also evaluated potential costs associated with two new facility types: secondary processing facilities and MWP facilities. The costs of secondary processing facilities to manage additional plastic covered material were estimated. Additionally, the costs of new MWP facilities was evaluated as a potential opportunity to increase the capture rate of certain covered material by recovering additional covered materials from the solid waste stream, beyond what is collected in an onsite curbside collection or drop-off recycling programs. See Appendix A, section 3.A for more details.

### 1.4.3.2 Organics Processing Facilities

Based on the tonnage flow model, the contractor estimated the amount of material that will reach OPFs in each of the milestone years. The contractor estimated the improvements for OPFs to manage additional covered materials using data collected through direct engagement with facility operators via site visits, survey responses, and phone or virtual interviews. Operators provided insight into challenges and opportunities related to feedstock variability, contamination, equipment condition, technology utilization, site limitations, and marketability of end products, such as compost or digestate. The contractor estimated organics processing facility costs by categorizing facilities by size and technology type and assessing the capital and operational upgrades required to handle additional covered materials for organics processing. More details on the framework can be found in Appendix A, section 3.B.

The contractor evaluated the capital and operational improvements needed for OPFs to manage additional covered materials, such as fibers, molded pulp, and untreated wood. Because these materials represent only a portion of the total organics stream, the tonnage flow model isolates incremental investments to integrate them into existing operations, focusing on equipment upgrades, infrastructure expansion, and labor enhancements necessary to address their unique processing and contamination challenges.

### 1.4.4 End Markets Methodology

Based on the tonnage flow model, the contractor estimated the amount of plastic covered material, by CMC end market group, that is projected to reach end markets and be recycled, accounting for losses at end market facilities. The contractor consolidated findings from the Current State of End Markets Report and conducted primary and secondary research to gather information on existing recovery capacities at end market facilities, contamination issues, CMC conversion rates (i.e., end market recovery rate), and investment needs. The CMC conversion rate is the total recycled output produced by an end market facility divided by the total quantity of a CMC accepted by that specific facility. The CMC conversion rate excludes contamination.

As publicly available cost and performance data at end markets was limited due to commercial sensitivity, the contractor conducted extensive secondary research and filled gaps through targeted stakeholder interviews. Interviewees included recycling industry experts, trade associations, and facility operators. These interviews helped validate assumptions, clarify market behavior, and refine cost estimates.

Using the acquired information, the contractor mapped covered materials into broader material grades, each with its own recycling processes, end uses, and associated cost structures. The contractor assessed current and potential future capacities for each grade and estimated the quantity of material that must enter end markets (accounting for conversion rates) to achieve proxy recycling rates. The contractor then performed a funding gap analysis by comparing feedstock, and operations and capital costs against potential revenues and reasonable profit margins. Additional details on the methodology

supporting the needed state of end markets can be found in section 2.4 and Appendix A, section 4.

## 2 Analysis and Findings

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### 2.1 Design Improvements for Covered Materials

Material redesign will likely play a significant role in achieving the Act's recyclability, compostability, and recycling rates requirements. Upstream decisions by producers regarding the variety and composition of covered material have widespread downstream impacts on the state's recycling infrastructure and operations. Reducing the variety of plastic covered material may promote increased collection of plastic CMC tons because it could simplify educational materials, reduce generator confusion when sorting, and increase the quality of generator participation in collection programs. Processing facilities are currently designed to handle material that is prominent or economically viable to recover.

If covered materials were further simplified by strategically redesigning them into CMCs that are already familiar to generators in curbside collection programs, can be captured with existing processing technologies, and are efficiently converted by end markets (e.g., OCC, glass, rigid PET #1); the educational, economic, and recovery benefits could compound across the entire system.

The contractor reviewed every CMC in the December 31, 2024 CMC List update to identify barriers in collection, processing, or end markets. This analysis provides insight into potential interventions, by CMC, that can be undertaken for covered material to help meet the recyclability, compostability, and recycling rate requirements.

This analysis was also used by the contractor to make assumptions about which CMCs would be included in the modeling of the future system in the tonnage flow model. Some CMCs that were found to have existing challenges were not included in the tonnage flow model for future years. For the purposes of the tonnage flow model for future years, these CMCs were assumed to be replaced in covered material applications.

For the purpose of the tonnage flow model, CMCs that were deemed recyclable or compostable on the December 31, 2024, CMC list were included in future years of the tonnage flow model, other than two CMCs that were modeled to remove the plastic component to reduce contamination and costs reaching end markets (see Table 2-1). Generally, it was assumed that collection infrastructure is sufficient and that material within those CMCs are currently accepted by processors and end markets and used to generate recycled output, rather than being disposed of. Even if a CMC is considered recyclable or compostable, item-specific design improvements may still be necessary to ensure the item in question meets all relevant requirements to be considered recyclable or compostable.

For the purposes of the tonnage flow model, CMCs that were not deemed recyclable or compostable in the December 31, 2024, CMC list were reviewed to identify which would be included in the modeling for future years. CMCs that were found to have relatively limited viable strategies but had a high volume of covered material (e.g., flexibles and films of certain plastic resins), were included in the tonnage flow model for future years but will likely require significant intervention to meet the requirements of the Act. CMCs

that were found to have limited viable strategies to improve recyclability and compostability and have a lower volume of covered material (e.g., ceramics) were not included in the modeling for future years. For those CMCs, the contractor identified alternative CMCs that are currently recyclable or compostable or are anticipated to be in the future. The alternative CMCs were identified for the purposes of the modeling, but do not represent the only types of covered material that may be considered as a potential replacement. Additional investment in collection, processing, or end markets could also help overcome some of the identified barriers from this analysis.

For identifying an alternative CMC, it was first evaluated whether redesigning the CMC to remove the plastic component (e.g., move from CMC of molded fiber with a plastic component to molded fiber without a plastic component) was likely feasible and could help overcome the identified barriers. If a plastic covered material is redesigned to a nonplastic covered material, it excludes the redesigned material from the recycling rate requirements because those are specific to plastic covered material. Additionally, redesigning covered material to use less plastic supports the source reduction requirements of the Act.

If removing the plastic component is not anticipated to help overcome the identified barriers to recyclability and compostability, the contractor identified another alternative CMC. For example, 24\_C1N (ceramics all forms without plastic component) is assumed to be replaced by 24\_G1N (glass bottles and jars without plastic component) in the tonnage flow model as it is the most similar form of packaging that was deemed recyclable. The contractor's methodology for this process is further described in Appendix A, section 5.

Table 2-1 summarizes the identified barriers for each CMC that was not deemed recyclable or compostable in the December 31, 2024, CMC list. Column four identifies barriers for each CMC and the final two columns identify the alternative CMC assumed for the tonnage flow modeling.

**Table 2-1: Identified Barriers to Recyclability or Compostability by CMCs, and Modeled Alternative CMCs**

Category ID	CMC Material Type	CMC Material Form	Recyclability or Compostability Barriers	Included in Modeling?	Alternative CMC ID for Modeling	Alternative CMC Material Type and Form
24_G2N	Glass	Other Forms w/o plastic component	Processing barriers are assumed to be overcome given high rates of collection and strong end markets.	Yes	N/A	N/A
24_G2P	Glass	Other Forms w/ plastic component	Processing barriers are assumed to be overcome given high rates of collection and strong end markets.	Yes	N/A	N/A
24_C1N	Ceramic	All Forms w/o plastic component	Limited end markets and costly processing assumed to result in lack of collection and processing for recycling.	No	24_G1N	Mixed Glass Bottles and Jars - Non-CRV
24_C1P	Ceramic	All Forms w/ plastic component	Limited end markets and costly processing assumed to result in lack of collection and processing for recycling.	No	24_G1N	Mixed Glass Bottles and Jars - Non-CRV
24_C2N	Ceramic	Small – Two or more sides measuring 2” or less w/o plastic component	Limited end markets and costly processing assumed to result in lack of collection and processing for recycling.	No	24_G3N	Small Format – Glass without a plastic component

Category ID	CMC Material Type	CMC Material Form	Recyclability or Compostability Barriers	Included in Modeling?	Alternative CMC ID for Modeling	Alternative CMC Material Type and Form
24_C2P	Ceramic	Small – Two or more sides measuring 2” or less w/ plastic component	Limited end markets and costly processing assumed to result in lack of collection and processing for recycling.	No	24_G3N	Small Format – Glass without a plastic component
24_M2P	Aluminum	Foil sheets w/ a plastic component	Plastic components can create challenges for end markets.	No	24_M2N	Aluminum foil sheets without a plastic component
24_M3P	Aluminum	Foil Molded Containers w/ plastic component	Plastic components can create challenges for end markets.	No	24_M3N	Aluminum molded containers without a plastic component
24_M12P	Metal	Small – Two or more sides measuring 2” or less w/ plastic component	Processing barriers are assumed to be overcome with processing upgrades given strong end markets for metal.	Yes	N/A	N/A
24_PF14P	Molded Fiber	All Forms w/ plastic component	Limited end markets and need for enhanced sorting assumed to result in lack of collection and processing.	No	24_PF14N	Molded Pulp without a plastic component
24_PF15P	Multi-Material Laminate	Aseptic Cartons	Processing barriers are assumed to be overcome with processing and end market upgrades.	Yes	N/A	N/A

Category ID	CMC Material Type	CMC Material Form	Recyclability or Compostability Barriers	Included in Modeling?	Alternative CMC ID for Modeling	Alternative CMC Material Type and Form
24_PF5P	Multi-Material Laminate	Gable-top Cartons	Processing barriers and limited end markets are assumed to be overcome with processing and end market upgrades.	Yes	N/A	N/A
24_PF7P	Multi-Material Laminate	Other Forms w/ plastic component	Processing barriers are assumed to be overcome with processing and end market upgrades.	Yes	N/A	N/A
24_PF8N	OCC	Waxed Cardboard w/o plastic component	Collection and processing barriers are assumed to be overcome with processing and end market upgrades.	Yes	N/A	N/A
24_PF8P	OCC	Waxed Cardboard w/ plastic component	Collection and processing barriers are assumed to be overcome with processing and end market upgrades.	Yes	N/A	N/A
24_PF16N	Paper and Fiber	Small – Two or more sides measuring 2” or less w/o plastic component	Processing barriers are assumed to be overcome with processing and end market upgrades.	Yes	N/A	N/A

Category ID	CMC Material Type	CMC Material Form	Recyclability or Compostability Barriers	Included in Modeling?	Alternative CMC ID for Modeling	Alternative CMC Material Type and Form
24_P16P	Paper and Fiber	Small – Two or more sides measuring 2” or less w/ plastic component	Plastic components can create challenges for end markets.	No	24_P16N	Small Format – Paper without a plastic component
24_P11P	PVC (#3)	Rigid Items	Limited end markets and toxicity concerns assumed to result in lack of processing.	No	24_P2P	Plastic #1 - PET Pigmented Bottles, Jugs, Jars - Non CRV
24_P13P	LDPE (#4)	Bottles, Jugs and Jars	Processing barriers are assumed to be overcome with processing and end market upgrades.	Yes	N/A	N/A
24_P14P	LDPE (#4)	Other Rigid Items	Processing barriers are assumed to be overcome with processing and end market upgrades.	Yes	N/A	N/A

Category ID	CMC Material Type	CMC Material Form	Recyclability or Compostability Barriers	Included in Modeling?	Alternative CMC ID for Modeling	Alternative CMC Material Type and Form
24_P19P	PP (#5)	Utensils	Limited end markets and increased need for sorting small format items assumed to result in lack of processing.	No	N/A	Redesign to a wooden utensil without a plastic component would result in the utensil no longer being covered material (i.e., single-use nonplastic food service ware is not covered material)
24_P23P	PS (#6)	Expanded/Foamed Hinged Containers, Plates, Cups, Tubs, Trays, and Other Foamed Containers	Limited end markets and challenges with processing assumed to result in lack of collection and processing.	No	24_PF10N	Paperboard without a plastic component
24_P42P	PS (#6)	Other Expanded/Foamed Forms	Limited end markets and challenges with processing assumed to result in lack of collection and processing.	No	24_PF14N	Molded Pulp without a plastic component

Category ID	CMC Material Type	CMC Material Form	Recyclability or Compostability Barriers	Included in Modeling?	Alternative CMC ID for Modeling	Alternative CMC Material Type and Form
24_P27P	PS (#6)	Utensils	Limited end markets and increased need for sorting small format items assumed to result in lack of processing.	No	N/A	Redesign to a wooden utensil without a plastic component would result in the utensil no longer being covered material
24_P43P	PS (#6)	Solid Hinged Containers, Plates, Cups, Tubs, Trays, and Other Solid Forms	Limited end markets and enhanced need for sorting assumed to result in lack of processing.	No	24_P38P	Plastic #1 - Other PET Rigid
24_P44P	Plastics and Polymers Designed for Compostability	Rigid Items	Limited end markets and challenges with processing. Plastics not considered allowable input under USDA National Organic Program requirements.	No	24_P1P	Plastic #1 - PET Clear Bottles, Jugs, Jars - Non CRV
24_P5P	PET (#1)	Flexible and Film Items	Limited end markets and challenges in processing films assumed to result in lack of collection and processing.	No	24_P16P	Plastic #4 - Mono LDPE Flexibles and Films

Category ID	CMC Material Type	CMC Material Form	Recyclability or Compostability Barriers	Included in Modeling?	Alternative CMC ID for Modeling	Alternative CMC Material Type and Form
24_P10P	HDPE (#2)	Flexible and Film Items	Collection and processing barriers assumed to be overcome with collection, processing, and end market upgrades to accommodate certain types of flexible and film plastics.	Yes	N/A	N/A
24_P12P	PVC (#3)	Flexible and Film Items	Limited end markets, toxicity concerns, and challenges in processing films assumed to result in lack of collection and processing.	No	24_P22P	Plastic #5 - Mono PP Flexibles and Films
24_P15P	LDPE (#4)	Clear Non-Bag Film	Collection and processing barriers assumed to be overcome with collection, processing, and end market upgrades to accommodate certain types of flexible and film plastics.	Yes	N/A	N/A

<b>Category ID</b>	<b>CMC Material Type</b>	<b>CMC Material Form</b>	<b>Recyclability or Compostability Barriers</b>	<b>Included in Modeling?</b>	<b>Alternative CMC ID for Modeling</b>	<b>Alternative CMC Material Type and Form</b>
24_P16P	LDPE (#4)	Other Flexible and Film Items	Collection and processing barriers assumed to be overcome with collection, processing, and end market upgrades to accommodate certain types of flexible and film plastics.	Yes	N/A	N/A
24_P21P	PP (#5)	Clear Non-Bag Film	Collection and processing barriers assumed to be overcome with collection, processing, and end market upgrades to accommodate certain types of flexible and film plastics.	Yes	N/A	N/A
24_P22P	PP (#5)	Other Flexible and Film Items	Collection and processing barriers assumed to be overcome with collection, processing, and end market upgrades to accommodate certain types of flexible and film plastics.	Yes	N/A	N/A

Category ID	CMC Material Type	CMC Material Form	Recyclability or Compostability Barriers	Included in Modeling?	Alternative CMC ID for Modeling	Alternative CMC Material Type and Form
24_P29P	PS (#6)	Flexible and Film Items	Limited end markets and challenges in processing films assumed to result in lack of collection and processing.	No	24_P16P	Plastic #4 - Mono LDPE Flexibles and Films
24_P45P	Plastics and Polymers Designed for Compostability	Flexible and Film Items	Limited end markets and challenges with processing. Plastics not considered allowable input under USDA National Organic Program requirements.	No	24_P16P	Plastic #4 - Mono LDPE Flexibles and Films
24_P36P	Other/Mixed Plastics	Flexible and Film Items	Limited end markets and challenges in processing films assumed to result in lack of collection and processing.	No	24_P16P	Plastic #4 - Mono LDPE Flexibles and Films
24_P46P	Multi-Material Laminate	Pouches and Envelopes	Limited end markets and challenges with processing assumed to result in lack of collection and processing.	No	24_P10P	Plastic #2 - HDPE Flexibles and Films
24_P33P	Multi-Material Laminate	Other Forms	Limited end markets and challenges with processing assumed to result in lack of collection and processing.	No	24_P10P	Plastic #2 - HDPE Flexibles and Films

Category ID	CMC Material Type	CMC Material Form	Recyclability or Compostability Barriers	Included in Modeling?	Alternative CMC ID for Modeling	Alternative CMC Material Type and Form
24_P34P	Other/Mixed Plastics	Textiles	Limited end markets and challenges with processing assumed to result in lack of collection and processing.	No	24_PF1N	Kraft Paper without a plastic component
24_P35P	Other/Mixed Plastics	Rigid Items	Limited end markets assumed to result in lack of processing.	No	24_P20P	Plastic #5 - PP Rigid Items
24_P47P	Plastic	Small – Two or more sides measuring 2” or less	Processing barriers assumed to be overcome with processing and end market upgrades.	Yes	N/A	N/A
24_WO1P	Wood	All Untreated Forms w/ plastic component	Limited end markets. Plastics not considered allowable input under USDA National Organic Program requirements.	No	24_WO1N	Wood – Untreated without a plastic component
24_WO2N	Wood	All Treated or Painted Forms w/o plastic component	Limited end markets and toxicity concerns assumed to result in lack of collection and processing.	No	24_WO1N	Wood – Untreated without a plastic component
24_WO2P	Wood	All Treated or Painted Forms w/ plastic component	Limited end markets. Plastics not considered allowable input under USDA National Organic Program requirements.	No	24_WO1N	Wood – Untreated without a plastic component

<b>Category ID</b>	<b>CMC Material Type</b>	<b>CMC Material Form</b>	<b>Recyclability or Compostability Barriers</b>	<b>Included in Modeling?</b>	<b>Alternative CMC ID for Modeling</b>	<b>Alternative CMC Material Type and Form</b>
24_WO3N	Other/Mixed Organic	Textiles w/o plastic component	Limited end markets and challenges with processing assumed to result in lack of collection and processing.	No	24_PF1N	Kraft Paper without a plastic component
24_WO3P	Other/Mixed Organic	Textiles w/ plastic component	Limited end markets. Plastics not considered allowable input under USDA National Organic Program requirements.	No	24_PF1N	Kraft Paper without a plastic component
24_WO4N	Other/Mixed Organic	Other Forms w/o plastic component	Barriers with identification for organics processing assumed to result in material being screened out frequently.	No	24_WO1N	Wood – Untreated without a plastic component
24_WO4P	Other/Mixed Organic	Other Forms w/ plastic component	Limited end markets. Plastics not considered allowable input under USDA National Organic Program requirements.	No	24_WO1N	Wood – Untreated without a plastic component
24_WO6P	Wood and Other Organic Materials	Small – Two or more sides measuring 2” or less w/ plastic component	Limited end markets. Plastics not considered allowable input under USDA National Organic Program requirements.	No	24_WO6N	Small Format - Wood and Organics without a plastic component

The following subsections summarize the modeling of CMCs by material class, including a brief discussion of the barriers for different types of CMCs and other rationale for the proposed alternatives.

### **2.1.1 Glass Design Improvements**

All but two glass CMCs were deemed recyclable in the December 31, 2024, CMC List. Based on available data and assumptions, CalRecycle did not determine other forms of glass with and without a plastic component to be recyclable. However, the contractor assumed that with minimal upgrades, other forms of glass would likely be deemed recyclable in the future, given the strong processing and end markets for glass, thus no alternatives were proposed for CMCs in the glass material class within the tonnage flow model.

Glass covered materials with and without a plastic component are generally accepted in curbside collection programs across the state and many processing facilities already have technology to separate glass from other covered materials. Most processors send glass residue to a secondary processor or a glass end market for removal of contamination. Improved sortation through equipment upgrades and secondary processing could reduce the contamination, and increase recovery of covered materials, in the glass stream. Overall, glass end markets are estimated to be currently sufficient to manage existing glass covered material types.

### **2.1.2 Ceramics Design Improvements**

None of the ceramic CMCs were deemed recyclable in the December 31, 2024, CMC List. Ceramic covered materials have identified barriers for collection, processing, and end markets. Ceramic covered material is often removed by glass end market facilities as contamination, and there are limited end markets for post-consumer ceramics.

Ceramic covered material could be replaced by multiple packaging formats in specific use cases, however for the tonnage flow model the contractor assumed that all forms of ceramic covered material would be replaced with glass covered material. Ceramic single-use packaging is currently utilized as an alternative to those searching for plastic-free products, as well as retailers and manufacturers who want product packaging to be seen as unique and artisanal (this is common for beauty products as well as food and beverage items).<sup>1</sup> Therefore, glass was assumed to be the alternative given its similar properties and uses as single-use packaging and the strong processing technology and end market acceptance of glass covered materials.

Table 2-2 summarizes the modeled alternatives for ceramic covered materials starting in 2028.

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<sup>1</sup> APG Packaging. "Exploring the Elegance of Luxury Cosmetic Jars." *APG Packaging*. Accessed Nov. 2025.

**Table 2-2: Modeled Alternatives for Ceramic CMCs**

<b>CMC ID</b>	<b>CMC Material Type</b>	<b>CMC Material Form</b>	<b>Alternative CMC</b>
24_C1N	Ceramic	All Forms w/o plastic component	24_G1N (Glass bottles and jars w/o plastic component)
24_C1P	Ceramic	All Forms w/ plastic component	24_G1N (Glass bottles and jars w/o plastic component)
24_C2N	Ceramic	Small – Two or more sides measuring 2” or less w/o plastic component	24_G3N (Small format glass w/o plastic component)
24_C2P	Ceramic	Small – Two or more sides measuring 2” or less w/ plastic component	24_G3N (Small format glass w/o plastic component)

### **2.1.3 Metal Design Improvements**

All but one metal CMC was deemed recyclable in the December 31, 2024, CMC List. Based on available data and assumptions, CalRecycle did not have sufficient evidence to determine small format metals with a plastic component as recyclable. Even though aluminum foil sheets with a plastic component and aluminum foil molded containers with a plastic component were deemed recyclable in that CMC list, the contractor proposed that the plastic components be designed out of those materials to maximize recovery at end markets.

Most metal covered materials are widely accepted by processors and retain strong marketability, including high value at end markets. Both aluminum and steel materials can be recycled indefinitely while other ferrous and small format metals can be effectively recovered through the use of magnets. Therefore, most metal covered materials are not assumed to require redesign.

Aluminum foil (both sheets and molded containers) with plastic components was identified by the contractor as less desired than aluminum foil without plastic components. Additionally, processing equipment was identified as unable to efficiently separate foil with and without plastic components. Because the functionality of aluminum foil with and without plastic components as a single-use packaging is very similar, and end markets would prefer a more homogenous foil inbound stream, the contractor modeled alternative aluminum foil packaging without any plastic components. This may not be possible for some types of food contact packaging.

Table 2-3 summarizes the modeled alternatives for some metal CMCs starting in 2028.

**Table 2-3: Modeled Alternatives for Metal CMCs**

<b>CMC ID</b>	<b>CMC Type</b>	<b>CMC Form</b>	<b>Alternative CMC</b>
24_M2P	Aluminum	Foil sheets w/ a plastic component	24_M2N (Foil sheets w/o a plastic component)
24_M3P	Aluminum	Foil Molded Containers w/ plastic component	24_M3N (Foil molded containers w/o a plastic component)

### **2.1.4 Paper and Fiber Design Improvements**

Eleven of the 19 CMCs within the paper and fiber material class were deemed recyclable in the December 31, 2024, CMC List. Based on available data and assumptions, CalRecycle did not have sufficient evidence to deem small format paper, molded fiber with a plastic component, multi-material laminates, or waxed cardboard as recyclable. Eight of the 19 CMCs within the paper and fiber material class were deemed compostable in the December 31, 2024, CMC list, only including paper and fiber CMCs without a plastic component.

Most processors can sort paper and fiber to be marketed, as paper and fiber materials have economic value in end markets as a substitute for virgin wood and other plant-based fibers. As demonstrated in the Current State of End Markets Report, cardboard makes up the majority of paper and fiber covered materials accepted by end markets. For some paper and fiber CMCs, upgrades to collection, processing, and end markets may be needed.

Molded fiber with a plastic component is commonly used for single-use food service ware such as takeout containers, particularly for the containment and transfer of foods with a high moisture content or in liquid form. The plastic component supports the durability and functionality of this food service ware which guards against leakage or temperature control. However, these items were not deemed compostable as of December 31, 2024, because plastic is currently not an allowable input under the USDA National Organic Program (NOP). Additionally, the items have barriers to recycling due to food waste as a contaminant and lack of end markets for other lined paper. It may be most effective to consider whether molded fiber single-use food service ware without a plastic component is a viable alternative. This may be feasible for food items that do not have a high moisture content and are not liquids. Transitioning to wooden single-use food service ware without a plastic component would result in the food service ware no longer being covered material (i.e., single-use nonplastic food service ware is not covered material). Molded fiber with a plastic component may also be replaced with a reusable alternative. Additionally, there is potential for redesigning molded fiber single-use plastic food service ware for compostability rather than recyclability by replacing the

coating with materials that meet the USDA NOP<sup>2</sup>. Molded fiber with a plastic component can also be used for packaging. Molded fiber without a plastic component was modeled as the alternative CMC for molded fiber with a plastic component.

Small format paper and fibers with a plastic component are challenging to recover as most of this material ends up as residue in the glass stream and is ultimately disposed of. Small format paper and fiber without a plastic component were deemed eligible to be labeled compostable in the CMC list. There are end markets for small format fibers without a plastic component, however additional secondary screening steps are likely needed to sort them from other covered materials. Redesigning covered material in the small format paper and fiber CMC to exclude the plastic component should be considered, where feasible.

Table 2-4 summarizes the modeled alternatives for paper and fiber CMCs. Molded fiber with a plastic component was modeled to be replaced starting in 2030 while small format paper was modeled to be replaced starting in 2028.

**Table 2-4: Modeled Alternatives for Paper and Fiber CMCs**

CMC ID	CMC Material Type	CMC Material Form	Alternative CMC
24_Pf14P	Molded Fiber	All Forms w/ plastic component	24_Pf14N (Molded fiber without a plastic component)
24_Pf16P	Paper and Fiber	Small – Two or more sides measuring 2” or less w/ plastic component	24_Pf16N (Small format paper and fiber without a plastic component)

### 2.1.5 Plastic Design Improvements

Eleven of the 35 CMCs within the plastic material classes were deemed recyclable in the December 31, 2024, CMC List. Based on available data and assumptions, CalRecycle did not have sufficient evidence to deem flexible and film plastics of any resin, plastic-based textiles, or rigid forms of PVC #3, LDPE #3, PS #6, and Other/Mixed Plastic #7 as recyclable.

Covered materials within the plastic material class range in resin type and product form, which ultimately impact their recyclability. Some forms of rigid PET, rigid HDPE, and rigid PP are commonly used in consumer packaging and were deemed recyclable in the CMC list. However, other rigid plastics and most flexible or film plastics are not source separated at processing facilities and have limited end market acceptance. Several processors indicated that with additional space on site, increased value of the materials

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<sup>2</sup> “Molded Fiber Food Containers: Promise or Problem?” *Inline Plastics*, 16 June 2025. Accessed Nov. 2025.

processed, and/or with reimbursements for operational changes, processors could support acceptance of more material types. Therefore, the contractor considered end market acceptance and viability as the largest factor when considering whether a CMC was included in the tonnage flow model in future years, given that processors may be able to capture most forms of plastic covered material with sufficient investment in sorting technology.

### 2.1.5.1 Rigid Plastic Design Improvements

Rigid plastic covered materials are currently produced in all resin types (#1 through #7) with multiple forms such as bottles, jugs, jars, cups, lids, containers, and utensils. The current recyclability of these rigid plastics is limited to PET, HDPE, and PP. They are commonly used in covered material for both food and nonfood applications and have a relatively strong end market. While rigid LDPE currently has limited end markets, with increased processing technology to sort LDPE into an HDPE bale, end markets will likely become available. Small format plastics are anticipated to be recovered through upgrades to processing to remove small format rigid plastics from glass residue material.

The remaining rigid resins and formats were evaluated based on processing and end market barriers applicable to each. PVC is currently being phased out internationally due to health concerns, is not sufficiently collected in curbside collection programs to generate enough material for source separation and currently has limited end markets.<sup>3,4</sup> New end markets are not anticipated to be developed for PVC in the future. Use of PVC in single-use packaging can be replaced with alternative resins that are both less harmful and more readily accepted at end markets.

Sorting for utensils at processing facilities is challenging due to their small size, but with implementation of increased sorting technology it can be achieved. An alternative to increasing processing capabilities for utensils is to transition to wood without a plastic component. Redesigning from a plastic utensil to a wooden utensil without a plastic component would also result in the utensil no longer being covered material (i.e., single-use nonplastic food service ware is not covered material).

All rigid PS plastics, both expanded/foamed and solid, currently have limited end markets available and are anticipated to have limited development of new end markets. Many processing facilities do not accept PS in curbside collection for recycling due to this barrier and because expanded PS is brittle and creates processing challenges. Replacement with an alternative material is a potential strategy for all expanded PS covered material with the recognition that some source-separated expanded PS that requires no additional processing may have available end markets.

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<sup>3</sup> Helsenki. "ECHA Identifies Risks from PVC Additives and Microparticle Releases." *European Chemical Agency*, 28 Nov. 2023. Accessed Nov. 2025.

<sup>4</sup> Parkinson, Lindsey. "Agencies from US and EU Scrutinizing Safety of PVC." *Food Packaging Forum*, 12 Jan. 2024. Accessed Nov. 2025.

PS covered material could potentially be redesigned into a fiber-based alternative with a coating that meets the USDA NOP requirements. Paperboard without a plastic component was the modeled alternative for expanded PS food service ware. Molded fiber without a plastic component was the modeled alternative for all other forms of expanded. Solid hinged containers and other solid forms (other than utensils) of PS were modeled with the alternative of a similar form of PET to maintain function while also transitioning to a CMC that is deemed recyclable.

Other mixed plastics have limited to no end markets and rigid polypropylene was modeled as the alternative CMC.

Table 2-5 summarizes the modeled alternatives for various rigid plastic CMCs starting in 2028.

**Table 2-5: Modeled Alternatives for Rigid Plastic CMCs**

CMC ID	CMC Material Type	CMC Material Form	Alternative CMC
24_P11P	PVC (#3)	Rigid Items	24_P2P (PET #1 Bottles, Jugs, and Jars Pigmented/Color)
24_P19P	PP (#5)	Utensils	24_WO6N (Small format wood without a plastic component)
24_P23P	PS (#6)	Expanded/Foamed Hinged Containers, Plates, Cups, Tubs, Trays, and Other Foamed Containers	24_PF10N (Paperboard without a plastic component)
24_P27P	PS (#6)	Utensils	24_WO6N (Small format wood without a plastic component)
24_P42P	PS (#6)	Other Expanded/Foamed Forms	24_PF14N (Molded Fiber without a plastic component)
24_P43P	PS (#6)	Solid Hinged Containers, Plates, Cups, Tubs, Trays, and Other Solid Forms	24_P38P (PET #1 Other Rigid Containers, Cups, Lids, Plates, Trays, Tubs)
24_P35P	Other/Mixed Plastics	Rigid Items	24_P20P (PP #5 Other Rigid Items)

### 2.1.5.2 Flexible and Film Plastic Design Improvements

Potential processing improvements to recover flexible and film plastic material include adding optical sorters and secondary processing of mixed flexibles and films. While flexible and film plastic of many resin types are a common packaging material, current end markets are generally limited to HDPE and LDPE and have limited acceptance of

post-consumer film plastics. End markets have potential to be developed for PP flexibles and film, but other resin types were considered likely to have limited future end markets. PP flexibles and film make up more than a third of the estimated 2024 plastic film generation and this material offers certain properties such as its stiffness for standup pouches or heat resistance for microwavable products that are difficult to replicate in other resin types. Flexibles and films, regardless of their resin type currently pose challenges for processing.

Simplifying the types of flexibles films may allow for simplified processing as well as a greater amount of recoverable material to create stable end markets. PET, PS and other/mixed plastics flexibles and films were modeled to be replaced by LDPE flexibles and film. PP flexibles and film were the modeled alternative to PVC flexibles and film. Monolayer films are likely to be more easily managed by processors and end markets.

Other mixed plastic textiles was given the modeled alternative of kraft paper because covered material plastic textiles are likely to consist of bags and other smaller fabric.

For pouches, envelopes, and other forms of plastic-dominant multi-material laminates, many onsite curbside collection programs are not currently collecting this material. HDPE flexible and film was the modeled alternative for these forms of multi-material laminate.

Table 2-6 summarizes the modeled alternatives for various flexible and film plastic starting in 2028.

**Table 2-6: Modeled Alternatives for Flexible and Film Plastic CMCs**

CMC ID	CMC Material Type	CMC Material Form	Alternative CMC
24_P5P	PET (#1)	Flexible and Film Items	24_P16P (LDPE #4 Other Flexible and Film Items – Mono LDPE)
24_P12P	PVC (#3)	Flexible and Film Items	24_P22P (PP #5 Other Flexible and Film Items – Mono PP)
24_P29P	PS (#6)	Flexible and Film Items	24_P16P (LDPE #4 Other Flexible and Film Items – Mono LDPE)
24_P36P	Other/Mixed Plastics	Flexible and Film Items	24_P16P (LDPE #4 Other Flexible and Film Items – Mono LDPE)
24_P34P	Other/Mixed Plastic	Textiles	24_PF1N (Kraft paper w/o a plastic component)
24_P46P	Multi-Material Laminate	Pouches and Envelopes	24_P10P (HDPE #2 Flexible and Film Items – Mono HDPE)
24_P33P	Multi-Material Laminate	Other Forms	24_P10P (HDPE #2 Flexible and Film Items – Mono HDPE)

### 2.1.5.3 Plastic and Polymers Designed for Compostability Design Improvements

Plastic and polymers designed for compostability currently have limited processor acceptance and limited end markets. As noted in the Current State of Processing Report, most surveyed composting and in-vessel digestion facilities indicated that they currently screen these materials out due to challenges with distinguishing them from noncompostable look-alikes and concerns with the quality and marketability of their recycled organic products. Additionally, at this time, plastics and polymers designed for compostability are not considered an acceptable compost feedstock for organic agriculture under the U.S. Department of Agriculture’s (USDA) National Organic Program (NOP) regulations. Under current NOP regulations, the only synthetic materials acceptable as compost feedstocks are newspapers or other recycled paper such as cardboard without glossy coatings or colored ink.

PET #1 bottles, jugs, and jars was the modeled alternative for rigid plastics designed for compostability. LDPE #4 flexible and film plastic (mono LDPE) was the modeled alternative for flexible and film plastics designed for compostability.

Redesigning single-use packaging to remove plastics designed for compostability, while requiring initial education and outreach, would potentially simplify education in the long term since there would be a reduced need to differentiate the type of plastic when

selecting the proper bin or collection method. Such a transition may yield significant increases in the collection of flexible and film plastic.

Table 2-7 summarizes modeled alternatives for plastics designed for compostability CMCs starting in 2028.

**Table 2-7: Modeled Alternatives for Plastics and Polymers Designed for Compostability**

CMC ID	CMC Type	CMC Form	Alternative CMC
24_P44P	Plastics and Polymers Designed for Compostability	Rigid Items	24_P1P (PET #1 Bottles, Jugs, and Jars Clear/Natural)
24_P45P	Plastics and Polymers Designed for Compostability	Flexible and Film Items	24_P16P (LDPE #4 Other Flexible and Film Items)

### 2.1.6 Wood and Organic Material Design Improvements

None of the 10 CMCs within the wood and other organic materials material class were deemed recyclable in the December 31, 2024, CMC List. Three of the 10 CMCs were deemed eligible to be labeled compostable.

Treated wood or painted wood are not recyclable or compostable as it cannot be chipped, ground, or mulched and thus is often disposed of in landfills due to its potentially hazardous chemicals. Similarly, some end markets will not accept wood with coatings or plastic components. Other organic materials used in packaging, such as bamboo, do not have currently identified end markets. Untreated wood without a plastic component was the modeled alternative for these CMCs.

The organic textile CMC likely to consist of bags and other small fabric may be redesigned into a kraft paper bag or sleeve that will function similarly to organic materials but is deemed recyclable. Small format wood and other organic items with a plastic component may be redesigned to remove the plastic component.

Table 2-8 summarizes for the modeled alternatives for wood and other organic CMCs starting in 2028.

**Table 2-8: Modeled Alternatives for Wood and Other Organic CMCs**

CMC ID	CMC Material Type	CMC Material Form	Alternative CMC
24_WO1P	Wood	All Untreated Forms w/ plastic component	24_WO1N (Untreated wood w/o a plastic component)
24_WO2N	Wood	All Treated or Painted Forms w/o plastic component	24_WO1N (Untreated wood w/o a plastic component)

CMC ID	CMC Material Type	CMC Material Form	Alternative CMC
24_WO2P	Wood	All Treated or Painted Forms w/ plastic component	24_WO1N (Untreated wood w/o a plastic component)
24_WO3N	Other/Mixed Organic	All Other Textiles	24_PF1N (Kraft paper w/o a plastic component)
24_WO3P	Other/Mixed Organic	All Other Textiles	24_PF1N (Kraft paper w/o a plastic component)
24_WO4N	Other/Mixed Organic	Other Forms w/o plastic component	24_WO1N (Untreated wood w/o a plastic component)
24_WO4P	Other/Mixed Organic	Other Forms w/ plastic component	24_WO1N (Untreated wood w/o a plastic component)
24_WO6P	Wood and Other Organic Materials	Small – Two or more sides measuring 2” or less w/ plastic component	24_WO6N (Small format wood and other organic materials w/o a plastic component)

## 2.2 Collection Programs for Covered Materials

The contractor created a tonnage flow model designed to project the amount of plastic covered material, by CMC, that will be collected in all material streams and the amount collected in the recycling stream in the milestone years. The projected tons of plastic covered materials collected reflect the impact of both waste stream composition interventions and CMC-level interventions. Waste stream composition interventions refer to factors that influence the distribution of covered materials among the three collection streams, such as changes in sorting behaviors as a result of education or improved labeling. CMC-level interventions refer to other changes that result from material design changes and reductions due to source reduction of plastic covered material (see section Appendix A, section 2.F.2 for further information).

The contractor integrated the impact of the Act’s source reduction requirements for plastic covered material by applying overall tonnage decreases across CMCs with a plastic component and the plastic covered material class to achieve each year’s respective source reduction targets. Refer to Appendix A, Table A-18 and A-19 for the reductions applied by milestone year and calculations supporting achievement of these reductions.

The outputs of the tonnage flow model allowed the contractor to estimate the amount of plastic covered material, by CMC, that is needed to be accepted by responsible end markets to meet the recycling rate requirements, using a calculated proxy recycling rate Needs Assessment Report on The Needed State of Collection, Processing, and End Markets

for 2024 and each milestone year. This rate is a proxy because instead of estimating generation of plastic covered material, it estimates the amount of plastic covered material collected via residential and commercial onsite curbside collection, alternative collection programs, and materials delivered directly to end markets (as described in Appendix A, section 2.F) and does not consider jurisdictional drop-off, covered material that is littered or released into the environment prior to reaching a collection system, material that ends up at end markets that are not considered responsible end markets, or material disposed via transformation, self-haul or Engineered Municipal Solid Waste conversion (EMSW).

For each milestone year, the contractor calculated the proxy recycling rate for plastic covered material, by CMC, as:

$$R_{Proxy} = \frac{T_{EM,AI}^{CMC}}{T_{All,AI}^{CMC}}$$

$T_{EM,AI}^{CMC}$  = After waste stream composition and CMC-level interventions, the tonnage of plastic covered material that end markets convert into a recycled product to be used in lieu of virgin material.

$T_{All,AI}^{CMC}$  = After waste stream composition and CMC-level interventions, the tonnage of plastic covered material collected across all three collection streams, including alternative collection programs and business-to-business sources.

This metric provides an approximate method to assess whether plastic covered materials, by CMC, are likely to meet the recycling rate requirements based on the modeled parameters. The contractor estimated future anticipated processing loss rates and end market CMC conversion rates, as summarized in Appendix A, Tables A-20 and A-21. These processing loss rates and end market CMC conversion rates influence the collection rate needed to reach the proxy recycling rates. The processing loss rates and CMC conversion rates also informed an iterative process that determined whether additional targeted interventions might be needed at each stage of the material flow to reach the proxy recycling rates.

In addition to the tonnage flow model, the contractor evaluated the expansion of onsite curbside collection to nonparticipating generators, increased local jurisdiction drop-off collection programs, and expansion of alternative collection programs. The contractor also evaluated mechanisms to improve convenient access to collection programs, educate effectively, provide additional collection opportunities, monitor compliance with collection programs, and overcome cost barriers for generators. Environmental, socioeconomic, and public health impacts are also further discussed, specifically surrounding the anticipated impacts from expanding and adding new onsite curbside collection programs.

In order for plastic covered material to reach the proxy recycling rates by CMCs, it will likely require that more than 60% of California's population have access to collection for recycling for that CMC. As such, the contractor assumed that for those CMCs the improvements to collection program access required for plastic covered material to meet the proxy recycling rate would also satisfy the required collection in PRC section Needs Assessment Report on The Needed State of Collection, Processing, and End Markets

42355.51(d)(2)(A), which is one of the categorical requirements to be deemed recyclable. The contractor also assumed that the improvements for plastic covered material would simultaneously improve the collection of similar nonplastic covered material and help those similar CMCs satisfy the requirements to be deemed recyclable. For example, improving collection of kraft paper with a plastic component is assumed to improve the collection of kraft paper without a plastic component.

### **2.2.1 Current Collection of Plastic Covered Materials in Onsite Curbside Collection Programs**

The contractor calculated the current collection rates for plastic covered materials to gauge the current participation in, and performance of, onsite curbside collection programs and material delivered directly to end markets. Refer to Appendix A, Table A-8 for data supporting this calculation. A total of 16,168,681 tons of covered materials were estimated to be collected in 2024, combining 12,799,590 tons collected from onsite curbside collection and 3,369,091 tons delivered directly to end markets. Of this total, 8,125,149 tons of CMCs were estimated to be plastic covered materials.

Of the 8,125,149 plastic covered material tons collected, 3,052,471 tons were materials collected for recycling stream and 25,857 tons were sent directly to end markets. Meaning, only 38% of collected plastic covered material tons were obtained from the materials collected for recycling stream. These tons were then delivered to recycling processing facilities for processing, delivered to end markets for recovery, and reintroduced into the marketplace as a replacement for virgin plastic material in production. Currently, most plastic covered material tons collected in the solid waste stream are disposed of rather than recovered by end markets. Similarly, plastic covered material tons that are collected in the materials collected for organics recycling stream are often screened out and disposed of (refer to section 2.1.5.3 for additional information) or degraded through the organics conversion process, if applicable, and are not reintroduced into the marketplace as a replacement for virgin plastic material. This highlights the need to further direct plastic covered material to collection for recycling from the disposal and organics recycling streams, especially in source separated systems, in order to achieve the required recycling rates.

### **2.2.2 Increasing Local Jurisdiction Drop-Off and Self-Haul**

As identified in the Current State of Collection Report, local jurisdiction drop-off programs vary widely in their operations and the customers that they serve (residential and/or commercial generators). Some sites are considered “attended drop-off” which includes onsite personnel, while others are “unattended drop-off sites” that lack onsite personnel. Additionally, the materials accepted vary widely with some solely accepting refuse, while others receive covered materials on a source-separated basis. Given the logistical and economic challenges with expanding onsite curbside collection to certain areas of the state, including rural areas, expansion of collection through jurisdiction drop off and self-haul is likely to be an effective method to expand access to collection of covered material, including expansion of the types of covered material accepted and access to drop off sites (e.g., location and operating hours). The contractor identified the

most common collection costs associated with drop-off and self-haul sites, which include labor, collection container, and transportation costs.

### 2.2.2.1 Labor Costs

Labor rates vary widely throughout different regions of the state. The contractor aggregated labor rates, inclusive of benefits, for sustainability specialists and recycling coordinators from recycling service provider (RSP) competitive procurements conducted by local jurisdictions. The labor rates were then inflated to 2024 dollars using consumer price index for the relevant region of the state. Based on this modeling, it is estimated that in 2024 dollars, labor costs for an attended drop-off facility will range between \$36.88 and \$61.96 per employee per hour, inclusive of benefits. The annual labor charges for each site will vary based on the site's operating hours and number of site users, which greatly vary statewide. While more limited operating hours will reduce the annual labor costs, it may also decrease convenience which is likely to impact participation. Assuming that a facility is open eight hours per day, six days per week, 52 weeks per year, it is projected that it would approximately cost between \$92,052 and \$154,652 per year to have a single attendant onsite. To assist with proper separation and mitigate illegal dumping, it is preferable to utilize an attendant onsite.

### 2.2.2.2 Collection Containers and Transportation Costs

The cost of collecting source-separated materials for recycling and organics recycling will also vary based on the type of collection containers utilized on each site. For the purposes of this study, the contractor assumed that drop-off sites will utilize bins with a capacity ranging from 1 to 8 cubic yards. Utilization of bins will allow for the containers to be collected by front-end load vehicles primarily on existing collection routes; although there are a few areas that may require additional routing. In areas that do not have onsite curbside collection, it may be more appropriate to utilize roll-off containers which have a larger volume which will allow for less frequent collection and increased cost efficiencies. Per the Current State of Collection Report, costs per ton for collection of materials for recycling ranges from \$587 in the Southern Region to \$720 in the Coastal Region. The costs per ton include the amortization of collection containers, along with other associated operating costs.

### 2.2.3 Increasing Alternative Collection Programs

As discussed in the Current State of Collection Report, alternative collection programs come in many forms, such as drop-off at third-party or public locations, mail-back, retail take-back, and business-to-business programs. Alternative collection programs that accepted primarily covered material were often limited by the acceptance only of specific brands or materials purchased through specific retailers.

Alternative collection programs are likely to be an effective strategy to capture specific types of covered materials. This includes covered material that is challenging to recover when placed for collection in recycling streams (e.g., flexibles and films, small format items) and CMCs with low existing collection rates, including some flexible and film plastics and certain types of paper CMCs.

Scaling alternative collection programs to significantly impact the collection rate of covered materials will require the development of collection and other infrastructure as well as implementation of educational programming regarding proper participation. Barriers that prevent generators' participation in existing alternative collection programs, such as lack of awareness, cost, and convenience, will need to be overcome to ensure successful implementation of expanded programming. Targeted, multilingual, educational campaigns that appeal to the values of individual communities along with free or reduced services can support increased participation, particularly for priority populations. Engagement with retailers, producers of covered materials, and businesses will also be necessary to expand the number of alternative collection options and accepted material types. See section 2.2.6 for additional information on education and engagement strategies that may support the expansion of alternative collection programs.

Table 2-12 lists CMCs that were estimated to require significant increases in collection rates by 2028. It may be effective to target these materials for additional strategies such as drop-off or alternative collection programs.

It may be most effective to develop infrastructure so that it can be adapted to accept other types of covered materials in the future and can be coordinated with existing infrastructure, such as the state's existing Beverage Container Recycling Program redemption centers. After collection of the materials in Table 2-12, the materials identified in Table 2-14 and Table 2-16 are next priority, as those are estimated to require substantial increases in collection rates to meet the 2030 and 2032 requirements.

The materials assumed to need supplemental collection through alternative collection programs may also vary over time depending on the speed at which processing infrastructure and technology are developed. For example, work can be conducted in 2026 to support establishing a robust network of retail partners to collect small format plastics and provide them with funding and resources to establish collection sites (e.g. collection containers, staffing). These same resources could then be shifted to support the collection of rigid HDPE items starting in 2030. Once infrastructure is established, public education and outreach can adapt to specific material types and programs to ensure that people know how to use all types of applicable collection systems. Utilizing this adaptable approach of focusing on strong retail and business partners, and adequately resourcing collection sites may reduce the risk of stranded alternative collection program assets that become obsolete once more processing infrastructure and technology come online that can support more convenient collection of covered materials through onsite curbside collection.

The following subsections describe the expansion of different types of alternative collection programs to support the collection of covered materials, including considerations of cost, collection rates, benefits, and challenges. Any reference to specific programs, retailers, or alternative collection programs are discussed for example purposes only. The examples discussed are not considered by the contractor to be the most common or most successful, and the contractor acknowledges that there are other programs not discussed in this report. Cost and tonnage estimates presented

in this section are based on self-reported statistics by companies via their websites or direct inquiry. For comparative purposes, the contractor assumed all materials collected and/or diverted through these alternative collection programs would have otherwise been sent to landfill.

### 2.2.3.1 Mail-Back Programs

The contractor identified mail-back programs as offering the most comprehensive alternative collection options for covered materials, even though most mail-back programs focus on materials that are not accepted in onsite curbside collection and are difficult to sort at processing facilities.

For example, mail-back programs offered by TerraCycle<sup>5</sup> and Ridwell<sup>6</sup> accept covered materials such as film plastic, small plastics (beauty items), and multi-material laminates (food wrappers and pouches).

TerraCycle offers some brand-specific product and packaging recycling programs at no cost to generators, such as Arm & Hammer, Brita, Burt's Bees, Takis, and Taco Bell, and paid boxes that generators purchase and fill with material for recovery. TerraCycle's least expensive Zero Waste Box™ collects diaper and wipe packaging for \$88 to \$161 (depending on box size), whereas the All-In-One Zero Waste Box™ accepts mixed recycling from any brand for \$241 to \$581. TerraCycle received 17,490 shipments of collected material for recycling from California in 2024, totaling an estimated 93,000 pounds (46.5 tons).<sup>7</sup>

Alternatively, Ridwell's mail-in program allows generators to return a much smaller list of materials for \$9 per bag (after a \$30 initiation fee). Ridwell advertises that it has kept "29 million pounds of recyclable and reusable material out of the waste stream" through all programs since 2018 (this figure is not specific to California or to specific material groups,<sup>8</sup> and equates to an estimated 4,800,000 pounds [2,416 tons] per year if spread equally over six years).

Based on the numbers presented above, and assuming all materials collected are covered materials under the Act, the annual tonnage of material collected by Ridwell and TerraCycle for recycling represents 0.04% of the estimated tons of covered materials sent to landfill in 2024. For this program, the composition of covered materials and noncovered materials is unknown and, therefore, the contribution of these programs to the collection of covered material may be lower than estimated.

TerraCycle reported that mixed boxes of material for recycling cost more to process than those that collect a single material, due to time required by staff to manually sort

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<sup>5</sup> "Recycle the Unrecyclable with TerraCycle®." *TerraCycle*.

<sup>6</sup> "The Simple Way to Recycle More from Anywhere." [Ridwell.com](https://www.ridwell.com). Accessed Nov. 2025.

<sup>7</sup> Golden, Ali. "TerraCycle RFI Response - ca SB 54." Received by Colleen Foster and Phil Mainolfi, 29 Oct. 2025.

<sup>8</sup> "The Simple Way to Recycle More from Anywhere." [Ridwell.com](https://www.ridwell.com). Accessed Nov. 2025.

materials upon receipt. However, as TerraCycle’s operations scaled and were refined over time, collecting more materials per box and more materials overall, operational costs for two of their programs decreased.<sup>9</sup> Allowing generators to use these programs, regardless of brand or manufacturer, can ensure convenience and simplicity for participants and keep costs reasonable as the programs scale over time. Expansion of mail-back programs would require investment in packaging and shipping, as well as substantial education and outreach (see section 2.2.6.2), and processing infrastructure and staffing to receive and sort collected materials. Additionally, equitable and convenient access to transportation and postal services, as well as computers, printers, and/or the internet, to print shipping labels for participants should be considered, especially for priority populations who may have the largest barriers to access these programs.

### 2.2.3.2 Retail Take-Back

Some retailers, such as Nespresso<sup>10</sup> and Pet Supplies Plus, offer retail take-back programs in their brick-and-mortar locations in addition to free mail-back programs. Retail take-back programs are often limited to the packaging and/or products that are sold by that specific retailer. Pet Supplies Plus, in partnership with TerraCycle, has collected and recycled 50 tons of flexible pet food packaging in less than two years through retail-take back programs in all 743 of their national retail stores, regardless of brand.<sup>11</sup>

Inclusive models, similar to the Sephora “Beauty (Re)Purposed” program in partnership with Pact Collective,<sup>12</sup> accept all beauty products (not just those purchased from Sephora), increasing the potential capture of materials for recycling. Sephora’s decade-long partnership with g2 revolution, a specialty recycling solutions company, now supporting “Beauty (Re)Purposed” and Pact Collective, has diverted “23.7 million pounds of returned, damaged or expired cosmetic product waste from landfills.”<sup>13</sup> This equates to 11,850 total tons diverted, or roughly 1,185 tons diverted annually over 10 years.

Under the assumption that all material collected through these programs is covered material, the annual tonnage of material collected by Pet Supplies Plus and Sephora

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<sup>9</sup> Golden, Ali. “TerraCycle RFI Response - ca SB 54.” Received by Colleen Foster and Phil Mainolfi, 29 Oct. 2025.

<sup>10</sup> Nespresso. “Choose to Recycle.” [Nespresso.com](https://www.nespresso.com), 2024.

<sup>11</sup> Golden, Ali. “TerraCycle RFI Response - ca SB 54.” Received by Colleen Foster and Phil Mainolfi, 29 Oct. 2025.

<sup>12</sup> Sephora. “Beauty (Re)Purposed.” [Sephora.com](https://www.sephora.com). Accessed Nov. 2025.

<sup>13</sup> Sephora. “Sephora Launches Sustainable Empties Collection Program, Beauty (Re)Purposed, to Help Reduce Packaging Waste.” [Sephora.com](https://www.sephora.com), 21 Apr. 2023.

represents approximately 0.02% of the estimated tons of covered materials sent to landfill in 2024.

One challenge with retail take-back programs is that many products are purchased online and consumers may not have access to brick-and-mortar retail locations within a reasonable geographic vicinity. The contractor suggests expansion of both mail-in and retail take-back programs together to effectively increase covered material collection and keep costs low for program participants. Expansion would be dependent on the participation of retailers to host or sponsor these types of alternative collection programs. As such, strong engagement and collaboration with the retail industry would be a significant benefit. This could be accomplished through outreach via industry groups with existing retail connections (such as Pact Collective) as well as direct outreach to corporate entities (specifically those with sustainability and/or environmental, social, and governance [ESG] initiatives).

### 2.2.3.3 Third-Party Drop-Off

As discussed in the Current State of Collection Report, free third-party drop-off programs are common for plastic bags and film plastics at retailers such as Target, Walmart, Kroger, Safeway and all its associated stores, Whole Foods, Home Depot, and Lowes. According to the GreenBlue/SPC California Regional Film & Bag Study published in 2022, 17.45 million pounds of plastic film and bags are collected annually through store drop-off programs, with 85 to 90% of that being recovered.<sup>14</sup>

Assuming 100% diversion, 17.45 million pounds is equal to 8,725 tons, representing only 0.9% of the estimated tons of flex and film plastic sent to landfill. The amount of covered material collected likely represents a much smaller percentage of the total covered materials sent to landfill as much of the plastic film and bags collected through these programs is not covered material.

Infrastructure expansion may include adding collection kiosks or collection containers to new or existing drop-off sites and increased staffing to support sorting of covered materials, site coordination, and participant engagement and education (see section 2.2.6). Participation may be improved if third-party drop-off programs are: (i) co-located with, or in close proximity to, other locations where generators routinely travel; and (ii) easily accessible via public transportation systems. For example, TerraCycle has sponsored drop-off locations at schools, places of worship, and doctors' offices.<sup>15</sup> As drop-off sites become more ubiquitous, the contractor suggests careful planning and oversight of publicly accessible drop-off locations to ensure containers do not overflow and turn into illegal dump sites.

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<sup>14</sup> Sustainable Packaging Coalition, et al. "GreenBlue/SPC California Regional Film & Bag Study Results - Sustainable Packaging Coalition." *Sustainable Packaging Coalition*, 15 Nov. 2022. Accessed Nov. 2025.

<sup>15</sup> Golden, Ali. "TerraCycle RFI Response - ca SB 54." Received by Colleen Foster and Phil Mainolfi, 29 Oct. 2025.

### 2.2.3.4 Buy-Back

As stated in the Current State of Collection Report, buy-back programs offer payment to generators for materials collected for recycling. Buy-back collection programs are largely dependent on the economic value of the collected covered material, which may limit their feasibility. However, expanding buy-back collection programs may result in a faster rate of increased collection, particularly in communities that may benefit from the economic incentives associated with buy-back collection programs. Forty percent of community-based organization (CBO) and environmental justice group (EJ group) respondents stated that they were “very motivated” to participate in recycling programs by earning extra income and 50% stated that they already participate in CRV recycling programs.<sup>16</sup> Buy-back programs may be useful for covered materials that require substantial increases to collection rates in order to meet the Act’s milestone recycling rates, such as those identified in Table 2-12, Table 2-14, and Table 2-16. Infrastructure development for buy-back programs may include the siting of new collection infrastructure, such as automated collection containers or kiosks (i.e., reverse vending machines), and the expansion of existing collection depots.

### 2.2.3.5 Business-to-Business

As stated in the Current State of Collection Report, business-to-business collection programs require the voluntary participation of businesses, since they directly handle the collection, sorting, transfer, and processing between themselves. Some business-to-business collection programs connect generators and end markets. For example, New-Indy Containerboard (New-Indy), which operates papermills, accepts cardboard directly from large-volume generators.<sup>17</sup> Another common form of business-to-business collection is pallet collection. Pallet collectors receive pallets from businesses and often provide payments to generators for the material. Once received, pallets are sorted, and then either repaired or dismantled. Dismantled pallets may receive further processing or go to end markets. The contractor suggests targeted education and outreach for industry groups that generate large volumes of covered materials to facilitate connections to processors and/or end markets for specific materials. Businesses that choose to participate in this type of alternative collection program may have unique circumstances to consider, based on the specific covered materials. Different materials may require additional staff and infrastructure to collect, sort, and transfer the materials. To streamline these efforts, the contractor suggests targeting generators that produce large volumes of clean, individual covered materials (such as OCC and flex and film plastic) that can be easily source-separated by the generator.

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<sup>16</sup> HF&H Consultants, LLC. *Current State of Collection Report*. 2025.

<sup>17</sup> “What We Do.” *New Indy Containerboard*, [newindycontainerboard.com/what-we-do/](https://newindycontainerboard.com/what-we-do/). Accessed 22 Sept. 2025.

## 2.2.4 Increasing Onsite Curbside Collection for Covered and Noncovered Material

### 2.2.4.1 Increasing Onsite Curbside Collection for Nonparticipating Generators

As discussed in the Current State of Collection Report, not all residential and commercial generators are currently receiving or participating in onsite curbside collection of materials collected for recycling or organics recycling. The report identified the areas where onsite curbside collection programs still do not exist, or only partially exist, and elaborated on the barriers to participating in those programs. These barriers include, but are not limited to, lack of accessibility to onsite curbside collection programs, knowledge gaps on program availability, lack of confidence in how to actively participate in onsite curbside collection programs, cost to receive service, and cost to participate in materials collected for recycling or organics recycling. The report also identified collection service barriers specifically in rural and low population areas, which have lower participation rates than urban environments, and specific operational challenges, such as inaccessible roads or long travel distances between generators.

Additionally, access to onsite curbside collection programs for material collected for recycling and organics recycling does not ensure subscription to those services. Areas that have relatively high access to onsite collection services may still have less than full subscription. For example, in Table 3-6 in the Current State of Collection Report, only 0.1% of the Southern Region’s population has no access to onsite curbside collection programs and yet 7.2% of households are not participating in materials collected for organics recycling. These customers may simply not be aware of the availability of programs or may feel confused on how to properly participate in these programs. Encouraging these nonparticipating households that live in areas with access to participate in collection services for recycling and organics recycling is an opportunity for increasing collection needing minimal infrastructure development.

The current number of generators not participating in onsite curbside collection service, as determined in the Current State of Collection Report, is included in Table 2-9.

**Table 2-9: Generators Not Currently Participating in Onsite Curbside Collection (2024)**

Collection Stream	Bay Area	Coastal	Mountain	Southern	Valley	Statewide
Residential: Recycling	14,577	4,461	3,060	137,836	15,174	175,108
Residential: Organics Recycling	47,895	40,708	30,361	308,752	156,078	583,794
Commercial: Recycling	6,688	3,133	1,302	47,051	22,538	80,712
Commercial: Organics Recycling	21,759	11,482	1,205	96,038	54,631	185,115

As one potential strategy to increase capture of covered materials from generators who do not have access or are not participating in onsite curbside collection, the contractor estimated the incremental cost of increased access and participation in onsite curbside collection and discussed alternative collection infrastructure that would support or supplement onsite curbside collection programs.

A customer lacking participation has access to an established collection program, including the necessary fixed costs for capital and overhead. The incremental cost of collection for that generator is limited to additional variable costs (e.g., labor, fuel, vehicle parts). A customer lacking access would require establishment of an onsite collection program which requires significant upfront fixed costs in addition to ongoing variable costs. However, data were not available to accurately estimate the split of nonparticipating generators between those that lack access and those that have access but lack participation.

The contractor estimated the incremental cost of onsite curbside collection of materials collected for recycling and organics by multiplying the incremental tons collected from each currently nonparticipating generator by the regional collection cost per ton for materials collected for recycling and organics recycling, respectively, as calculated in the Current State of Collection Report. The incremental costs of collection are reflective of fixed costs and variable costs from communities that already have access to onsite curbside collection programs, which will serve as an approximate average cost between a generator lacking access or not participating. This calculation assumes that each nonparticipating generator would receive two additional containers, one for materials collected for recycling and one for materials collected for organics recycling, to achieve onsite curbside collection service similar to the participating generators in their region. Estimated regional costs to expand onsite curbside collection to all generators ranged from about \$31 million in the Coastal region to about \$1 billion in the Valley region, demonstrating the need to consider alternatives for collection other than onsite curbside collection. The significant cost differences reflect challenges in providing collection services in areas with low population density and other geographic factors. Refer to Appendix A, section 2, for a more detailed calculation of the incremental costs to expand onsite curbside collection.

In areas where providing onsite curbside collection may not be the most practical or effective solution, a more cost-effective and targeted strategy involving the promotion, enhancement, or expansion of currently available or new jurisdiction drop-off collection programs may be more effective (see section 2.2.2). This can also include expanding opportunities for collection at these facilities, adding new drop-off facilities, increasing education on how to participate in drop-off collection programs, increasing awareness of the location of these facilities, and limiting programmatic barriers for self-hauling.

#### 2.2.4.2 Increasing Quantities of Material Collected Through Onsite Curbside Collection

Building upon estimates of increased collection of covered material, the contractor also projected the total weight of both covered and noncovered material that would be collected through onsite curbside collection in all material streams in future years. The

purpose of this estimate was to provide an overall picture of material flows through onsite curbside collection given that covered material is collected alongside noncovered material. Table 2-10 provides the estimated difference in tons of covered and noncovered material collected in onsite curbside collection between 2024 and 2032 in the recycling stream and Table 2-11 provides the difference in the organics recycling stream.

**Table 2-10: Estimated Increase in Covered Material and Noncovered Material Collected in Onsite Curbside for Recycling Between 2024 and 2032**

Description	Bay Area	Coastal	Mountain	Southern	Valley	Statewide
Tons of Material Collected for Recycling (2024)	1,536,813	315,350	104,379	4,490,200	1,084,441	7,531,183
Tons of Material Collected for Recycling (2032)	1,921,120	453,552	143,163	6,219,806	1,702,346	10,439,987
Change in Tons Collected for Recycling	384,307	138,202	38,784	1,729,606	617,905	2,908,804

**Table 2-11: Estimated Increase in Covered Material and Noncovered Material Collected in Onsite Curbside for Organics Recycling Between 2024 and 2032**

Description	Bay Area	Coastal	Mountain	Southern	Valley	Statewide
Tons of Material Collected for Organics Recycling (2024)	1,967,586	467,581	105,128	4,251,271	2,043,819	8,835,385
Tons of Material Collected for Organics Recycling (2032)	1,916,521	843,975	101,531	3,770,788	1,982,612	8,615,427
Change in Tons Collected for Organics Recycling	(51,065)	376,394	(3,597)	(480,483)	(61,207)	(219,958)

The contractor adjusted for inflation the estimated cost of onsite curbside collection from the Current State of Collection Report, for each material stream by region. For materials collected for recycling, the inflated cost per ton was estimated to increase to between \$769 and \$942 in 2032. For material collected for organics recycling, the inflated cost per ton was estimated to increase to between \$236 and \$292 in 2032. These are the costs per ton to collect both covered and noncovered material.

## **2.2.5 Increased Collection of Plastic Covered Materials**

The contractor modeled onsite curbside collection as the main method of collection to achieve the recycling rates, given its general accessibility and current access across the state. The contractor included tonnage collected from onsite curbside collection programs, alternative collection programs, and material delivered directly to end markets when calculating proxy recycling rates. Alternative collection programs are currently limited in reach and capacity; therefore, the contractor assumed that marginal tonnage of flexible and film plastic covered materials is collected using alternative collection programs. The contractor assumed rates of material delivered directly to end markets and tonnage collected would remain steady throughout the milestone years for this analysis. Increases in business-to-business collection for recycling may represent a potential opportunity to reduce the estimated amount of material that needs to be collected through onsite curbside collection. Refer to assumptions and limitations within Appendix A for additional information.

In addition to expansions to onsite curbside collection, additional strategies may be needed to facilitate additional recovery of plastic covered material, including expansion of local jurisdiction drop-off sites, increased business-to-business collection for certain material streams, alternative collection programs especially for hard-to-recycle materials or materials that currently have limited collection for recycling, or MWP of the solid waste stream.

The following subsections summarize the projected tons of plastic covered material, organized by CMC collection group, collected through onsite curbside collection, alternative collection programs, and materials delivered directly to end markets. Additionally, the following subsections specify the projected tons of plastic covered materials that need to be collected for recycling to achieve the required recycling rates for the milestone years. Each milestone year will highlight which plastic covered materials may require specific focus to achieve the needed collection rate in the materials collected for recycling stream, based on projected processing loss rates and end market CMC conversion rates.

### **2.2.5.1 Milestone Year 2028 – 30% Recycling Rate**

To achieve the 30% recycling rate for plastic covered material in 2028, significant increases to collection rates for the recycling stream of certain types of plastic covered materials will be needed. Collection rates represent the proportion of material that is collected in the recycling stream compared to the amount collected in all collection streams, including solid waste. A higher collection rate indicates a higher proportion of collected material is collected for recycling. Some CMCs that are currently not

commonly collected for recycling and are not assumed to be designed out due to their common usage may require significant investments.

Table 2-12 lists the CMCs that are predicted to require significant increases in their collection rates to reach the 2028 recycling rate requirement. This includes CMCs with collection rates that are currently unknown due to limited information specific to the CMCs in question. The future collection rates shown in Table 2-12 are estimated based on contractor modeling and could be reduced if additional improvements are made to material redesign, processing losses, or end market losses.

**Table 2-12: CMCs Estimated to Need Significant Increases in Projected Collection Rates (2028)**

CMC ID	CMC Material Type and Form	2024 Collection Rate	2028 Projected Collection Rate	Percentage Point Increase in Collection Rate
24_P15P	LDPE #4 Clear Non-Bag Film	Unknown	80%	N/A
24_P7P	Paper Multi-Material Laminate Other Forms	Unknown	78%	N/A
24_P22P	PP #5 Other Flexible and Film Items	Unknown	75%	N/A
24_P38P	Plastic #1 - Other Rigid Containers, Cups, Lids, Plates, Trays, Tubs	3%	70%	67%
24_P47P	Small Format Plastics	29%	93%	64%
24_M5P	Aluminum Other Forms with a Plastic Component	Unknown	68%	N/A
24_M12P	Small Format Metals with a Plastic Component	Unknown	66%	N/A
24_PF10P	Paperboard with a Plastic Component	Unknown	63%	N/A
24_P41P	PP #5 Other Rigid Containers, Cups, Lids, Plates, Trays, Tubs	Unknown	60%	N/A
24_P20P	PP #5 Other Rigid Items	Unknown	58%	N/A
24_PF15P	Aseptic Cartons	24%	75%	51%
24_PF5P	Gable top Cartons	26%	76%	50%

Given the existing challenges in processing flexible and film covered materials, the contractor modeled expanded alternative collection programs to target flexible and film covered materials. Refer to section 2.2.1 for specific discussions on currently available flexible and film alternative collection programs, such as mail-back and third-party drop-

off programs. The contractor assumed a 20% collection rate for flexible and film alternative collection programs in 2028, with marginal decreases in collection over time once effective processing technology comes online. These tons were included in the collection rates calculated in Table 2-12 and were considered when calculating the additional tons required through additional strategies in Table 2-13.

Significant increases in collection could be achieved with implementation of targeted flexible and film alternative collection systems, multiple interventions, and effective education and outreach. Design improvements for covered material, as further discussed previously in section 2.1, can also help reduce the required rate of collection. For example, material that is not currently collected or is collected in low volumes in onsite curbside collection programs could be removed from the collection stream or converted into a more commonly recognized and collected covered material.

In the modeling, the contractor assumed that plastic covered materials would no longer flow through the organics recycling stream due to modeled alternatives. As found in the Current State of Processing Report, many organics processing facilities screen out all plastics, including plastic and polymers designed for compostability as contaminants due to concerns about end product quality. Additionally, currently plastics designed for compostability do not meet the USDA National Organic Program (NOP) requirements as allowable organic input and would not be eligible to be labeled compostable in 2028 without changes to the NOP. As a result, the modeling assumed an alternative to plastics and polymers designed for compostability. For similar reasons, the contractor modeled that wood and other organic covered materials with a plastic component would have alternative CMCs of paper covered materials without a plastic component, untreated wood covered materials without a plastic component, or small format wood covered materials without a plastic component.

For some CMCs, additional strategies beyond those modeled will be needed to further increase the amount of material collected in the recycling stream, increase the amount of material that is processed to be sent to end markets for recycling, or decrease losses at processing facilities or end markets. Examples of potential additional strategies above what was modeled include additional adoption of alternative collection programs, use of MWP to recover plastic covered material in the solid waste stream, further material redesign, expansion of jurisdiction drop-off programs, and additional business-to-business collection for recycling or increasing material sent directly to end markets.

Table 2-13 summarizes the outputs of the tonnage flow model and provides the weight of plastic covered materials, by CMC collection group, estimated in 2028 as being collected in all onsite curbside collection streams in addition to plastic covered material collected in alternative collection programs and sent directly to end markets. Additionally, for the milestone year 2028, the table provides the estimated weight of CMC collection groups collected in the recycling stream, the estimated weight sent to end markets, and the estimated weight required to be sent to end markets to achieve the required recycling rate in 2028. If the needed tons of plastic covered material accepted by end markets is greater than the estimated tons sent to end market in 2028, then additional strategies above those that were modeled are likely needed for those CMC collection groups to achieve the 30% recycling rate.

**Table 2-13: Estimated Amounts (tons) of Plastic Covered Materials Collected and Sent to End Markets in 2028 to Achieve 30% Recycling Rate**

<b>CMC Collection Group</b>	<b>Amount Collected in All Streams</b>	<b>Amount Collected for Recycling</b>	<b>Amount Sent to End Markets Given Processing Losses</b>	<b>Amount End Markets Need to Accept to Achieve 30% Recycling Rate</b>	<b>Additional Strategies Likely Needed?</b>
Glass	120,017	62,435	40,583	37,119	No
Ceramic	Not Modeled	Not Modeled	Not Modeled	Not Modeled	Not Modeled
Aluminum	40,581	18,800	14,398	14,190	No
Tin/Steel/Bimetal	137,395	51,577	43,165	42,493	No
Other Nonferrous	29,550	23,329	16,331	13,639	No
Other Ferrous	80,842	64,491	45,144	25,003	No
Other Metal	5,215	3,442	2,409	2,407	No
Mixed Paper	1,515,335	1,151,527	638,437	630,810	No
Aseptic Cartons	67,434	50,522	29,170	28,900	No
Gable-top Cartons	98,702	75,353	42,522	42,301	No
Waxed OCC	115,062	91,397	50,268	49,312	No
OCC	2,204,823	1,397,087	698,544	689,007	No
Paperboard	187,457	118,098	59,049	58,580	No
Plastic #1 - PET Rigid	443,102	270,128	189,102	199,054	Yes
Plastic #2 - HDPE Rigid	305,838	194,350	171,423	102,743	No
Plastic #3 - PVC Rigid	Not Modeled	Not Modeled	Not Modeled	Not Modeled	Not Modeled
Plastic # 4 - LDPE Rigid	22,595	10,846	9,761	10,428	Yes
Plastic #5 - PP Rigid	374,373	232,388	177,750	172,788	No
Plastic #6 - Expanded or Foamed Plastic, Rigid	Not Modeled	Not Modeled	Not Modeled	Not Modeled	Not Modeled

<b>CMC Collection Group</b>	<b>Amount Collected in All Streams</b>	<b>Amount Collected for Recycling</b>	<b>Amount Sent to End Markets Given Processing Losses</b>	<b>Amount End Markets Need to Accept to Achieve 30% Recycling Rate</b>	<b>Additional Strategies Likely Needed?</b>
Plastic #6 - Other Expanded or Foamed Plastic	Not Modeled	Not Modeled	Not Modeled	Not Modeled	Not Modeled
Plastic #6 - PS Rigid	Not Modeled	Not Modeled	Not Modeled	Not Modeled	Not Modeled
Flexible and Film Plastic	1,468,929	1,104,435	661,459	677,967	Yes
Flexible and Film Plastic Designed for Compostability	Not Modeled	Not Modeled	Not Modeled	Not Modeled	Not Modeled
Plastic #7 - Other Rigid Designed for Compostability	Not Modeled	Not Modeled	Not Modeled	Not Modeled	Not Modeled
Plastic Pouches and Envelopes	Not Modeled	Not Modeled	Not Modeled	Not Modeled	Not Modeled
Other Multi-Material Laminate	Not Modeled	Not Modeled	Not Modeled	Not Modeled	Not Modeled
Other Mixed Plastics	78,902	73,327	36,664	36,416	No
Wood - Untreated	Not Modeled	Not Modeled	Not Modeled	Not Modeled	Not Modeled
Wood - Treated	Not Modeled	Not Modeled	Not Modeled	Not Modeled	Not Modeled
Textiles	Not Modeled	Not Modeled	Not Modeled	Not Modeled	Not Modeled
Other Mixed Organic	Not Modeled	Not Modeled	Not Modeled	Not Modeled	Not Modeled

To understand the potential of mixed waste processing (MWP) of solid waste as an additional strategy for CMC collection groups likely requiring additional strategies to meet recycling rate requirements, the contractor estimated the minimum tons of solid waste that would need to be processed at MWP facilities to capture additional tons of plastic covered materials. The contractor estimated that MWP facilities would need to process about 4.2 million tons of solid waste to recover the additional tons estimated for flexible and film plastics as well as other plastic CMCs. Current MWP annual permitted capacity, per the Current State of Processing Report Table 3-5, is estimated to be approximately 4 million tons. While some additional MWP using available capacity would help increase the amount of plastic covered material reaching responsible end markets in 2028, new MWP facilities are unlikely to be operational prior to that time. If MWP is used as a strategy to increase the capture rate of certain plastics, the facility is also likely to capture other CMCs which would increase the amount of those materials reaching end markets. For example, magnets will be used for MWP regardless of whether the target material is flexible and film plastic, thus additional ferrous metals would be also captured.

Based on the modeling, the contractor projects that, in response to interventions designed to increase collection rates, tons of plastic covered materials will shift from the materials collected for organics recycling and solid waste streams into the materials collected for recycling stream. This redistribution is expected to reduce costs associated with the organics recycling stream processing but increase overall collection costs due to more material in the recycling stream which has a higher cost to collect per ton than the other two streams (see the Current State of Collection Report). Generators will also continue to receive onsite curbside collection for solid waste and organics, regardless of shifts in volume. While some generators may downsize service levels, if highly responsive to interventions, the overall reduction in solid waste tonnage is likely not significant enough to reduce route frequency.

#### 2.2.5.2 Milestone Year 2030 – 40% Proxy Recycling Rate

To achieve the 40% recycling rate for plastic covered material in 2030, continued increases to the collection of plastic covered materials will be required. Unlike in 2028, the contractor assumed that incremental increases in collection rates may be less pronounced in 2030, due to potential diminishing returns of PE&O methods, as further described in section 2.2.6. However, specific plastic CMCs were identified that will require a targeted focus for much higher collection rates leading up to 2030. The contractor anticipates that MRFs and MWP facilities will have greater technological improvements for capture of plastic covered materials in 2030, including a reduction in processing loss. However, the contractor still anticipates that some additional strategies may be required to support increases in collection rates for flexible and film plastics and some rigid plastics.

Table 2-14 lists the CMCs that are estimated to require the most significant increases in their collection rates between 2028 and 2030 to reach the recycling rate requirement. The projected collection rates shown in Table 2-14 are estimated based on contractor

modeling and could be reduced if further improvements beyond what was modeled are made to material redesign, processing losses, or end market losses.

**Table 2-14: CMCs Estimated to Need Significant Increases in Projected Collection Rates (2030)**

CMC ID	CMC Material Type and Form	2028 Projected Collection Rate	2030 Projected Collection Rate	Percentage Point Increase in Collection Rate
24_P7P	HDPE #2 Bottles, Jugs, and Jars (Clear/Natural)	33%	59%	26%
24_P40P	HDPE #2 Other Rigid Items	40%	60%	20%
24_P8P	HDPE #2 Pails and Buckets	37%	50%	13%
24_M1P	Aluminum Non-aerosol Container with a Plastic Component	40%	51%	12%
24_M6P	Tin/Steel/Bimetal Non-aerosol Container with a Plastic Component	37%	49%	12%
24_M8P	Tin/Steel/Bimetal Other Forms with a Plastic Component	38%	50%	12%
24_M7P	Tin/Steel/Bimetal Aerosol Can with a Plastic Component	39%	49%	11%

The contractor modeled that modeled pulp without a plastic component was the alternative to molded pulp with a plastic component due to lack of viable end markets starting in 2030.

Given the challenges in processing plastic flexible and film covered material, the contractor modeled expanded alternative collection programs to target flexible and film plastics would achieve 10% of the collection rate. Compared to 2028, flexible and film alternative collection programs were modeled to capture slightly less tons in 2030 as onsite curbside collection and processing at recycling processing facilities was anticipated to help increase overall collection of flexible and film plastics in 2030. These tons were included in the collection rates calculated in Table 2-14 and were considered when calculating the additional tons required through additional strategies in Table 2-15.

Table 2-15 summarizes the output of the tonnage flow model. It provides the weight of plastic covered materials, by CMC collection group, estimated in 2030 as being collected in all onsite curbside collection streams in addition to plastic covered material collected through alternative collection programs and sent directly to end markets. Additionally, for the milestone year 2030, the table provides the estimated weight of CMC collection groups collected in the recycling stream, the estimated weight sent to end markets, and the estimated weight required to be sent to end markets to achieve

the required recycling rate. If the needed tons of plastic covered material accepted by end markets is greater than the estimated tons sent to end markets in 2030, then additional strategies above those that were modeled are likely needed for those CMC collection groups to achieve the 40% recycling rate.

**Table 2-15: Estimated Amounts (tons) of Plastic Covered Materials Collected and Sent to End Markets (2030)**

<b>CMC Collection Group</b>	<b>Amount Collected in All Streams</b>	<b>Amount Collected for Recycling</b>	<b>Amount Sent to End Markets Given Processing Losses</b>	<b>Amount End Markets Need to Accept to Achieve 40% Recycling Rate</b>	<b>Additional Strategies Likely Needed?</b>
Glass	108,932	63,087	47,316	44,921	No
Ceramic	Not Modeled	Not Modeled	Not Modeled	Not Modeled	Not Modeled
Aluminum	37,777	20,677	17,575	16,901	No
Tin/Steel/Bimetal	126,639	62,553	53,170	52,222	No
Other Nonferrous	26,180	20,681	17,579	13,963	No
Other Ferrous	71,639	57,216	48,634	29,542	No
Other Metal	4,895	3,231	2,746	2,611	No
Mixed Paper	1,268,023	1,006,549	805,239	655,590	No
Aseptic Cartons	67,515	50,582	41,080	36,008	No
Gable-top Cartons	98,830	75,449	60,839	52,709	No
Waxed OCC	103,204	82,568	66,055	55,042	No
OCC	1,977,180	1,255,766	1,004,613	823,825	No
Paperboard	175,990	110,873	88,699	73,329	No
Plastic #1 - PET Rigid	409,161	260,429	234,933	218,219	Yes
Plastic #2 - HDPE Rigid	275,356	206,196	183,267	123,370	Yes
Plastic #3 - PVC Rigid	Not Modeled	Not Modeled	Not Modeled	Not Modeled	Not Modeled

<b>CMC Collection Group</b>	<b>Amount Collected in All Streams</b>	<b>Amount Collected for Recycling</b>	<b>Amount Sent to End Markets Given Processing Losses</b>	<b>Amount End Markets Need to Accept to Achieve 40% Recycling Rate</b>	<b>Additional Strategies Likely Needed?</b>
Plastic # 4 - LDPE Rigid	21,041	11,994	10,794	11,222	Yes
Plastic #5 - PP Rigid	343,387	223,984	184,646	183,140	Yes
Plastic #6 - Expanded or Foamed Plastic, Rigid	Not Modeled	Not Modeled	Not Modeled	Not Modeled	Not Modeled
Plastic #6 - Other Expanded or Foamed Plastic	Not Modeled	Not Modeled	Not Modeled	Not Modeled	Not Modeled
Plastic #6 - PS Rigid	Not Modeled	Not Modeled	Not Modeled	Not Modeled	Not Modeled
Flexible and Film Plastic	1,354,118	1,056,657	819,999	722,196	Yes
Flexible and Film Plastic Designed for Compostability	Not Modeled	Not Modeled	Not Modeled	Not Modeled	Not Modeled
Plastic #7 - Other Rigid Designed for Compostability	Not Modeled	Not Modeled	Not Modeled	Not Modeled	Not Modeled

<b>CMC Collection Group</b>	<b>Amount Collected in All Streams</b>	<b>Amount Collected for Recycling</b>	<b>Amount Sent to End Markets Given Processing Losses</b>	<b>Amount End Markets Need to Accept to Achieve 40% Recycling Rate</b>	<b>Additional Strategies Likely Needed?</b>
Plastic Pouches and Envelopes	Not Modeled	Not Modeled	Not Modeled	Not Modeled	Not Modeled
Other Multi-Material Laminate	Not Modeled	Not Modeled	Not Modeled	Not Modeled	Not Modeled
Other Mixed Plastics	71,840	67,006	40,204	38,315	No
Wood - Untreated	Not Modeled	Not Modeled	Not Modeled	Not Modeled	Not Modeled
Wood - Treated	Not Modeled	Not Modeled	Not Modeled	Not Modeled	Not Modeled
Textiles	Not Modeled	Not Modeled	Not Modeled	Not Modeled	Not Modeled
Other Mixed Organic	Not Modeled	Not Modeled	Not Modeled	Not Modeled	Not Modeled

To understand the potential of MWP of solid waste as an additional strategy for CMC collection groups likely requiring additional strategies to meet recycling rate requirements, the contractor estimated the minimum tons of solid waste that would need to be processed at MWP facilities to capture additional tons of plastic covered materials. The contractor estimated that MWP facilities would need to process about 4 million tons of solid waste to recover the additional tons estimated for flexible, film, and some rigid plastics. Current MWP annual permitted capacity, per the Current State of Processing Report Table 3-5, is estimated to be approximately 4 million tons. If MWP is used as a strategy to increase the capture of certain plastics, the facility is also likely to capture other CMCs.

Based on the modeling, the contractor projects that in response to interventions, tons of plastic covered material will continue to shift to the recycling stream from the solid waste and organics recycling streams. This redistribution is expected to increase overall collection costs because more material will enter the material collected for recycling stream which currently has the highest estimated cost of collection per ton.

### 2.2.5.3 Milestone Year 2032 – 65% Proxy Recycling Rate

To achieve the 65% recycling rate for plastic covered material in 2032, sustained improvements in the collection of plastic covered materials will continue to be required. By 2032, the contractor projects that 83% of plastic covered material that is collected in any material stream will be collected for recycling through the combination of expanded curbside collection and alternative collection programs. Achieving high collection rates for covered material will rely on the types and complexity of covered material in the market, available collection programs, and ease of participation in collection programs for recycling. Additionally, further reductions in losses in processing and end markets can reduce the collection rate that will be needed.

Table 2-16 lists the CMCs that are estimated to require the most significant increases between 2030 and 2032 in their collection rates to reach the recycling rate requirement. These CMCs represent the priority focus for intensified generator outreach and participation initiatives to ensure continued increases in collection rates. The projected collection rates shown in Table 2-16 are estimated based on contractor modeling and could be reduced if further improvements beyond what was modeled are made to material redesign, processing losses, or end market losses.

**Table 2-16: CMCs Estimated to Require Significant Increases in Projected Collection Rates (2032)**

<b>CMC ID</b>	<b>CMC Material Type and Form</b>	<b>2030 Projected Collection Rate</b>	<b>2032 Projected Collection Rate</b>	<b>Percentage Point Increase in Collection Rate</b>
24_G1P	Glass Bottles and Jars with a Plastic Component	55%	85%	29%
24_G3P	Small Format Glass with a Plastic Component	55%	84%	29%
24_M1P	Aluminum Non-aerosol Container with a Plastic Component	51%	81%	30%
24_M4P	Aluminum Aerosol Can with a Plastic Component	50%	81%	31%
24_M5P	Aluminum Other Forms with a Plastic Component	68%	90%	22%
24_M6P	Tin/Steel/Bimetal Non-aerosol Container with a Plastic Component	49%	79%	30%
24_M7P	Tin/Steel/Bimetal Aerosol Can with a Plastic Component	49%	80%	30%
24_M12P	Small Format Metal with a Plastic Component	66%	90%	24%
24_P2P	PET #1 Bottles, Jugs, and Jars (Pigmented/Color)	53%	83%	30%
24_P1P	PET #1 Bottles, Jugs, and Jars (Clear/Natural)	54%	83%	29%
24_P40P	HDPE #2 Other Rigid Items	60%	89%	29%
24_P8P	HDPE #2 Pails and Buckets	50%	84%	34%
24_P13P	LDPE #4 Bottles, Jugs, and Jars	57%	85%	28%
24_P14P	LDPE #4 Other Rigid Items	57%	85%	28%
24_PF1P	Kraft Paper with a Plastic Component	54%	80%	26%
24_P20P	PP #5 Other Rigid Items	64%	89%	25%
24_P41P	PP #5 Other Rigid Containers, Cups, Lids, Plates, Trays, Tubs	60%	89%	29%

By 2032, the contractor projects that an aggressive, sustained education and outreach program, combined with the implementation of material redesigns, and an assumed 25% reduction in total generated plastic covered material tons will enable the achievement of the required recycling rate. Additionally, these high collection rates may be offset by improvements to recycling yields at end markets through improved processes and reduced contamination. These outcomes reflect the cumulative influence of multiple systemwide interventions including material redesign, comprehensive and targeted generator outreach, effective deployment of alternative collection programs, continued upgrades to MRF and MWP facility infrastructure; and the availability of robust and viable end markets.

In 2032, the contractor anticipates that processing facilities will have integrated technology to capture significant quantities of flexible and film covered materials and utilize a secondary processor in the state for further recovery of small format covered material as well as certain types of plastics such as flexibles and films and mixed rigidids. Flexible and film alternative collection programs may continue to be needed, but it is assumed there will be a lower participation rate by expanding collection through onsite curbside collection. The contractor projects that flexible and film alternative collection programs will need to capture 10% of all flexible and film covered materials in 2032 to meet the recycling rate requirement, given upgraded system performance for recycling processing facilities.

Table 2-17 summarizes the output of the tonnage flow model. It provides the weight of plastic covered material, by CMC collection group, estimated in 2032 as being collected in all onsite curbside collection streams in addition to plastic covered material collected through alternative collection programs and sent directly to end markets. Additionally, for the milestone year 2032, the table provides the estimated weight of CMC collection groups collected in the recycling stream, the estimated weight sent to end markets, and the estimated weight required to be sent to end markets to achieve the required recycling rate. If the needed tons of plastic covered material accepted by end markets is greater than the estimated tons sent to end markets in 2032, then additional strategies above those that were modeled are likely needed for those CMC collection groups to achieve the 65% recycling rate.

**Table 2-17: Estimated Amounts (tons) of Plastic Covered Materials Collected and Sent to End Markets (2032)**

<b>CMC Collection Group</b>	<b>Amount Collected in All Streams</b>	<b>Amount Collected in Recycling</b>	<b>Amount Sent to End Markets Given Processing Losses</b>	<b>Amount End Markets Need to Accept to Achieve 40% Recycling Rate</b>	<b>Additional Strategies Likely Needed?</b>
Glass	99,730	84,535	67,628	66,829	No
Ceramic	Not Modeled	Not Modeled	Not Modeled	Not Modeled	Not Modeled
Aluminum	35,448	29,535	25,105	24,928	No
Tin/Steel/Bimetal	117,715	93,533	79,503	78,881	No
Other Nonferrous	23,373	21,073	17,912	17,873	No
Other Ferrous	63,984	51,147	43,475	42,876	No
Other Metal	4,631	4,168	3,543	3,541	No
Mixed Paper	1,161,121	1,032,607	877,716	873,597	No
Aseptic Cartons	67,620	60,425	51,822	51,709	No
Gable-top Cartons	98,986	88,740	75,789	75,695	No
Waxed OCC	93,351	84,276	71,635	71,386	No
OCC	1,788,012	1,427,697	1,213,542	1,210,633	No
Paperboard	166,501	133,201	113,221	112,735	No
Plastic #1 - PET Rigid	395,018	328,698	296,375	302,072	Yes
Plastic #2 - HDPE Rigid	262,552	227,928	201,590	191,180	Yes
Plastic #3 - PVC Rigid	Not Modeled	Not Modeled	Not Modeled	Not Modeled	Not Modeled
Plastic # 4 - LDPE Rigid	20,398	17,338	15,604	15,598	No
Plastic #5 - PP Rigid	330,450	294,627	250,433	252,697	Yes

<b>CMC Collection Group</b>	<b>Amount Collected in All Streams</b>	<b>Amount Collected in Recycling</b>	<b>Amount Sent to End Markets Given Processing Losses</b>	<b>Amount End Markets Need to Accept to Achieve 40% Recycling Rate</b>	<b>Additional Strategies Likely Needed?</b>
Plastic #6 - Expanded or Foamed Plastic, Rigid	Not Modeled	Not Modeled	Not Modeled	Not Modeled	Not Modeled
Plastic #6 - Other Expanded or Foamed Plastic	Not Modeled	Not Modeled	Not Modeled	Not Modeled	Not Modeled
Plastic #6 - PS Rigid	Not Modeled	Not Modeled	Not Modeled	Not Modeled	Not Modeled
Flexible and Film Plastic	1,306,132	1,161,885	994,930	998,807	Yes
Flexible and Film Plastic Designed for Compostability	Not Modeled	Not Modeled	Not Modeled	Not Modeled	Not Modeled
Plastic #7 - Other Rigid Designed for Compostability	Not Modeled	Not Modeled	Not Modeled	Not Modeled	Not Modeled
Plastic Pouches and Envelopes	Not Modeled	Not Modeled	Not Modeled	Not Modeled	Not Modeled
Other Multi-Material Laminate	Not Modeled	Not Modeled	Not Modeled	Not Modeled	Not Modeled
Other Mixed Plastics	68,869	64,963	52,458	52,664	Yes
Wood - Untreated	Not Modeled	Not Modeled	Not Modeled	Not Modeled	Not Modeled
Wood - Treated	Not Modeled	Not Modeled	Not Modeled	Not Modeled	Not Modeled
Textiles	Not Modeled	Not Modeled	Not Modeled	Not Modeled	Not Modeled

<b>CMC Collection Group</b>	<b>Amount Collected in All Streams</b>	<b>Amount Collected in Recycling</b>	<b>Amount Sent to End Markets Given Processing Losses</b>	<b>Amount End Markets Need to Accept to Achieve 40% Recycling Rate</b>	<b>Additional Strategies Likely Needed?</b>
Other Mixed Organic	Not Modeled	Not Modeled	Not Modeled	Not Modeled	Not Modeled

Additional strategies beyond those modeled are likely needed to increase the amount of plastic covered material recycled to meet recycling rates, especially for flexible and film plastics as well as rigid plastics. Additional strategies include further material redesign to simplify incoming material streams and remove problematic materials, further reduction of processing and end market losses, and capturing plastic covered material discarded in the solid waste stream. The findings underscore the continued importance of advancing MRF performance to reduce processing losses and to consistently produce material that meets end market specifications. Parallel progress in expanding and strengthening end markets will also be necessary to ensure the system can absorb and utilize the increased volume of recovered plastics.

To understand the potential of MWP of solid waste as an additional strategy for CMC processing groups likely requiring additional strategies to meet recycling rate requirements, the contractor estimated the minimum tons of solid waste that would need to be processed at MWP facilities to capture additional tons of plastic covered materials. The contractor estimated that MWP facilities would need to process about 4.2 million tons of solid waste to recover the additional tons estimated for flexible, film, and some rigid plastics. Current MWP annual permitted capacity, per the Current State of Processing Report Table 3-5, is estimated to be approximately 4 million tons. If MWP is used as a strategy to increase the capture of certain plastics, the facility is also likely to capture other CMCs. To be conservative in this analysis, the contractor did not assume additional MWP capacity would be available in 2032. However, if these facilities are constructed and operational, additional MWP could further reduce the collection rates modeled in Table 2-17 and Table A-24.

Based on the modeling, the contractor projects that in response to interventions, tons of plastic covered material will continue to shift to the recycling stream from the solid waste and organics recycling streams.

### **2.2.6 Improving Participation in Collection Programs**

Improving participation in collection programs of all types as well as promoting proper sorting and collection behaviors will be very effective in maximizing the amount of material that is collected for recycling and organics recycling, minimizing contamination in the recycling streams, and minimizing the amount of recyclable or compostable materials in the solid waste stream will also be effective. Improved participation at the collection stage can minimize the burden at the processing and end markets stages. For example, reducing contamination at the point of collection reduces negative impacts of contamination on processing and end markets.

The Community Recycling and Composting Survey asked CBOs, EJ groups, and Tribes what would make it easier to participate in onsite curbside collection programs for materials collected for recycling and organics recycling, and there was a clear difference in responses between populations currently with and without widespread access to these programs. Regions with high rates of existing access to onsite curbside collection identified knowledge gaps, such as confusion over how to sort and unclear product labels as more significant barriers. Survey respondents across all regions identified a

lack of priority as a key barrier to participation.<sup>18</sup> These findings underscore that, while expanding collection service access is an effective first step, further efforts to reduce confusion and simplify collection requirements are needed.

Another barrier to participating in collection for recycling was lack of awareness of available programs. This supports the finding that education and outreach will not only be effective for onsite curbside collection, it will also be critical to support the expansion of local jurisdiction drop-off programs and alternative collection programs, specifically providing information on the types of material that each accepts and the parameters of participation. Coupled with effective educational campaigns, this may help close gaps in access to collection programs, especially in areas without full access currently.

Targeted behavior changes and marketing campaigns, coupled with program monitoring, are two key strategies to help improve participation in collection programs of varying types. By designing the system to make sorting and collection easy (e.g., simplification in types of materials or clear labeling), the need for changes in behavior will be simplified and minimized.

The following section presents recommended actions and related costs to improve participation in collection programs for covered material.

#### 2.2.6.1 Establishing Convenient Access

Convenient access to collection programs will maximize participation in those collection programs, which extends to access in all places where covered material will be generated, including home, work, and public spaces. Community Recycling and Composting Survey responses from CBOs and EJ groups showed that people are most likely to utilize collection containers for recycling and organics recycling at least some of the time at home compared to when they are in public or at work or school. Eighty-one percent of these respondents also indicated that they found containers for recycling most easily accessible at their homes. Fifty-nine percent of respondents cited the same for containers for organics recycling (see Appendix D, section 3, for full Community Recycling and Composting Survey results).

To understand how to make collection programs more convenient, the contractor first identified the barriers to utilizing existing onsite curbside collection programs. The Community Recycling and Composting Survey found that 62% of respondents report lack of availability or services as main barriers to participating in onsite curbside collection programs for recycling and organics recycling. Increasing access to containers, especially in places with full access to onsite curbside collection, will be effective in establishing convenient access. When local jurisdictions were asked in the Collection Survey to identify specific populations that generally do not receive onsite curbside collection service, respondents identified unhoused communities, remote or unincorporated areas, generators subject to SB 1383 and SB 613 waivers, self-haulers, and vacation/rental homeowners.

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<sup>18</sup> HF&H Consultants, LLC. *Current State of Collection Report*. 2025.

Education and outreach can first be targeted at generators that could currently receive onsite curbside collection, but do not. This could include providing information on how to participate, including outreach to multifamily generators to ensure all residents in multifamily housing are aware of where material is collected for recycling and organics recycling.

In cases where establishing onsite curbside collection may not be operationally feasible or only available at a prohibitively high cost, the contractor considered additional collection opportunities, including those that could fit within their existing behaviors to minimize the amount of behavior changes required. Additional collection opportunities include self-haul, drop-off, mail-back, public collection containers or shared collection containers. The contractor also suggests that expansion of drop-off and alternative collection programs tailored to fit the geographic, demographic, and socioeconomic needs of the region or local jurisdiction be developed. For example, some areas may have active community centers, shopping centers, libraries, or post offices that can serve as drop-off locations.

Some existing drop-off programs may be inconvenient or inaccessible because of factors such as their distance from home, operating hours, the range of materials accepted, line length,<sup>19</sup> and limited transportation access. These barriers can result in limited participation and illegal dumping.

Expansion of existing jurisdiction drop-off and third-party drop off programs may offer a convenient, and thereby effective, solution for capturing additional covered materials in areas where onsite curbside collection is challenging. A study conducted in Tennessee<sup>20</sup> found generator homes needed to be within 5 miles of a drop-off center for them to be more likely to use the facility. Drop-off locations that are centrally located in a community, routinely visited, and have the space to collect a plethora of covered materials are ideal for expanding access.

### 2.2.6.2 Effective Education

Educating generators to participate more in collection programs for covered materials and properly sort materials for the appropriate type of collection will be critical to reducing contamination and maximizing capture of appropriate covered material in the recycling and organics recycling stream. Education should be coupled with material redesign and clear labeling on products to reduce confusion and the need for complex education campaigns.

Producers can potentially reduce the level of investment needed to meet the requirements of the Act by reducing the diversity and complexity of covered material.

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<sup>19</sup> ---. *Municipal Solid Waste Recycling in the United States: Analysis of Current and Alternate Approaches*. National Academies Press EBooks, 18 June 2025, pp. 138–182, [nap.nationalacademies.org/read/27978/chapter/8#143](https://nap.nationalacademies.org/read/27978/chapter/8#143).

<sup>20</sup> Sidique, Shaufique, et al. “Estimating the Demand for Drop-off Recycling Sites: A Random Utility Travel Cost Approach.” *Journal of Environmental Management*, vol. 127, 28 June 2013, pp. 339–346, <https://doi.org/10.1016/j.jenvman.2013.05.001>.

Simplified packaging reduces confusion about proper sorting and preparing materials for recycling, which lowers the need for complex education campaigns and behavior-change strategies. Fewer required actions make messaging clearer and less frequent, potentially reducing education costs mainly for proper sorting and preventing contamination. Producers can also improve packaging labeling to provide clear guidance on source separation for recycling and organics.

The Current State of Collection Report found that local jurisdictions across the state encounter issues with generator confusion and contamination, which makes it difficult to implement effective collection programs. Over 98% of local jurisdictions reported that they distribute public education and outreach (PE&O) materials on information such as available waste and recycling services and proper sorting. Despite this, most Community Recycling and Composting Survey respondents indicated they had not received, or were unsure of receiving, education from their local jurisdiction or RSP on proper sorting. These findings were echoed in listening sessions with CBOs, EJ groups, and Tribes, who stated that there is a desire to recycle and to better understand its benefits, but also a need for additional education on how to do it successfully. This indicates that the current educational strategies may need to be changed to better reach larger portions of the population.

Based on desktop research, the contractor divided effective education into three key methods that can be delivered statewide or locally to increase generator understanding and engagement:

- Informational messaging, which has been shown to increase participation between zero and 30%.
- Emotional and empathetic messaging, which has been shown to increase participation between 25 and 58%.
- Direct engagement with generators, which has been shown to increase participation between 25 and 100%.

The contractor's research shows that granular, single-message education and marketing are most effective for implementing behavior change and laying the foundation for direct engagement to build upon.

Educational materials must also be provided in multiple languages to be effective. Many of the examples and research shown in this section are for single-language materials and programs. The survey responses from CBOs, EJ Groups, and Tribes, stated that lack of access to materials in multiple languages was a barrier to participation. The need for educational materials to be available in multiple languages and adapt to culturally specific contexts will be imperative in increasing participation and should be prioritized in campaign development.

Employing all three of these educational methods concurrently, with targeted multi-lingual messaging (e.g., how to use a new alternative collection program, how to prepare materials for recycling, how film plastic should be collected), can result in faster and substantial rates of participation, with a lasting impact on generator behavior.

Historically, the burden of funding and implementing PE&O programs related to collection for recycling and organics recycling has fallen on local jurisdictions and RSPs. Statewide education programs and programs run by other entities such as industry groups, community associations, business groups, nonprofits, and packaging and manufacturing groups, should also be considered. Local education initiatives should be done in collaboration with the local jurisdiction in which the program is implemented.

#### **2.2.6.2.1 Statewide Initiatives and Campaigns**

There are various reasons for why generators across the state may not place covered materials into the correct collection containers. Responses to the Community Recycling and Composting Survey show that generators across all regions found materials that are a mixture of multiple material classes (e.g. paper with a plastic component) the most confusing to sort for both recycling and organics recycling. Respondents from the Bay Area, Coastal, and Mountain regions also found plastics without the plastic identification number included in their labeling confusing, while respondents in Southern and Valley regions were confused by how to deal with dirty (e.g., food contaminated) covered material items. When asked how to decide whether to put plastic items in the solid waste containers or containers designated for recycling, respondents in all regions stated their prior knowledge and experience strongly dictated their behavior. Respondents in the Bay Area and Coastal regions pay closer attention to labeling, including the recycling symbol and plastic identification number. These responses indicate that it is beneficial to develop a common understanding of sorting materials for recycling and organics recycling and increase generators' confidence in their own knowledge. Consistent messaging, through electronic and printed media and product labels, can help establish proper participation in collection programs for all generators throughout the state. The following subsections explore different avenues for utilizing statewide resources to increase the collection of covered materials.

##### **2.2.6.2.1.1 Statewide Web and Mobile Applications**

Readily accessible information that is easy to understand, memorable, and compelling can help generators feel confident in their ability to correctly sort materials for recycling and organics recycling. It also motivates generators to seek out correct information when in doubt, since it is at their fingertips. Statewide resources devoted to enhancing the availability of electronic information, such as web portals or mobile applications, can allow for immediate access to information. Generators often go to municipal websites or their RSP website for local recycling information.<sup>21</sup> To improve statewide consistency, local jurisdiction and RSP websites could link to a statewide website portal, or product search engine, that informs generators about sorting covered materials into the appropriate collection containers based on their location, whether at home, work, or traveling.<sup>22</sup> If information is presented consistently across the state, generators can

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<sup>21</sup> Tanimoto, Asami, et al. "2019 West Coast Contamination Initiative Research Report." Apr. 2020.

<sup>22</sup> Tanimoto, Asami, et al. "2019 West Coast Contamination Initiative Research Report." Apr. 2020.

seamlessly transition their recycling and organics recycling habits across different locations. Consistency of information and trustworthy sources can also alleviate confusion and increase participation in regions that lack localized information.

The cost of developing and maintaining a website varies greatly, depending on the complexity of the build (up to \$200), design and functionality (up to \$10,000 as a one-time cost), hosting fees (up to \$250 per month), domain names (between \$1 and thousands of dollars per year), and other ongoing costs that keep the website secure, integrate additional functions, and maintain updates to the website on a regular basis.<sup>23</sup> <sup>24</sup> Proportionally, the website design and user interface are the highest portions of the overall cost as an intuitive and easy to use user interface is a key factor when creating an application that generators will want to use.

In CalRecycle's 2-year "iRecycle Smart" campaign, the project budgeted \$55,000 for hard costs related to software, approximately \$115,000 for staff time devoted to website content design and development in English and Spanish, and approximately \$22,000 for administration and oversight of the website development.<sup>25</sup> Assuming a website sharing information on proper sorting of covered materials would require at least the same level of functionality, a website may cost as much as \$96,000 per year to develop and maintain, with the cost likely decreasing once the website is fully designed. Once the website is built, a budget is still needed to maintain and update the user interface, as needed. As covered materials are redesigned and simplified across the state, the website and applications interface and design could also be simplified. As products and packaging are redesigned and simplified, the need for frequent website updates to maintain accurate listings of covered materials and associated products will decrease. This reduction in maintenance requirements is expected to lower ongoing operational costs.

Similarly, a statewide mobile application could increase recycling and organics recycling awareness and participation by providing quick, accessible, and convenient information at the point where generators are purchasing or discarding materials. Research conducted on the cost of developing a mobile application found a large range of costs, from as little as \$5,000<sup>26</sup> up to \$300,000.<sup>27</sup> The cost largely depends on the number of features or how complex the application is to develop. A mobile application in California would need to be made available in multiple languages to ensure the information is accessible to California's multilingual population.

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<sup>23</sup> Hartman, Stacey. "How Much Does a Website Cost in 2023?" *GoDaddy*, 11 Feb. 2025.

<sup>24</sup> Cvetković, Ana. "How Much Does a Website Cost in 2025?" *Wix*, 29 Sept. 2025.

<sup>25</sup> Department of Resources Recycling and Recovery. *State of California - Department of General Services Standard Agreement (SCO ID: 3970-DRR23049)*. 1 Feb. 2024.

<sup>26</sup> Novikova, Darya, and Maria Kravchinskaja. "How Much Does It Cost to Design an App in 2024? Explained." *SolveIt*, 15 Nov. 2023.

<sup>27</sup> The Upwork Team. "How Much Does It Cost to Build a Mobile App?" *Upwork*, 8 Sept. 2025.

A 2023 paper by Wildt and Meijers titled, “Time spent on separating waste is never wasted: Fostering people’s recycling behavior through the use of a mobile application,” found that the frequency of application use decreased as knowledge gained from the mobile application increased and became part of the generator’s own knowledge and experience. This indicates that a mobile application is likely best used to engage less-informed generators or push notifications about changes to covered materials or recycling and organics recycling programs. A mobile application should not be the only method to gain access to the appropriate sorting information given that some generators may lack sufficient access to the internet or a cell phone.

#### 2.2.6.2.1.2 Statewide Marketing Campaigns

Statewide marketing campaigns can normalize certain behaviors and appeal to people’s emotions, values, and sensibilities, setting a foundation for local PE&O programs and direct engagement. Marketing campaigns can vary in scale and scope but generally include the development and production of material as well as the distribution of those materials. The contractor used campaigns run by the Ad Council and CalRecycle to estimate the impact of public service campaigns and their associated costs.

In 2016, the Natural Resources Defense Council (NRDC) launched its “Save the Food” campaign with the Ad Council to reduce food waste nationwide. The campaign received \$8.4 million in donated media, including local broadcast television, network cable television, local cable television, billboards, print, and interactive media for English-language collateral materials. The campaign also utilized strategic partnerships within the food industry, including grocery stores, and restaurants, as well as local jurisdictions, stadiums, and schools to amplify the marketing campaign. The campaign implemented experiential activities, including competitions, public art, food swaps, and scavenger hunts in addition to digital and printed advertising. A creative media ad agency provided campaign research, development, production, and evaluation free of charge.

According to a presentation given by the NRDC, the agency earned<sup>28</sup> 300 ad placements in the first seven months of the campaign (earned media is media published by a third-party without any form of payment to the publisher). The top 10 press hits reached over 31 million people. Like many of the Ad Council’s assets, people and public agencies could download the campaign materials for free then tailor, print and distribute the materials to relevant places unique to their communities (e.g., local newspaper, community boards, local events, bus stops). This level of outreach was not included in the NRDC’s reporting of campaign distribution costs, since costs were absorbed by the agency or individual who distributed the material. After eight months of the campaign, the Ad Council performed a market survey to determine its effectiveness of the campaign. The percentage of people surveyed who “strongly agree” that food waste is a

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<sup>28</sup> Dietrich, Gini. “Spin Sucks: Communication and Reputation Management in the Digital Age.” *Google Books*, Pearson Education, Inc., Mar. 2014, [books.google.com/books?id=KCbgAgAAQBAJ&pg=PA38#v=onepage&q&f=false](https://books.google.com/books?id=KCbgAgAAQBAJ&pg=PA38#v=onepage&q&f=false).

big problem in the U.S. increased from 51% to 56%. Additionally, 20% of people surveyed recognized the materials from the campaign.<sup>29,30</sup>

In 2020, CalRecycle engaged a consultant to research, develop, produce, distribute, and evaluate a two-year Community-Based Social Marketing (CBSM) campaign titled “iRecycle Smart.”<sup>31</sup> The campaign’s goals were to increase awareness on waste reduction, recycling and composting, to promote positive behavior change, and achieve measurable improvements and participation in these efforts. A detailed cost analysis for this campaign shows that approximately 60% of the \$14.78 million overall budget was spent on media distribution (approximately \$8.8 million) in specific market areas of the state in both English and Spanish.<sup>32</sup> The final report provided to CalRecycle states that the paid media included digital, radio, and out-of-home (e.g., transit ads, shopping carts, billboards) media buys over an 11-month period. In that time, the campaign had over 382 million impressions<sup>33</sup> (number of times an ad is shown) from digital media placements, 48,600 visits to the campaign website after radio spots were played, and between 16.5 million to 49.9 million impressions (number of times an ad is seen) from out-of-home advertisements. Additionally, the consultant was able to secure at least \$312,000 in donated out-of-home media and numerous earned media placements on America Recycles Day and during the holiday season.

As noted in the final report for iRecycle Smart, the campaign increased food scrap recycling, positive recycling attitudes, and generator desire for more accurate information. The report noted that cultural and language differences between English and Spanish speakers reduced the relevance of the campaign for certain audiences and will require additional consideration in future efforts. Distributed campaign assets will need to be customizable so that local jurisdictions can tailor messaging to be culturally relevant and appeal to their communities. Editable campaign assets would allow additional translations to the materials, increasing access to communities throughout the state.

Both campaigns demonstrate that tailored messaging focusing on a specific topic often produces the most successful results. Launching multiple versions of a statewide campaign over several years may help reinforce desired behaviors and address identified barriers in various social and demographic groups. A campaign focused on covered material will need to be dynamic, as packaging types and other parts of the

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<sup>29</sup> NRDC. “Save the Food.” 30 Nov. 2016.

<sup>30</sup> Sustainable Brands. “NRDC Updates “Wasted”; Enlists Dan Barber, Alexa for Phase 2 of “Save the Food” Campaign.” *Sustainable Brands*, 17 Aug. 2017.

<sup>31</sup> CalRecycle. *CalRecycle iRecycleSmart Final Report*. 1 Jan. 2025.

<sup>32</sup> Department of Resources Recycling and Recovery. *State of California - Department of General Services Standard Agreement (SCO ID: 3970-DRR23049)*. 1 Feb. 2024.

<sup>33</sup> Adobe Communications Team. “Marketing Impressions — What They Are, How They’re Measured, and Why They Matter.” *Adobe*, 30 Aug. 2022, [business.adobe.com/blog/basics/marketing-impressions](https://business.adobe.com/blog/basics/marketing-impressions).

system change. Moreover, as generators become more informed and the demographics in the state change, the campaign will need to be adaptable to stay relevant.

The resources for a statewide marketing campaign can be scaled and adjusted year to year, depending on the campaign’s particular message. It is highly recommended that adequate resources are devoted to conducting a robust statewide marketing campaign during the implementation and changes to the system, including new collection programs and changes to what can be accepted in collection programs.

#### 2.2.6.2.1.3 Product Labeling

In 2021, SB 343 was signed into law and prohibits use of the chasing arrows or any other indicator of recyclability on products and packaging unless certain criteria are met. These labeling restrictions will apply to products and packaging manufactured after October 4, 2026.<sup>34</sup> While this may help alleviate confusion for generators in the future, the history of the “chasing arrow” symbol has left many generators feeling deceived and discouraged by claims of recyclability on a product. Confusion caused by product labels has led to a significant amount of “wishcycling,” where generators believe or hope they are recycling correctly without actually knowing.<sup>35</sup> The Recycling Partnership reports that 71% of generators feel deceived when a product claims to be recyclable when it is not.<sup>36</sup> Nearly a quarter of Community Recycling and Composting Survey respondents identified a “lack of trust in the recycling system” as a major barrier to participating in onsite curbside collection programs. This sentiment was echoed by CBOs, EJ groups, and Tribal participants in listening sessions. Additionally, confusion over covered materials is a main contributing factor to lack of participation in collection programs and contamination by generators.

A survey conducted by the Recycling Partnership in 2023 found that 78% of surveyed consumers rely heavily on product labeling to try and sort materials correctly and 82% of surveyed generators trust labels to be accurate. These findings are supported by the Community Recycling and Composting Survey responses described earlier in this section, which found that generators pay attention to the recycling symbol (i.e. “chasing arrows”) to determine recyclability. To regain generator trust in the system, new labeling standards will require strategic marketing and educational campaigns to provide information on how labeling should be used.

Standardizing labels across all covered materials can eliminate multiple barriers to participation and contamination reduction by increasing generators’ confidence in their recycling and organics recycling decisions and their trust in the recycling system. For

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<sup>34</sup> CalRecycle. ---. “SB 343: Accurate Recycling Labels.” *CalRecycle*. Accessed Nov. 2025.

<sup>35</sup> Kramer, Eli, and Erez Yoeli. “Individual, Corporate, and National Wishcycling: Improving Recycling in the U.S. By Understanding Its Complexity.” *MIT Science Policy Review*, vol. 4, 31 Aug. 2023, pp. 41–48.

<sup>36</sup> National Academies of Sciences, Engineering, and Medicine, et al. *Municipal Solid Waste Recycling in the United States: Analysis of Current and Alternate Approaches*. National Academies Press EBooks, 18 June 2025.

example, in 2008, the Sustainable Packaging Coalition, a packaging industry group, launched a voluntary label to help generators understand the types of packaging that can be collected for recycling at a local level called the “How2Recycle” label. This label helps consumers identify:

- Which parts of the packaging are recyclable (as defined by How2Recycle).
- Which parts require confirmation with a local program to determine recyclability.
- Materials that are not yet accepted by most collection programs for recycling.<sup>37</sup>

In 2024, the How2Recycle labeling system also launched a QR code option to feature alongside its traditional labels, allowing generators to scan the product and get additional local collection program information. Leveraging How2Recycle, or a similar labeling system — such as the “Green Dot” used to identify packaging covered by EPR laws in Germany,<sup>38</sup> or a newly developed labeling system — may alleviate much of generators’ confusion. Generators may also be more receptive to a new design that does not utilize the chasing arrow symbol which has fostered distrust in the recycling system and confusion for many generators over the past several decades.

Better systems for distributing information at the point of purchase and point of discard, such as mobile and web applications and better product labeling, still rely on generators being ultimately responsible for correctly participating in covered materials collection programs. Increasing generator participation in collection programs will require more than just attitude and values shifts. It will require system change. Increased transparency and simplification of the complex systems generators are trying to navigate could fundamentally improve the efficacy of the overall system, reduce complexity in education and messaging, and encourage participation.

#### **2.2.6.2.2 Local Education Initiatives**

The Current State of Collection Report estimated the statewide budget for local jurisdictions and RSPs to implement contamination monitoring and reduction initiatives across all local jurisdictions at approximately \$533 million annually. This was based on 80 Collection Survey responses from local jurisdictions that reported the number of full-time equivalent (FTE) staff used for implementing contamination monitoring and reduction initiatives to estimate the number of total FTEs in each region and throughout the state. This estimate is assumed to include general education initiatives and contamination monitoring and reduction initiatives. This estimate does not include hard costs, such as printing, mailing, software, physical resources, and kitchen pails, due to the variability of hard costs and the fact that they represent only a fraction of salary allocations.

The contractor divided the current estimated statewide budget of \$533 million by the total number of generators in the state (10,556,579 households and 464,392

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<sup>37</sup> “How2Recycle.” *How2Recycle*, 2019. Accessed Nov. 2025.

<sup>38</sup> GD Europe. “About Green Dot®.” *GD Europe*. Accessed Nov. 2025.

commercial generators). This calculation resulted in an estimated \$48 spent per generator, annually, on education and outreach related to properly managing discarded materials in 2024. As this estimate is assumed to encompass all discarded materials related education and outreach implemented by local jurisdictions and RSPs, it is reasonable to assume that \$48 per generator is a higher cost estimate than what is actually spent on education and outreach related specifically to the collection of covered materials and reducing contamination in the covered materials collected for recycling and organics recycling.

The breadth of educational topics that might be included within any single local jurisdiction's PE&O budget, coupled with the lack of detail found within publicly available local jurisdiction budgets, makes it difficult to determine a reasonable estimate of the ratio of PE&O funds directed specifically to increasing the collection of covered materials and reducing contamination in the covered materials collected for recycling and organics recycling streams. Additionally, local jurisdictions will often maximize opportunities for engagement with generators by presenting multiple topics or fulfilling multiple educational requirements within each interaction. Based upon the Collection Survey responses and the contractor's analysis of 11 well-resourced local jurisdictions, there is a wide range of budgets for PE&O across the state — ranging from \$0 per generator to almost \$60 per generator. Local jurisdictions responding to the Collection Survey reported population-to-staff ratios ranging from over 500,000 people per FTE to 832 people per FTE. See Appendix A, section 2.D.2 for how these estimates were calculated.

To estimate the potential impact of PE&O, the contractor analyzed three well-resourced local jurisdictions, for which diversion data were readily available, and found that they experienced a 0.36 to 5 percentage point increase in diversion from 2022 to 2024, or approximately a 0.18 to 2.5 percentage point increase per year. See Appendix A, section 2.D.2 for additional details on the methodology of this approach. While these changes may seem small, two of the identified local jurisdictions and four of the seven member agencies making up the third local jurisdiction have achieved an overall diversion rate that exceeds the statewide diversion rate of 42%<sup>39</sup> by over 8 percentage points in 2024. This demonstrates that the programs implemented in these jurisdictions are outperforming the standard programs implemented across the state.

Part of the success of these well-resourced jurisdictions is that they have created a culture that normalizes recycling behaviors and creates trust in the current system. This is achieved through activities such as consistent and clear messaging delivered to generators through flyers, postcards, and pamphlets, direct engagement through technical assistance visits and participation at local events, and targeted campaigns to address the most substantial barriers to successful recycling programs. They invest heavily in ensuring relevant information is accessible and establishes a common understanding of best practices for recycling among generators. This has created some

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<sup>39</sup> CalRecycle. "State of Disposal and Recycling in California." *CalRecycle*, 2024, [calrecycle.ca.gov/stateofreport/](https://calrecycle.ca.gov/stateofreport/).

of the highest levels of recovery in the state despite the increasing complexity of materials generators encounter.

Significant investment in PE&O will be required to normalize recycling behaviors. Local jurisdictions that have previously invested significantly in PE&O may require substantial funding to reach the standards of mature programs where these practices are well established. At minimum, the contractor estimates an annual expenditure of \$5.50 per household and \$233 per business, with the majority of that funding allocated to employing staff for technical assistance, contamination monitoring, and program development. As a benefit, these initial investments will encourage job creation at local communities across the state. These initial investments may lead to robust increases in the collection of covered materials in the first one to two years of new programs, with those who are already motivated to participate or who experience the lowest barriers more easily engaged. However, the rate of change in participation and contamination levels may decrease over time unless these investments are coupled with packaging redesign.

The following subsections are proven methods and specific activities that can support local education initiatives.

#### 2.2.6.2.2.1 Community-Based Social Marketing and Implementation of Pilot Programs

Successful behavior-change strategies often use individualized attention, direct engagement, and specific actions targeting their unique audience. For example, the Recycling Partnership's 2020 "West Coast Contamination Initiative Research Report" found that recycling knowledge and information must be presented in ways that are accessible to all individuals that make up diverse communities.<sup>40</sup> Furthermore, Doug McKenzie-Mohr, founder of Community Based Social Marketing (CBSM), provides multiple examples that demonstrate education alone often has little to no effect on sustainable behavior. Rather, sustainable behavior change is driven through direct interventions to reduce or eliminate specific barriers preventing behavior change.<sup>41</sup> CBSM is successful through its ability to provide practical solutions that overcome barriers associated with participating in a desired behavior.

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<sup>40</sup> The Recycling Partnership, "West Coast Contamination Initiative Research Report," April 2020.

<sup>41</sup> McKenzie-Mohr, Doug. *Fostering Sustainable Behavior Change: An Introduction to Community Based Social Marketing*. 3<sup>rd</sup> ed. Canada: New Society Publisher, 2011.

CBSM is comprised of the following key steps:

- Identify specific behaviors to be promoted.
- Identify the barriers and benefits associated with the selected behavior.
- Design a strategy that utilizes behavior-change tools to address the barriers and benefits.
- Pilot a strategy.
- Evaluate the impact.<sup>42</sup>

Local jurisdictions report in the Collection Survey that the following PE&O methods that provide opportunities for direct and tailored engagement are the most effective for curbing contamination:

- Direct engagement, such as site visits to single-family homes, multifamily properties, and commercial businesses, to conduct audits, provide trainings, and offer tailored recommendations for improving participation. These site visits are often considered part of a technical assistance program.
- Educational resources and support offered in multiple languages that are culturally relevant to people of various backgrounds.
- Direct engagement with schools and school districts to provide training, presentations, and technical assistance to students, school staff, and administrators.
- Distribution of physical resources to support proper recycling and organics recycling, such as indoor collection containers, container signage, or monitoring technology.

Local jurisdictions are already responsible for creating and administering initiatives to promote multiple behaviors and educate generators on multiple topics at the same time. This can inhibit their ability to accurately track the granular metrics required to assess the successes of specific educational messages and campaigns. Local jurisdictions often measure the success of large-scale campaigns and annual localized PE&O by the amount of money spent, the amount of materials (e.g. flyers, tags) distributed, or the amount of people engaged (e.g. visitors at a booth). However, these metrics do not capture if individuals are changing their recycling behaviors or sustaining this behavior. To address this, pilot programs implemented with CBSM framework can be implemented to determine the effectiveness of a specific educational or engagement approach on a more granular level.

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<sup>42</sup> McKenzie-Mohr, Doug, *Fostering Sustainable Behavior Change: An Introduction to Community-Based Social Marketing*, 3<sup>rd</sup> ed., Gabriola, B.C., New Society Publishers, 1 Feb. 2011, p. 8.

Pilot programs are small-scale trials that typically operate for a designated period of time and include measurements before and after the trial to determine the effectiveness of a specific intervention. This provides quantitative and qualitative data on the target audience's actual behavior change as a result of the intervention. Pilot programs can be adapted for different populations within a jurisdiction and test the response by specific demographics (e.g., income level, education level, or native language) to different types of messages. This testing can help inform the scalability of the pilot program across the entire local jurisdiction or the pilot program's replicability in other local jurisdictions. For these reasons, the contractor suggests pilot programs that test different tactics in different contexts.

Local jurisdictions will need to factor in administrative, creative (i.e. development of flyers), and field staff time into the planning, implementation, and analysis of pilot programs. For example, larger communities may need more labor hours to gather statistically significant sample sizes (e.g., additional container inspections, larger samples, or multi-season waste characterizations). Population density may be a contributing factor for the time needed to perform the pilot program. For example, in Northern Cook County, Illinois, staff reported that population density affected time required to perform container inspections and deployment of contamination notices. Field staff reported the ability to reach eight to 10 homes per day in lower density areas, versus 18 to 20 homes per day in higher density areas.<sup>43</sup>

The method of measuring the pilot's effectiveness greatly impacts the cost of a pilot program and its scalability. Pilot programs analyzed in this report used a variety of methods to measure effectiveness, including container inspections, community surveys, and waste characterizations, for which costs vary. Container inspections and visual audits can be a cost effective way to determine effectiveness of pilot programs; of the pilot programs evaluated by the contractor, visual audits had a significantly lower cost per unit (\$2.14 to \$4.13 per container and \$5.37 per household) than waste characterizations (\$31.67 to \$752.69 per household). See Appendix A, section 2.D.2 for further details on how these estimates were calculated.

The contractor did not find evidence suggesting that container inspections or waste characterizations were more or less successful in gathering reliable data. However, the contractor did find evidence that surveys may include social desirability biases, making them a less desirable measurement method. A study by the Norwegian University of Science and Technology found that "for a behavior that is morally relevant, such as pro environmental behavior, it is not unlikely that people bias their responses to achieve a better social impression of themselves."<sup>44</sup> Another study by the University of Victoria found that survey participants reported regularly sorting their household materials for

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<sup>43</sup> Solid Waste Agency of Northern included (SWANCC). "Curbside Recycling Cart-Tagging Pilot Program." July 2022.

<sup>44</sup> Vesely, Stepan, and Christian A. Klöckner. "Social Desirability in Environmental Psychology Research: Three Meta-Analyses." *Frontiers in Psychology*, vol. 11, no. 1, 24 July 2020.

recycling, even if they did not.<sup>45</sup> The contractor suggests that consistency in measurement method used before, during, and after the pilot program is necessary to have a high confidence in the measurement method.

Pilot programs can be an effective tool to verify whether specific approaches significantly increase participation in collection programs at the community level. Additionally, as more resources are dedicated to plan, perform, and evaluate pilots, a robust set of successful example programs will become readily available for local jurisdictions to replicate, adapt, and scale in their communities, potentially reducing cost over time. Please note that pilot programs are not intended to replace traditional engagement that jurisdictions are already undertaking, such as technical assistance, school programs, and informational campaigns such as direct mailers and advertisements. Instead, these pilot programs provide a means to augment the effectiveness of existing campaigns by developing new strategies to broaden and deepen connections with the intended recipients.

#### 2.2.6.2.2.2 Case Studies of Successful Local Education Initiatives

The contractor reviewed small-scale pilot program case studies utilizing CBSM tools, conducted inside and outside of the state, to evaluate methods that substantially increased participation in collection programs and decreased contamination. The programs reviewed have varying methodologies with different metrics on effectiveness, program costs, and staffing requirements. Scaling these projects community-wide or across jurisdictions may result in varied costs due to factors including, but not limited to, population density, evaluation methodology, and dedicated staffing. Furthermore, the case studies described tools and interventions based on specific community needs and characteristics, so local jurisdictions may find that they need different (or different amounts of) messaging and interventions for similar results in their own communities. Moreover, due to the targeted nature of these case studies, they cannot necessarily be copied or easily expanded to cover multiple topics. For example, a new program to collect flexible and film plastics in a blue bag to be placed in onsite curbside collection containers may deliver a specific number of free blue bags to generators, while a different program asking generators to utilize new containers for recycling and organics recycling at a public park may require staff to engage generators directly at the park's collection station. For these reasons, the contractor has not extrapolated or made assumptions about total statewide costs for implementing these case studies. Rather, the contractor provides an estimate of costs per program or per year.

Of the case studies reviewed, the contractor found that peer-to-peer engagement in the form of direct engagement and empathetic messaging resulted in the largest increase in participation in collection programs (see Appendix A, section 2.D). For example, in Sunnyvale, Calif., a CBSM pilot determined how messaging, methods of delivery, and order of information affected multifamily participation in their organics recycling

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<sup>45</sup> Kormos, Christine, and Robert Gifford. "The Validity of Self-Report Measures of Proenvironmental Behavior: A Meta-Analytic Review." *Journal of Environmental Psychology*, vol. 40, no. 1, Dec. 2014, pp. 359–371.

program. During the pilot program, the consultant performed in-person “knock-and-talks” as either the first, second, or third method of engagement coupled with other engagement (e.g., door hangers) for residents in three multi-family buildings. The pilot resulted in a 25% increase when in-person knock-and-talks were the first method of engagement, 2,748% increase when it was the second, and a zero percent increase when it was the third, in pounds of organic material collected in the collection container designated for organics recycling.<sup>46</sup> The building with the largest increase in participation used direct engagement as the second interaction, after multi-family dwelling units received informational door hangers as the first engagement. This supports that setting a foundation of information before direct engagement may make generators more willing to change their behavior, since they have a basic awareness of the program and its importance prior to direct interaction. To conduct the pilot program, the city of Sunnyvale spent approximately \$753 per household. This cost included labor hours to develop door hangers, engage with generators and deliver door hangers, and perform waste characterizations to determine the pilot program’s effectiveness.

In Reynoldsburg, Ohio, a pilot program tested emotional, empathetic, and logical container tags against each other and ensuing increases in participation, where participation means placing materials in the materials collected for recycling stream. This pilot saw the largest increase in participation (51% increase in pounds collected) through an empathetic cart tag, which normalized confusion over recycling. The pilot program saw a 38% increase in participation through the use of an emotional message asking residents to consider where their waste went after being discarded.<sup>47</sup> On the other hand, the logical cart tag saw no significant change in participation. This study had a cost of \$5.37 per household for the development and printing of cart tags and labor hours for delivery of tags. A key difference between this study and the one conducted in Sunnyvale is that the increase in participation was measured based on the total tonnage of material collected on each route participating in the study. This was determined via the scale-house weights of collection trucks as they entered a processing facility. This process did not require any changes in operations or labor and, therefore, significantly reduced the cost of the pilot program. Sunnyvale’s pilot program utilized individual waste characterizations to determine effectiveness at each property, which was much more expensive.

Both pilots suggest that the type of messaging can have an impact on participation, particularly when followed up with direct contact. Although demographic indicators, including household income, race, education level, owner versus renter status, and language spoken, were considered in the distribution of outreach materials for both pilots, there are no definitive cross-study findings based on these indicators. It is worth noting, however, that messaging utilizing social norming strategies may differ depending

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<sup>46</sup> HF&H Consultants, Inc. “City of Sunnyvale: CBSM Multi-Family Food Scraps Pilot Results Meeting.” 3 Oct. 2025.

<sup>47</sup> The Recycling Partnership. “Reynoldsburg, Ohio Pilot Project Report: Increasing Recycling by Utilizing Cart Tags and Mailers with Motivational Messages, How Messaging and Methods Can Affect Recycling Behavior.” 2022.

on the demographics of a particular community, neighborhood, or building. As noted in the findings of CalRecycle’s iRecycle Smart campaign, this can be especially true for multilingual communities, where direct translation of materials is not sufficient to address differences in values, attitudes, and motivations. These tailored approaches may be critical in providing appropriate empathetic and emotional messaging to specific community groups.

Both pilot programs utilized relatively small sample sizes. The Sunnyvale pilot program included 204 multifamily units and the Reynoldsburg pilot program included 8,239 households. It is often challenging to determine scalability once the pilot program is complete. Local jurisdictions may not have sustainable funding mechanisms, political will, or staff resources to continue the level of effort needed for extended periods of time or additional communities. For example, an interview with staff from the city of Livermore found that once grant funding for the city’s in-bin camera pilot program to reduce contamination was depleted, the city was only able to maintain 50 of its initial 170 cameras to continue the pilot program. The reduction in number of cameras, the large investment of staff time required to review camera footage then engage directly with each individual bin customer, the increasing cost of maintaining aging technology, and the monthly cost for the software program ultimately led the city of Livermore to discontinue the program three years after the grant ended, despite seeing an overall decrease in contamination (3%) at the end of the grant period.<sup>48</sup>

It is possible, however, to scale pilots successfully and for a potentially lower cost due to economies of scale. In 2020, the Mojave Desert and Mountain Authority Joint Powers Association (Mojave Desert JPA) in the Southern Region conducted a pilot program to reduce contamination in the containers collected for recycling and organics recycling by testing the effectiveness of “oops” cart tags alone versus “oops” cart tags and direct engagement with residential generators. The results indicated a 33.63% (oops cart tags alone) to 43.81% (“oops” cart tags and direct engagement) reduction in targeted contaminants, as determined by waste audits conducted before and after the pilot. The cost of the pilot was approximately \$31.67 per household. The Mojave Desert JPA was able to scale the pilot program to continue as part of its ongoing public education, which decreased the cost per household to approximately \$8.04 annually. The reports from Mojave Desert JPA did not explicitly state how the cost per household decreased, but the assumptions were made in how the cost may have decreased. Cost savings when scaling pilot programs could come from:

- Reuse of collateral developed during the pilot. Effective collateral created during the pilot needs less redevelopment resulting in cost savings from development and design.

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<sup>48</sup> Erlandson, Judy. *Personal Interview*. 10 Oct. 2025.

- Greater efficiency supplying direct engagement to customers in larger and more concentrated areas (i.e., reduced travel time between pilot neighborhoods or areas used in testing).
- Less intensive evaluation costs. Pilots tend to have more data collection, analysis, and reporting to determine effectiveness than ongoing programs. Once effectiveness is determined and proven messaging and methods are expanded, evaluation may be less necessary or less frequent.

Note two limitations in Mojave Desert JPA's lower cost per household. First, this cost does not include the costs for conducting waste characterizations to evaluate the effectiveness of the Mojave Desert JPA's ongoing public education efforts. The cost of the waste characterization, which the Mojave Desert JPA contracted a third-party to perform, is approximately \$60,000 in additional cost for each scheduled characterization. The costs of waste characterizations can vary significantly based on sampling protocols, who conducts the study, and several other factors. Second, the stated cost for the ongoing education included a larger scope of work encompassing regulatory compliance support for the Mojave Desert JPA, generator inspections, and edible food recovery. For these reasons, the actual, ongoing cost of scaling the pilot program may be slightly higher or lower than the stated \$8.04 per household.

As demonstrated by the case studies described, empathetic messaging that normalizes recycling and organics recycling behaviors has the potential to increase the tonnage of material collected through recycling and organics recycling when paired with direct engagement. As discussed, these results are likely achieved when messaging addresses a specific behavior. Considering the large number of covered materials, multiple campaigns will likely be required over time. It is recommended that the first programs target the covered materials requiring the most substantial increases in collection from 2024 to 2028, as shown in Table 2-12. Beginning in 2028, marketing can shift to materials identified in Table 2-14. By 2032, marketing can again shift to target materials identified in Table 2-16.

### **2.2.6.2.3 Engaging Priority Populations**

Survey results indicate an opportunity to increase engagement with the public about how collection operations impact their communities and effective strategies for improving participation. As identified through listening sessions with CBOs, EJ groups, and Tribes, access to collection programs is not merely a matter of establishing onsite curbside collection containers or alternative collection systems. There are unique barriers such as mobility or transportation limitations, and communication challenges with landlords or property managers, that must be overcome. Additionally, CBO, EJ group, and Tribal participants in the listening sessions indicated that varying levels of motivation due to competing priorities, a perceived lack of agency, and distrust in the recycling system prevent many people from actively participating in available programs. While the development of policy and infrastructure may help overcome access issues, overcoming motivational barriers requires fostering a strong level of trust with impacted communities, the success of which is largely dependent on how, and by whom, engagement is conducted.

According to The Trusted Messenger Study conducted by the Ad Council in 2022, when presented with facts, people are influenced equally, or more, by who the message comes from than by what the specific content of the message is.<sup>49</sup> Furthermore, the study found that “race, age, region, political affiliation, and so many other demographic characteristics can influence a person’s level of trust (or distrust) in the messengers around them.”<sup>50</sup> A 2023 report by the Hastings Center also found that “people are often more willing to trust those who are similar to them, taking shared aspects of identity, such as race or ethnicity, as signals of shared values and interests. This can be particularly true for minoritized groups.”<sup>51</sup> The Hastings Center report identified cultural competence and an understanding of intersectionality as necessary proficiencies for trusted messengers<sup>52</sup>. Building a network of trusted messengers will require consistent and authentic engagement with community partners to identify shared values and gain buy-in from community leaders. Once a network is established, trusted messengers must be equipped with the tools and resources to facilitate initiatives that demonstrate how adjusting recycling and composting attitudes and behaviors is beneficial to their communities.

Trusted messengers can serve as liaisons between community members and key decision makers such as the PRO. The right trusted messenger will have an established rapport with their community members and be more readily available to them. This may make community members more willing and able to discuss ideas and concerns with trusted messengers versus other decision-making entities. They can also utilize their existing influence to encourage participation by community members in meetings, surveys, listening sessions, and other engagement strategies. Connecting periodically with a network of trusted messengers may therefore centralize community feedback that can get relayed more effectively to decision makers. This may result in a continuous feedback loop to develop, test, and refine strategies that effectively improve participation in collection programs for priority populations and identify solutions to mitigate Public Health, Environment, and Community (PHEC) impacts.

Developing a network will first require developing strong relationships, built on a foundation of trust, with those identified as potential trusted messengers for their community. Potential trusted messengers may be obvious community leaders, such as a pastor or school principal, or other community influencers that are known to that specific community. Establishing relationships will require boots-on-the-ground efforts to meet people where they are. As highlighted by the Association of American Medical

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<sup>49</sup> Ad Council and Research Institute, “Who Do We Trust with Our Lives? The Inaugural Study of Who Americans Trust on Social and Societal Issues,” p. 3.

<sup>50</sup> Ad Council and Research Institute, “Who Do We Trust with Our Lives? The Inaugural Study of Who Americans Trust on Social and Societal Issues,” p. 56.

<sup>51</sup> Chau, Michelle M, et al. “Community-Based Organizations as Trusted Messengers in Health.” *The Hastings Center Report*, vol. 53, no. S2, Sept. 2023.

<sup>52</sup> Chau, Michelle M, et al. “Community-Based Organizations as Trusted Messengers in Health.” *The Hastings Center Report*, vol. 53, no. S2, Sept. 2023.

Colleges (AAMC) Center for Health Justice, those seeking to engage with a community that they are not inherently a part of need to spend sufficient time understanding all of that community's assets. They will need to, "Visit them. Meet the patrons. Meet the leaders. Break bread and share a meal — at their tables."<sup>53</sup> Once the appropriate, potential trusted messenger is identified, an article by Linda Gallagher of the Municipal Research and Services Center (MRSC) stresses utilizing transparency as a tool to help build trust with that community member. Transparency includes proactively disclosing information; using plain language and avoiding jargon; acting promptly on concerns and providing timely updates on progress; and creating plenty of opportunities for public input. In addition, the MRSC article reports that strong foundations of trust are built on a culture of collaboration that involves community members in decision making. Once trust is established with the right community leaders, relationships will require continuous attention to be maintained. As stated by the AAMC, "it takes a long time to build trust and only a split second to destroy it."

According to the MRSC article, those working to establish trust within a community "must work both to increase perceptions of their trustworthiness as well as their actual capabilities to deliver services, products, and experiences worthy of trust."<sup>54</sup> Therefore, it is imperative that dedicated resources and time are continuously provided to ensure consistent engagement and follow through with engaged communities. It is recommended that a dedicated team, with adequate available funding, is established to build meaningful connections with priority populations and develop unique strategies with community leaders to disseminate information, improve access to collection programs, and mitigate negative impacts of the collection and processing of materials collected for recycling and organics recycling.

The contractor administered the Community Recycling and Composting Survey and conducted listening sessions with representatives of CBOs, EJ Groups, and Tribes to solicit community perspectives regarding past, current, and future recycling collection services and impacts on their communities. The contractor received input from 332 individuals via the Community Composting and Recycling Survey, in addition to participation from 14 CBOs and 3 Tribes through listening sessions.

During the listening sessions, participants indicated that direct engagement at public events and meetings was effective at informing the community about recycling and organics recycling, and other environmental issues. This was particularly true for several CBOs and one Tribe that host monthly meetings to discuss local environmental issues. In addition to in-person engagement, one CBO noted that having a hotline where community members could call to request information on how to recycle certain items was an effective tool. Further supporting community members, CBOs, and EJ groups to engage with their community about recycling and related topics should be

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<sup>53</sup> AAMC Center For Health Justice. "The Principles of Trustworthiness Toolkit." *AAMC.org*. Accessed Nov. 2025.

<sup>54</sup> Gallagher, Linda. "Building Trust: Effective Tools for Local Government." *MRSC*, 12 Aug. 2024. Accessed Nov. 2025.

accompanied by resources and support to allow them to coordinate meetings, attend community events, and develop digital and printed collateral materials. This could include funding for engagement tools and services such as virtual meeting platforms, webcast applications, and outreach tracking systems, as well as staffing to support these efforts. While these strategies may be effective at educating community members and providing opportunities to solicit community feedback, they do not overcome access issues. Expanding access to priority populations must be addressed prior to, or in tandem with, implementing education and engagement strategies to avoid further eroding trust in the recycling system.

### 2.2.6.3 Additional Collection Opportunities

In addition to strong educational initiatives, there are additional programs that can support added convenience for generators and reduce confusion about what materials are allowable in collection containers for recycling and organics recycling, thereby increasing participation in collection programs and reducing contamination. Some of these initiatives, such as those implemented at large venues and events, may focus solely on increasing collection of covered materials in a specific context. However, the widespread exposure these programs have to a diverse set of generators may indirectly increase knowledge of covered material collections and normalize recycling behavior. Other programs work to establish behavior changes that can improve the recycling and organics recycling of specific covered materials by reducing contamination levels through source separation.

#### 2.2.6.3.1 Participation in Alternative Collection Systems

Alternative collection programs can supplement access to curbside collection programs, especially for hard-to-collect items or in rural communities with low population densities and those within geographically challenging terrains for which onsite curbside collection access is not feasible or prohibitively expensive. Alternative collection programs may be best utilized for the collection of specific source-separated materials, to provide public space collection, and to provide additional drop-off locations in areas without full access to collection.

Source separation and collection through alternative collection systems could be a valuable tool to increase the collection of covered materials that are difficult to capture at processing facilities or that negatively impact the capture rate of other covered materials, such as flexible and film plastics. Alternative collection programs may also be particularly valuable to supplement collection of covered materials that require the largest increases in collection rate from 2024 to 2032. These programs, however, will require careful consideration and resources to overcome existing barriers of participation. The Current State of Collection Report identified a lack of awareness as a barrier to participation in alternative collection programs. Increasing PE&O about available alternative collection programs for covered materials, particularly flexible and film plastic as well as paper and metals with plastic components, is therefore imperative to the success of these programs. Targeted education and marketing campaigns will play a key role in increasing awareness of these programs. Additionally, generators most likely to seek out alternative collection programs, and meet the requirements of

participation (e.g. purchasing products from participating brands), are often those who are predisposed to seek out waste reduction activities and self-identify as recyclers. Therefore, educational campaigns may need to employ a variety of messaging to appeal to a broader audience of people who are not engaged in or knowledgeable about recycling in addition to ensuring widespread and convenient access to collection.

Cost is a significant barrier to participation in collection programs for some communities, including some priority populations. Alleviating the financial burden of purchasing items such as shipping labels or boxes for mail-back programs could support more equitable access to these programs. This could be done by providing shipping labels at no cost to generators statewide or to specific priority populations either online, at stores, or through a partnership with a third-party reverse logistics company such as Happy Returns.<sup>55</sup> Happy Returns, which typically works with online retailers, allows generators to start a return online, and then deposit their return at a participating location without the need for a shipping label or box. A similar system, coupled with participation by a wide variety of retail locations serving as collection drop-offs, could increase access, particularly for disadvantaged populations, who may have limited transportation services to certain retail locations. Additionally, as identified during listening sessions with CBOs, EJ groups, and Tribes, monetary incentives are effective in driving participation and also serve as source of income for many individuals. For materials such as small format plastics and multi-material laminates that are particularly challenging to collect and process, offering a monetary incentive for collection can increase participation in these collection programs and also support economic development.

Convenience will also play a role in the success of alternative collection programs. For example, generators will require time and space to store materials until a sufficient quantity is accumulated in order to fill a preferred mail-back receptacle<sup>56</sup> or deliver to a third-party drop-off location. As identified by CBOs, EJ groups, and Tribes during listening sessions, increasing the number of retail locations that receive covered material for recycling such that generators are in close proximity to a drop-off center, and expanding their operating hours can increase the convenience of participation and allow generators to deliver materials to collection points more frequently. Additionally, reducing any barriers to drop-off materials, such as the requirement to make an appointment, will provide more flexibility to generators and improve convenience.

Crucially, generators must have trust and belief that their sorted materials are recycled, particularly when those materials are actively promoted as recyclable by branded companies yet are not accepted in onsite curbside recycling programs.<sup>57</sup> Transparency

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<sup>55</sup> “We Take Returns Seriously.” *Happy Returns*. Accessed Nov. 2025.

<sup>56</sup> National Academies of Sciences, Engineering, and Medicine, et al. *Municipal Solid Waste Recycling in the United States: Analysis of Current and Alternate Approaches*. National Academies Press EBooks, 18 June 2025.

<sup>57</sup> Kaufman, Leslie. “The Warehouses of Plastic behind TerraCycle’s Recycling Dream.” *Bloomberg L.P.*, 27 Oct. 2022. Accessed Nov. 2025.

around what happens to covered materials collected by an alternative collection system should be a priority in large scale media campaigns.

Overall, PE&O promoting alternative collection systems should utilize the same framework of informational, emotional, and direct-contact education as any other single-message campaign. Distribution of PE&O should happen strategically, only when sufficient alternative collection infrastructure is in place so as not to discourage or deter generators upon first interaction with the alternative collection system.

### **2.2.6.3.2 Closed-Loop Systems at Large Venues and Events**

Large venues and events often generate a significant amount of waste in a short amount of time. They also have more control over what covered materials are used onsite and what systems and messaging are implemented for recycling, organics recycling, and disposal. This creates an opportunity to increase the collection of covered materials by limiting the types of covered material onsite, simplifying collection systems, and educating staff for back-of-house operations on recovery efforts.<sup>58,59</sup>

Existing waste recovery programs at large venues and events focus on front-of-house (areas and operations accessible and viewable by customers and guests) and back-of-house (operations and areas not accessible or viewable to customers and guests)<sup>60</sup> operations separately. Most often, front-of-house operations focus on collecting bottles, cans, and food service ware and limiting food waste, while back-of-house operations focus on recovering other materials, such as film plastic.<sup>61,62</sup> In front-of-house operations, large venues and events help normalize recycling behavior amongst generators through clear and consistent collection infrastructure, signage, on-site advertisements, and incentives. Examples of these strategies include strategically placing collection receptacles for recycling and organics recycling in high-use areas, establishing reverse vending machines<sup>63</sup> for plastics (e.g., souvenir cups) or food service ware (e.g., disposable flatware), partnering with large brands to show

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<sup>58</sup> Pyzyk, Katie. "Stadiums Pursue New Technologies and Tactics to Boost Waste Diversion." *Waste Dive*, 9 Jan. 2023. Accessed Nov. 2025.

<sup>59</sup> Reynolds, Matt. "At Final Four, Coke Tips off Certified Closed-Loop Recycling." *Packaging World*, 8 Apr. 2024. Accessed Nov. 2025.

<sup>60</sup> Indeed Editorial Team. "Front of House vs. Back of House." *Indeed*, [www.indeed.com/career-advice/finding-a-job/front-of-house-vs-back-of-house](https://www.indeed.com/career-advice/finding-a-job/front-of-house-vs-back-of-house).

<sup>61</sup> Varagur, Krithika. "When the Music Stops, Festivals Are Left with Mountains of Uneaten Food." *HuffPost*, 21 July 2016. Accessed Nov. 2025.

<sup>62</sup> Caliendo, Heather. "SC Johnson, Liverpool Football Club to Create a Closed Loop Recycling Model." *Plastics Technology*, 17 Sept. 2021. Accessed Nov. 2025.

<sup>63</sup> Pyzyk, Katie. "Stadiums Pursue New Technologies and Tactics to Boost Waste Diversion." *Waste Dive*, 9 Jan. 2023. Accessed Nov. 2025.

generators what their collected materials are recycled into<sup>64</sup>, and sharing marketing campaigns with all attendees.<sup>65,66</sup>

These applied strategies at major stadiums have seen considerable results. SoFi Stadium in Inglewood reports diverting two million pounds of waste per year. The stadium worked with its vendor to transition to aluminum cups, preventing 661,000 plastic cups from disposal.<sup>67</sup> The Los Angeles Coliseum generates 74 tons of discarded materials during football season. In 2021, the stadium reported diverting 64 tons of materials including 40 tons of materials for recycling using 80 to 145 custodial staff.<sup>68</sup> In 2024, Coca-Cola partnered with the National Collegiate Athletic Association (NCAA) to implement a plastic and aluminum collection program at NCAA venues for the men's and women's Final Four tournaments. The large audience on-site, and watching at home, was seen as a unique opportunity to put a spotlight on recycling. The company enlisted on-site sorters to direct generators on proper material sorting for recycling, improved bin signage at both stadiums to focus on bottle and can recycling, incentivized participation through redeemable merchandise, gamified some of the bin collection stations, and added 200 additional collection bins. The company also used a third-party auditor to generate trust amongst generators that the collected material would be sent to the proper channels for recovery.<sup>69</sup>

The ability of large venues, like SoFi stadium, and events to dictate purchasing can lower barriers for generators to participate in collection programs established on site by limiting generator confusion about what materials are accepted for recycling and organics recycling. Large venues and events can use specific signage and marketing for those limited materials, further reducing confusion and thereby increasing generator participation and reducing contamination. Using third-party audits can help establish trust in the recycling systems at large venues and events and underscore the value of generator participation.

Large venues and events provide an opportunity to establish systems that can yield high collection rates for covered materials and normalize recycling behavior to a large audience. This public display of behavior normalization can directly or indirectly

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<sup>64</sup> Reynolds, Matt. "At Final Four, Coke Tips off Certified Closed-Loop Recycling." *Packaging World*, 8 Apr. 2024. Accessed Nov. 2025.

<sup>65</sup> Mohan, Anne Marie. "Coca-Cola Creates Closed-Loop Stadium Recycling System." *Packaging World*, 10 Oct. 2024. Accessed Nov. 2025.

<sup>66</sup> Darley, James. "Coachella, Coldplay & Glastonbury: Can Festivals Go Green?" *Sustainability Magazine*, Bizclik Media Ltd, 10 Apr. 2025. Accessed Nov. 2025.

<sup>67</sup> SoFi Stadium. "Hollywood Park Sustainability Program." *SoFi Stadium*. Accessed Nov. 2025.

<sup>68</sup> Los Angeles Coliseum. "Sustainability." *L.A. Memorial Coliseum*. Accessed Nov. 2025.

<sup>69</sup> Reynolds, Matt. "At Final Four, Coke Tips off Certified Closed-Loop Recycling." *Packaging World*, 8 Apr. 2024. Accessed Nov. 2025.

influence generator behavior in other situations outside of the venues or events.<sup>70</sup> This may be especially true if generators are exposed to other messaging and marketing materials in their routine spaces such as their home or workplace. A systematic approach to collecting materials for recycling at venues and events creates transparency and further establishes trust in the recycling system for generators.<sup>71</sup> The cost of implementing these programs was not publicly available through the contractor's research into these private programs. However, it is recommended that targeted support, via technical assistance and/or direct distribution of resources, is provided to enhance collection systems at large venues and events across the state. This team could be established by additional staff at local jurisdictions, focused on large venue and event support, or via the establishment of regional teams, managed by industry associations or other third-party sources, that can harmonize efforts across multiple venues and events.

### **2.2.6.3.3 Color-Coded Source Separation Systems**

Using color coded bags to further source separate specific materials within existing collection systems can help to overcome some process and contamination challenges. By separating certain types of materials, such as flexible and film plastics, multi-material laminates, and small format plastics, into color coded bags, generators can utilize their current means of onsite curbside collection while increasing the collection and ultimate capture rate of those materials at MRFs. Implementing such a system in California would likely not have material impacts on collection operations as the bags would, ideally, be allowed in onsite curbside collection containers and collected via existing collection routes. However, recycling processing facilities would need to make upgrades to their systems or alter their current operations to capture the bags. Additional educational costs would be incurred to ensure generators are aware of the program and know how to use it properly. Collection drivers who pick up materials would also require education on the new program to ensure they are only accepting bags that meet program requirements.

A color-coded bag collection system is currently used in Eskilstuna, Sweden, which sorts into seven different colored plastic film bags based on material type. MRFs processing this material use optical sorters to sort the bags by color.<sup>72</sup> A similar program in the U.S. is the Hefty ReNew program which asks generators to sort film plastics and multi-material laminate material into an orange plastic film bag for recovery in onsite curbside collection programs. Although this program is not currently available in California, Hefty self-reports that 2.3 million households in nine other states have

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<sup>70</sup> Mohan, Anne Marie. "Coca-Cola Creates Closed-Loop Stadium Recycling System." *Packaging World*, 10 Oct. 2024. Accessed Nov. 2025.

<sup>71</sup> Reynolds, Matt. "At Final Four, Coke Tips off Certified Closed-Loop Recycling." *Packaging World*, 8 Apr. 2024. Accessed Nov. 2025.

<sup>72</sup> Shaw, Dougal. "This City Manages to Recycle Half of Its Waste." [Bbc.com](https://www.bbc.com), 23 Feb. 2022. Accessed Nov. 2025.

access to this program and have diverted over 3,100 tons of plastics from disposal since September 2024.<sup>73,74</sup> Collected materials are sent to operations that use them in building products, construction materials, and plastic lumber. If no end use is found, the collected plastics are used as fuel in cement kilns. Based on available data, it is unclear what percentage of the collected material has been used for each of the end uses described. A color-coded bag system would require an established structure to distribute these bags. Current systems require stores to voluntarily stock these bags for purchase and generators bear the cost of purchasing the bags. In established onsite curbside collection programs, asking generators to pay an additional cost for color-coded bags, and how accessible they are for purchase, may present additional barriers to participation.<sup>75</sup> The Hefty ReNew bags are nearly double the cost of similar sized non-orange bags.<sup>76,77</sup> Generators, especially those amongst disadvantaged communities, may opt not to use the color-coded bag based on cost and continue to place more challenging covered materials directly into their collection container for recycling, reducing the likelihood those covered materials are captured at a MRF. Educating generators at the point of purchase and through local education initiatives on the purpose and intent of color-coded bags, as well as how to use them, would be imperative to the success of the program<sup>78</sup> if it were implemented.

While implementing a source-separation system for certain covered materials has the potential to significantly increase the collection of those materials for recycling, there are key considerations to address to make these programs successful. First, programs would need to reduce the cost barrier to participation by offering generators free or low-cost bags for collection. Second, bags to collect covered materials must be readily available to generators through popular retail locations or direct delivery. Finally, robust education and CBSM tools will be necessary to get generators to participate in the programs correctly and ensure generator confidence in the new system. Particularly for items where considerable education and outreach efforts have historically told generators not to place these items in containers for recycling or organics recycling,

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<sup>73</sup> Hefty. "Hefty ReNew™ Accepted Items." [Hefty.com](https://www.hefty.com). Accessed Nov. 2025.

<sup>74</sup> Hefty. ---. "Hefty Responsibility and Impact." [Hefty.com](https://www.hefty.com). Accessed Nov. 2025.

<sup>75</sup> KGUN 9. "Not That Bag! Hard to Recycle Program Struggles to Gain Orange Bag Compliance." *YouTube*, 1 Oct. 2024. Accessed Nov. 2025.

<sup>76</sup> ACE Hardware. ---. "Hefty ReNew 13 Gal No Scent Recycling Bags Drawstring 20 Pk." [Acehardware.com](https://www.acehardware.com). Accessed Nov. 2025.

<sup>77</sup> ACE Hardware. ACE Hardware. "Ace 13 Gal No Scent Tall Kitchen Bags Drawstring 45 Pk." [Acehardware.com](https://www.acehardware.com). Accessed Nov. 2025.

<sup>78</sup> KGUN 9. "Not That Bag! Hard to Recycle Program Struggles to Gain Orange Bag Compliance." *YouTube*, 1 Oct. 2024. Accessed Nov. 2025.

such as film and flexible plastics and multi-material laminates, targeted messaging will be needed to undo the narrative that these materials are not possible to recycle.

#### 2.2.6.4 Overcoming Cost Barriers for Generators

Reducing costs was identified as a method to improve participation in onsite curbside collection programs by over a third of respondents from CBOs and EJ groups from the Mountain (34%), Southern (32%), and Valley (49%) regions, and by 38% of Tribal respondents. This finding demonstrates that cost may inhibit some populations more than others from participating in onsite curbside collection programs. In order to make collection programs more equitable across the state, thereby improving participation, equitable cost structures must be implemented, and cost barriers will require careful consideration for how they might be overcome.

Local jurisdictions, in response to the Collection Survey, cited cost as the fourth-most significant barrier statewide. When asked about strategies to overcome barriers to participation, the following strategies to reduce costs to generators were identified:

- Allowing program exceptions (e.g., shared service, low-income rates).
- Offering free resources (e.g., internal collection containers, funding to build recycling container enclosures).
- Providing tailored services (e.g., audits to identify cost-saving opportunities such as right-sizing and waste reduction or source separation of high-volume materials).

Programmatic changes and rate restructuring may require modifications to solid waste and recycling contracts, municipal ordinances, or other administrative processes. Costs of implementing these changes will vary across local jurisdictions depending on the extent of changes needed and number of interested parties involved. Primary interested parties may include the affected communities, local jurisdiction staff, RSPs, council members or board members, and third-party policy or industry experts. As changes are implemented, it is essential to engage with the communities potentially impacted by any changes to collection programs or municipal ordinances, particularly priority populations. Consistent and varied engagement (i.e., meetings, events, surveys) before, during, and after any changes are implemented is an effective strategy to ensure that feedback from impacted communities is considered throughout the process. Based on the contractor's internal database of contract modifications and municipal ordinance developments performed throughout the state, implementing these processes may range from thousands of dollars to over one hundred thousand dollars<sup>79</sup> and are expected to be one-time costs.

The provision of resources and tailored services will likely require ongoing funding to continuously meet the changing needs of generators. This may involve establishing more robust technical assistance programs to assist more generators in identifying cost

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<sup>79</sup> HF&H Consultants, LLC. "Contract and Municipal Ordinance Database." "HF&H Consultants Intranet." Accessed November 12, 2025.

saving opportunities. For example, when visiting a generator technical assistance staff can identify cost-saving changes in service levels for each collection container (e.g., reducing solid waste could reduce the size of their solid waste container and subsequent rate) or other types of cost-saving opportunities through source reduction. Reducing or eliminating additional costs of participating effectively in collection programs may also help alleviate significant cost burdens on many generators, particularly those operating commercial businesses. Materials that can support generator participation and are often an added cost include items such as internal containers used for the collection of materials for recycling and organics recycling, container signage, and internal container liners. These resources can be provided directly to generators at no, or discounted, cost or purchased by the generator through the use of grants or reimbursements. Costs to administer such programs will vary based on the number of anticipated generators who are eligible for the program and who it is administered by, whether it be a local jurisdiction, nonprofit organization, or a private entity. Mini-grant or reimbursement programs, where small amounts of funding are provided to applicants who meet a specific requirement, are a flexible way to reduce cost barriers for many generators. Examples of this type of program include Zero Waste Sonoma's Food Recovery Organization Capacity Building Mini Grant program offering grants of \$500 to \$2,500;<sup>80</sup> the city of San Jose's Zero Waste Innovations program offering grants of \$5,000 to \$50,000;<sup>81</sup> and the Santa Clara Valley Water District's Mini Grant program offering grants of up to \$10,000.<sup>82</sup> These grants can be used to cover one-time purchases that support the facilitation of successful collection programs for covered materials such as internal containers, signage, or the development of collection container enclosures for commercial properties.

### **2.2.7 Public Health, Environmental, and Community Impacts of Collection Programs**

The contractor assessed the environmental and public health impacts of collection programs in California through a combination of qualitative results from the Community Recycling and Composting Survey, the Collection Survey, the MRF and OPF surveys<sup>83</sup>, facility interviews, desktop research, engagement with regional and national trade associations, and introductory meetings and listening sessions with CBOs, EJ groups, and Tribes. A total of 16 CBOs and EJ groups and three Tribes provided their expertise and perspectives via The Community Recycling and Composting Survey, introductory meetings, and listening sessions. The primary objective was to have these communities share their experiences and provide their expertise related to their waste practices, as

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<sup>80</sup> Zero Waste Sonoma. "FRO Capacity Building Mini Grant | Zero Waste Sonoma." *Zero Waste Sonoma*. Accessed Nov. 2025.

<sup>81</sup> City of San Jose. "Zero Waste Innovations Grant Program | City of San José." [Sanjoseca.gov](https://sanjoseca.gov). Accessed Nov. 2025.

<sup>82</sup> Valley Water. "Mini-Grant Program." *Valley Water*. Accessed Nov. 2025.

<sup>83</sup> All three surveys can be found in the Current State of Processing Report.

well as understand communities' concerns and suggestions on the impacts of processing facilities, facility development or expansion, and siting of new facilities. Additional information on this engagement is presented in the Current State of Collection Report and the Current State of Processing Report.

The contractor found through the Community Recycling and Composting Survey that illegal dumping is a concern for community members and a contributing cause of contamination and environmental pollution. Participants reported that much of the public dumping that occurs is due to the lack of recycling and composting bins and inadequate container sizes for the volume of trash generated by families in large multi-family units. Additionally, 86% of CBO and EJ group respondents and 75% of Tribal respondents believe proper collection of material is considered the top community benefit to reduce litter and pollution, creating a cleaner neighborhood.

According to the U.S. EPA's 2025 report on the National Strategy to Prevent Plastic Pollution: Part Three of a Series on Building a Circular Economy for All, the following provides considerations for how to enhance positive outcomes and mitigate negative impacts related to illegal dumping:

- New drop-off locations in close proximity to communities should be developed to enable more convenient access. Accessibility issues should be mitigated for all community members, such as those with disabilities or limited transportation options. Drop-off facilities must consider installing ramps and elevators, providing audible signs, implementing public transportation systems to reach the facility (e.g., bus drop-off, mobility assistance companies to provide rides, etc.) and strive to provide services that are accessible to all members of the population.
- Outreach and engagement with communities to develop solutions that address the driving forces of illegal dumping such as cost prohibitive user fees or lack of access to collection.

In the Collection Survey, 89.4% of local jurisdictions across all regions stated that increased education would be the most effective way to reduce the potential negative impacts of expanding collection operations in their communities. Increased education can ensure people are utilizing collection programs correctly, thereby maximizing the PHEC benefits of recycling.

The Community Recycling and Composting Survey responses regarding negative PHEC impacts also demonstrate a need to address the direct impacts of heavy truck traffic. Local jurisdictions also identified the use of more efficient collection routes to minimize traffic and the use of electric vehicles to reduce the potential negative impacts of expanding collection operations in their communities (52.9% and 44.7%, respectively). Only the Bay Area region ranked the use of electric vehicles higher than more efficient collection routes. Community Recycling and Composting Survey respondents statewide identified the use of electric vehicles as the second most effective strategy. Only the Coastal region ranked the use of electric vehicles higher than education. The Bay Area, Southern, and Valley regions identified more efficient collection routes as the third most effective strategy, while the Mountain and Coastal regions chose improved bike lanes and sidewalks as the third most effective strategy.

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As collection programs, processing operations, and infrastructure increase, robust PE&O programs will be needed to ensure generators are using the programs correctly to maximize potential PHEC benefits. Education should focus on actions that improve collection rates and reduce contamination. This will address some of the concerns identified by Community Recycling and Composting Survey respondents, as noted in the Current State of Collection Report, including litter, waste filling landfills, and illegal dumping. While collection worker safety was identified as a key concern by 25% of Community Recycling and Composting Survey respondents, the expansion of collection programs and manner in which covered materials are collected is not expected to require changes to how collection programs operate. Therefore, the implementation of the Act is expected to have minimal impact or changes to worker safety, but implementing robust educational programs would provide tangential benefits to collection workers. For example, proper participation in collection programs reduces contamination, including potentially hazardous materials that may be unsafe for workers to handle. Robust education can also reduce improper set outs of onsite curbside collection containers, potentially reducing the number of times collection workers must exit their vehicles, thereby limiting workplace accidents.

Strategies to help maximize community benefits identified by CBOs, EJ groups, and Tribes in listening sessions included developing comprehensive zero-waste plans and providing resources to train individuals to become leaders within their communities. If plans and training modules are developed in collaboration with community members, they can empower individuals by keeping them apprised of decisions impacting their communities and developing leadership skills to help strengthen community networks. The strategies identified are particularly beneficial for priority populations that may experience a disproportionate amount of cumulative negative PHEC burdens or have other socioeconomic indicators, such as linguistic isolation or living below statewide poverty levels, that may reduce their individual capacity to overcome such burdens.

The U.S. Center for Disease Control (CDC) has developed a framework, “Building Resilience Against Climate Effects,” that may be used as a model to identify and address PHEC impacts of expanded collection operations and infrastructure. This framework includes anticipating impacts, estimating and quantifying the additional burdens to communities, assessing PHEC interventions to address those burdens, creating an adaptation plan, and evaluating the implementation and plan process.<sup>84</sup> If this framework is implemented in collaboration with leaders in impacted communities, it may be possible to anticipate direct and indirect PHEC impacts, implement early mitigation plans, and build resiliency within the impacted communities so that they can adapt to their own changing needs and concerns.

## **2.3 Processing of Covered Materials**

To explore potential actions and investments to expand and enhance processing of plastic covered material to meet the proxy recycling rates, the contractor identified

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<sup>84</sup> “Public Health Resiliency Strategies.” *US EPA*, 7 Aug. 2025.

upgrades and expansion for both recycling processing facilities and organics processing facilities. Using operator input, survey results, and desktop research, the contractor estimated inflows and outflows from processing facilities, evaluated potential improvements for existing facilities, and explored the potential for additional facilities, including secondary processing facilities.

The contractor assumed that for plastic covered material to reach the proxy recycling rates by CMCs, that it would require 60% of recycling programs statewide to be served by large volume transfer or processing facilities sorting CMCs into defined streams sent to and reclaimed at reclaiming facilities consistent with the requirements of the Basel Convention. As such, the contractor assumed that for those CMCs the improvements to access to collection programs required for plastic covered material to meet the proxy recycling rates would also satisfy the required collection in PRC section 42355.51(d)(2)(B)(i), which is one of the categorical requirements to be deemed recyclable. For nonplastic CMCs that were included in the tonnage flow model, the contractor assumed that the improvements to access to collection programs required for plastic covered material to meet the proxy recycling rates would also enable such nonplastic CMCs to satisfy the required collection in PRC section 42355.51(d)(2)(B)(i) to be deemed recyclable.

### **2.3.1 Recycling Processing Facilities**

#### **2.3.1.1 Access to Recycling Processing Facilities for Covered Materials**

The contractor assessed the ability of the current infrastructure to manage potential increased quantities of covered materials. As part of the tonnage flow model, the contractor estimated the amount of material likely to reach recycling processing facilities based on the amount of covered material collected, excluding covered material that was estimated to be sent directly to end markets.

The contractor then identified actions and investments for recycling processing facilities to manage differing quantities and types of covered material. The contractor gained an understanding of recycling processing facilities through site visits, interviews, surveys, discussions with equipment suppliers, internal data files, and industry experience. The contractor was unable to obtain facility-specific information for capital and operational improvements from all facilities surveyed; therefore, the contractor utilized necessary assumptions to model the changes needed to manage covered materials during the milestone years.

##### **2.3.1.1.1 Estimated Inbound Tons to Recycling Processing Facilities in Milestone Years**

The contractor estimated the amount of material likely to reach recycling processing facilities based on the amount of covered material collected, excluding covered material that was estimated to be sent directly to end markets.

Table 2-18 summarizes the estimated quantities of covered material, by material class, that recycling processing facilities will need to sort for delivery to secondary processing facilities or end markets by 2032. These estimates account for proposed material

redesign as well as reductions in plastic covered material because of the source reduction requirements of the Act.

The contractor estimated that approximately 8.4 million tons of covered materials will need to be managed by recycling processing facilities in 2032 compared to an estimated 5.9 million tons in 2024 estimated in the Current State of Processing Report. With material redesign and strategies aimed at maximizing proper sorting, the inbound materials received in future years would be more homogenous and less contaminated resulting in a higher proportion of inbound material that can be processed to be sent to end markets. Appendix A, section 3 describes the methodology utilized to arrive at the potential increased quantities by CMC processing group.

**Table 2-18: Estimated Inbound Tons of Covered Material, by Material Class, to Recycling Processing Facilities in Milestone Years<sup>1</sup>**

<b>CMC Material Class</b>	<b>Current Inbound Tons in 2024</b>	<b>Estimated Inbound Tons in 2028</b>	<b>Estimated Inbound Tons in 2030</b>	<b>Estimated Inbound Tons in 2032</b>
Plastic	617,882	1,665,842	1,705,248	1,970,604
Paper and Fiber	4,748,637	6,129,369	5,845,840	5,944,397
Metal	285,005	320,668	323,588	358,932
Glass	126,113	131,524	132,262	153,821
Ceramic	250	0	0	0
Wood and Other Organic	80,772	43,844	30,990	5,173
<b>Total</b>	<b>5,858,659</b>	<b>8,291,248</b>	<b>8,037,928</b>	<b>8,432,927</b>

<sup>1</sup> Numbers may not sum exactly due to rounding.

As projected, the most significant increases in inbound tonnages to recycling processing facilities will be for the plastic and paper and fiber material classes. Ceramics and Wood and Other Organics have a projected decrease in inbound tons as a result of material design changes and shifting certain items without plastic components to the organics recycling stream.

Using the projections of inbound covered material to recycling processing facilities, the contractor prioritized actions and investments for processing associated with CMC processing groups that contain plastic components, to meet the proxy recycling rates as plastic covered material is required to meet the Act's recycling rate requirements. These additional investments will also contribute to ensuring covered material meets the requirements to be deemed recyclable.

### 2.3.1.1.2 Upgrades to Existing Facilities

For the purposes of the analysis, identified recycling processing facilities were aggregated into several broad categories with generally similar features and operating models to inform potential capital and operational upgrades. Facility types include:

- Small facility for processing materials collected for recycling using manual processing.
- Medium facility for processing materials collected for recycling using modest processing equipment (the extent of the processing equipment varies from minimal features such as screens and magnets to relatively robust systems with multiple screens, air classification, eddy current, magnets, and possibly one or two optical sorters).
- Large facility for processing materials collected for recycling using robust processing equipment (the extent of the processing equipment generally reflects relatively robust systems with multiple screens, air classification, eddy current, magnets, and likely several optical sorters).
- MWP facility with robust processing equipment (the extent of the processing generally reflects relatively robust systems with multiple screens, air classification, eddy current, magnets, and likely many optical sorters).

Appendix A, section 3.A provides further details on varying assumptions regarding infrastructure and operational improvements by facility size and level of automation.

Table 2-19 summarizes the estimated investments by region for improvements to the existing infrastructure and operations to handle the higher quantity and new types of covered material processed by recycling processing facilities. The contractor estimated that upgrades to existing facilities may occur between 2028 to 2030; however, for simplicity and to provide sufficient time for facility retrofits, the 2030 tons are used to illustrate the costs of improving the existing system. Based on the contractor's findings, the estimated costs of upgrades vary by type of facility and region, as shown in the third column of Table 2-19. The estimated investments include capital improvements and additional operating costs for adding staff, but it does not include other operating costs related to the additional equipment (e.g., utilities, insurance).

The contractor estimated investments based on the estimated inflow of covered materials to recycling processing facilities in 2030 multiplied by the average regional cost per ton. Based on this calculation, improvements to the existing infrastructure to manage these materials is estimated to cost approximately \$447 million per year. This estimate is based on the total inflow expected at recycling processing facilities. If the upgrades are targeted at specific material types, it is likely that costs would fall much closer to the lower end of the cost range provided in the table. The lowest cost per ton for improvements is in the Southern region, and highest cost per ton is in the Coastal region.

**Table 2-19: Estimated Investments for Existing Recycling Processing Facility Improvements by Region (2024)**

<b>Region</b>	<b>Estimated 2030 Inbound Covered Material Tons (Without Residue)<sup>1</sup></b>	<b>Estimated Investment Range and Average for Upgrade (\$/Ton) (Average)</b>	<b>Estimated Average Investment per Year</b>
Bay Area	1,479,628	\$8.5 - \$248 (\$66)	\$97,655,448
Coastal	351,179	\$51 - \$164 (\$94)	\$33,010,826
Mountain	110,350	\$34.7 - \$80.6 (\$58)	\$6,400,300
Southern	4,776,331	\$8.5 - \$200 (\$40)	\$191,053,240
Valley	1,320,439	\$8 - \$292 (\$90)	\$118,839,510
<b>Total</b>	<b>8,037,927</b>	<b>N/A</b>	<b>\$446,959,324</b>

<sup>1</sup> This estimate does not include residue quantities; therefore, recycling processing facilities may see higher inbound quantities.

The Current State of Processing Report found that there is currently about 41 million tons of permitted capacity for 89 identified recycling processing facilities, which is more than the estimated throughput. The most permitted capacity was found in the Southern and Bay Area regions. It was not feasible to estimate the specific available capacity at recycling processing facilities statewide because annual permitted capacity covers all activities at each facility type, including nonrecycling activities.

In addition to considering infrastructure upgrades to increase the permitted capacity at recycling processing facilities, expanding operational hours should be considered to capture more material at existing facilities.

Details on the estimated costs provided in the table and material recovery are provided in subsection 2.3.1.3.

### **2.3.1.1.3 New Facilities**

New processing facilities may be needed to capture additional covered material, especially flexible and film plastics and mixed rigid plastics. Projections are based on regional tonnage flows. However, the contractor estimated the number of new facilities that may be needed statewide by 2032 given the large uncertainties on where new facilities would be located. Potential new facilities identified for this analysis were secondary processing facilities and MWP facilities.

#### **2.3.1.1.3.1 Secondary Processing Facilities**

Secondary processing facilities are designed to further sort for covered materials from MRFs and MWP facilities. Secondary processing is a strategy for covered materials that are currently less feasible to process into bales for end markets in MRFs and MWPs due to physical, economic, or operational constraints. As found in the Current State of Processing Report, many facilities are unable to expand their operations to accept new material types due to physical site limitations. In other cases, it was found that the Needs Assessment Report on The Needed State of Collection, Processing, and End Markets

upgrades to existing recycling processing facilities are sometimes not economically justified given the limited quantity of additional materials that would be sent to end markets. Bales of mixed rigid plastics and flexibles and film plastics are good candidates for further sortation at a secondary location to sufficiently prepare that material to be sent to end markets.

Secondary processors are modeled to sort for at least the following CMC processing groups:

- Plastic #1 - PET flexibles and films
- Plastic #2 - HDPE flexibles and films
- Plastic #4 - Mono LDPE flexibles and films
- Plastic #5 - Mono PP flexibles and films
- Multi-material laminate (plastic)
- Plastic #5 – PP rigid Items, other PP
- Plastic #6 – PS rigid Items, other PS
- Plastic #7 – Other rigid plastics

To understand the potential costs for secondary processing, the contractor developed a theoretical secondary processing facility for plastics to help determine the potential size, scale, and planning level costs of a new facility. Costs are based on capital inputs of equipment, installation, storage capacity, and building envelope construction. The cost assessment does not consider real estate investment or value.

Due to the complexity of identifying and separating covered materials sent to secondary processing, those facilities have reduced processing rates compared to other recycling processing facilities. For this report, the contractor is modeling a 7 tons-per-hour (TPH) processing line for plastic containers, and a 6 TPH processing line for flexibles and films. To enhance material separation, the design of this facility would likely implement a looped sorting system. The estimated equipment cost for a looped processing line is approximately \$4.5 million, excluding storage and baling infrastructure. For a facility designed to process the plastic covered materials simultaneously, the total equipment cost is projected to be in the range of \$19 to \$21 million for two looped systems, one for rigid plastics and one for flexibles and films. Appendix A, section 3, provides more detail on the assumptions for this facility, including Table A-46, which provides a list of potential equipment including estimated facility retrofit costs for a secondary processing facility for plastics. These estimates do not take into account development costs, engineering, permitting and assume each facility is capable of operating at a maximum of 12 TPH, with two eight-hour shifts per day. The total estimated capital costs per facility were \$65 million.

Based on feedback from interested party experience and contractor experience with new facility construction in California, the main barrier to secondary processing to increase recycling rates in the milestones years is the time it will take to plan, permit,

build, and begin operation of the facilities. If secondary processing is a chosen strategy, immediate work should be done to start planning these facilities and those facilities would be unlikely to be in operation before the 2030 milestone year.

The contractor estimated that secondary processing facilities could receive approximately 978,000 tons of mixed plastics requiring further sortation from MRFs and MWP facilities across the state. Based on the modeled size of secondary processing facilities, that amount of material would require 13 new secondary processing facilities for plastics in California. In addition to the plastic covered material targeted above for secondary sortation, these investments would also likely result in the capture of other recyclables including PET #1 and HDPE #2 that might be missorted into mixed rigid plastic bales.

#### 2.3.1.1.3.2 MWP Facilities

Even with the processing of source-separated materials collected for recycling through increased onsite curbside collection, the contractor projects additional strategies beyond those modeled may be needed to increase the amount of certain types of plastic covered material recycled at end markets, especially flexible and film plastics and certain types of rigid plastics.

MWP facilities designed to recover additional covered materials that are disposed of is a potential additional strategy. New or upgraded MWP facilities may be able to accommodate the advanced systems to recover materials that are problematic for existing infrastructure. A complete list of materials by CMC processing group that may be recovered from these facilities is provided in Appendix A, section 3.A.2.

In the Current State of Processing Report, the contractor estimated that there is currently about 4 million tons of permitted capacity for MWP facilities in the state, some of which may be available capacity. After the use of existing available capacity, new MWP facilities could be considered. To understand the potential costs for new MWP facilities, the contractor developed a theoretical MWP facility to help determine the potential size, scale, and planning level costs of a new facility.

A new MWP facility would theoretically resemble a MRF but incorporate additional front-end systems to mitigate contaminants and size-sort incoming material. Operations typically begin with a metering device and bag opener, followed by a presorting station for bulky or tangled items. A trommel screen then separates large- and small format material while separating material within bags, prolonging downstream equipment life expectancy and exposing materials collected for recycling. Larger items are processed for cardboard and fibers, while smaller fractions enter systems similar to single-stream MRFs, including mechanical screens, optical sorters, robotics, and manual sorting. Most recovered commodities are metals and plastics, sorted via magnets, eddy current separators, optical sorters, robotics, and manual methods. Ferrous (tin, steel, bimetal) and nonferrous (aluminum) metals are separated, while flexible films remain challenging, with current recovery rates around 10 to 15%.

The contractor modeled that new MWP facilities in California would have a throughput rate of 300,000 tons per year and include additional optical systems (six) and looped

conveyors to provide for increased rates of plastic recovery, which is not currently how MWP facilities operate in California. The six optical systems were modeled on the looped conveyor system to give the MWP facility capacity to remove all material types of flexible and film plastics that were included in the tonnage flow model. The contractor estimated that each new MWP facility would cost about \$130 million with an estimated annual operating cost of \$158 per ton. For MWP to capture about 25,000 tons of plastic covered material identified as needing additional strategies (i.e., flexible and film plastics), more than 4 million tons of material would need to be processed, which is about 17% of the solid waste stream estimated to be collected in 2032. The contractor estimated that there is 1.4 million tons of existing capacity at MWP facilities. The contractor also estimated that nine new MWP facilities would capture the 2.8 million additional tons of material. While MWP would capture additional covered materials, new MWP facilities are a costly solution requiring years to design, permit, build, and operate.

This further highlights that within the capacity of existing infrastructure some mixed plastics (i.e., flexibles/films and mixed rigids #3-7) are particularly difficult to sort for. Increasing source reduction, additional material redesign, expanded alternative collection programs, secondary sortation, and further reducing losses in processing and end markets are likely more cost-effective strategies to additionally capture plastic covered materials than new MWP facilities. However, existing capacity at MWP facilities should be considered to recover additional covered material.

#### **2.3.1.1.4 Actions and Barriers for Increasing Capacity**

Increased capacity, through upgrades to existing infrastructure and potentially new infrastructure, will be needed to process additional covered materials at recycling processing facilities. Increasing the capacity of a facility may impact its physical footprint or may result in changes to operating hours. Through interested party engagement, MRFs expressed concern that their sites are unable to expand due to physical limitations with the property, permitting limitations, or other concerns that constrain opportunities for growth.

##### **2.3.1.1.4.1 Permitting**

Permitting a facility in the state can be complex and costly depending on the facility size and attributes. Permitting timelines can range from one to 10 years. The solid waste permitting process is overseen by the local enforcement agency (LEA), which is often housed within a county or city environmental health department. Multiple state regulatory agencies are involved, each tasked with enforcing different regulations, including separate and distinct permitting processes. Additionally, the California Environmental Quality Act (CEQA) could be required which could further extend timelines. If new or expanding facilities requiring new or revised permits are needed, public and private service providers should begin facility improvements and new facility construction as soon as feasibly possible to ensure the upgrades and facilities are available before 2032.

To encourage a smooth and efficient permitting process, recycling processing facilities should consider the following:

- Start the process early and engage with permitting agencies. Such agencies include but are not limited to the agency overseeing land use (typically the city or county where the property is located), LEA, local air quality management district, and local water quality management district. Early engagement with these four agencies will enable the applicant to identify key features that will be needed for the process to proceed as well as to gauge the level of expertise that will be needed to respond to the various requirements.
- Following initial engagement, create a development schedule outlining steps needed for each agency, paying special attention to requirements that necessitate long lead times. The schedule should include milestone dates where key deliverables or approvals are necessary. Within the schedule, applicants may implement a standing meeting with each of the agencies such that the project remains active and agency staff are prompted to provide timeline reviews or input.
- Plan for buffer space between the new facility and the surrounding community when possible. For example, vegetation can be used to reduce truck noise and operation visibility.
- Address traffic issues with roadway improvements and consider rail solutions for transport of commodities where possible.
- Develop a communications campaign with local community leaders, civic organizations, and schools to communicate any significant changes to the facility that may impact the community. The permitting process offers periods of public review and a comment period to address any concerns regarding how the proposed facility would impact the community. These public comment periods are structured into local land use permitting, California Environmental Quality Act review, and the solid waste facility permit process.

#### 2.3.1.1.4.2 Upfront Capital Costs

Upfront capital expenditures for the equipment and infrastructure needed to recover covered materials for delivery to end markets can be costly. Even with state grant incentives to encourage development and covered material recovery, or options to take on loans, service providers that have less upfront capital such as small businesses or municipalities may need assistance with these investments.

#### 2.3.1.1.4.3 Lack of Viable End Markets

Another barrier to processing covered materials is the lack of stable and reliable end markets. Upgrades to processing must be complemented with more stable and viable end markets to send material to after it is processed. Consistent demand for covered materials, especially material that are more costly to process, is a key factor for the financial feasibility of MRF operations to implement capital upgrades.

#### 2.3.1.1.4.4 Amending Existing Agreements

Amending the existing agreements to accommodate for the new facilities potentially built by 2032 in California will require careful planning. A key step will be to understand current contracts and franchise agreement timelines and the feasibility of redirecting waste from current facilities (e.g., landfills) to new MWP facilities. Interested party engagement indicated that there are significant costs associated with contract negotiations, which are not included in this study.

#### 2.3.1.2 Contamination at Recycling Processing Facilities

Contamination at recycling processing facilities consists of materials that either are not accepted by the facility or are accepted but screened out for disposal. Even after processing, the presence of these materials can remain as contamination and reduce the quality of outgoing bales resulting in lower commodity values and contamination and losses at end markets. In addition to contaminants, bales may contain other improperly sorted materials (e.g., paper bales containing flexible plastics). As discussed in the current state of processing report, facilities reported contamination rates ranging from 5% to 40%, with the majority falling between 20% and 30%. Benefits of reduced contamination include increased marketability for outgoing commodities, increased safety for facility staff, increased capacity, less downtime, less material destined for disposal, and equipment longevity.

While upgrades to facilities can help limit outbound contamination, reduction of inbound contamination offers significant benefits. Inbound material monitoring, in addition to material redesign and PE&O by local jurisdictions, RSPs, and others are effective strategies to reduce inbound contamination.

The contractor identified solutions that recycling processing facilities may implement to minimize processing contamination of inbound materials and create new sorting solutions to capture additional covered materials.

##### **2.3.1.2.1 Inbound Material Auditing**

To minimize quantities of unacceptable materials entering MRFs, inbound material audits can be conducted to assess the composition of the material and identify generators that require further education on acceptable items in the collection program and potential penalties for contamination. Minimizing contamination of inbound materials will not only create higher quality bales for end markets, it will reduce costs, increase safety of sorters, and reduce labor demands on sorters to remove nonaccepted items.

Inbound material audits can range from floor sorting or tabletop sorting of inbound materials to full facility audits where a dedicated customer's sample is exclusively processed to evaluate material composition profile, contamination quantities, processing loss, and equipment efficiency. Material audits can be conducted by the facility operator or by hiring a third-party contractor to oversee the methodology, data analysis, and results. Material audits can significantly interrupt operations by diverting staff for tabletop sorting and weighing of material or only processing a single customer's

material causing a backlog of inbound materials. However, material audits are an effective method for operators to understand inbound material characterization and plan facility development strategically.

The benefit of tabletop or floor sorts is that it provides a snapshot of the inbound composition profile, while a full facility audit can also reveal where outdated or nonfunctioning equipment or processes contribute to process loss for specific material types. For example, evaluating a facility may reveal that more glass is ending up in the residue stream. Further examination of the equipment subsystem could show that worn or plugged screens are failing to separate glass by size as intended. Additionally, seeing higher than expected levels of ferrous metals in the residue stream may indicate that metal separators are not functioning as intended.

#### **2.3.1.2.2 Technology Improvements**

There are additional technological and operational measures that can be implemented to create higher quality bales by reducing the amount of contamination and nontarget material in those bales. For example, the contractor recommends that recycling processing facilities consider installing additional optical sorters on the fiber sorting line that identify flexible and film plastics. These incidental materials often end up in fiber bales since they are flat, even if not accepted by the facility. Modern recycling processing facilities are increasingly implementing AI and sophisticated optical sorting systems to achieve higher recovery and bale quality. AI-based sorting technology combines AI sensing with precision air ejection systems to eject multiple materials at once, allowing for recovery even with high throughput. Costs associated with this equipment are provided in the next subsection.

Manual pre-sorting is an effective strategy to remove unaccepted materials before they come in contact with the processing equipment and potentially cause damage or downtime. The manual presort stage is challenging to automate due to high burden depths (vertical height of material on conveyor belt) and significant material variability, which contributes to process loss. With increasing labor shortages impacting staffing for manual pre-sorting, new equipment is being introduced that is less negatively impacted by contamination. For example, larger screens that are less likely to allow film and other tangles to get wrapped around the equipment are significant improvements that recycling processing facilities can consider to minimize downtime and increase operational efficiency. Equipment suppliers generally use techniques such as larger diameter shafts and altered spacing of discs to decrease the potential for wrapped and plugged screens. Equipment suppliers have also learned better locations and shapes of material detection systems and air nozzles for optical sorters that require less cleaning and other enhancements for ballistic separators and other screens as well.

#### **2.3.1.2.3 Quality Control**

Throughout the sorting process, recycling processing facilities may consider manual quality control processes that seek to intercept certain material types that may not exhibit high enough volume to warrant installing new technologies. For example, sorting staff may be utilized to remove incidental film from the paper line or identify covered materials within the residue line that should have been caught in the sorting process. AI

may also be utilized to identify additional covered materials that are found in the residue line in order to gather data on this topic in real-time; however, this is an emerging technology use. For example, one facility installed an AI system in 2022 to monitor the residue stream for missorted items. The facility found that the AI system reduced personnel time invested in quality control and allowed for prompt response to missorted items.

Quality control can also occur in the form of bale audits, which are frequently conducted by recycling processing facilities visually. Bale audits can identify covered materials that are missorted or materials that are not accepted by the facility but still end up in the bale. A short bale can be produced and a bale break completed to sort the contents of the bale.

### 2.3.1.3 Recovery of Covered Materials from Recycling Processing Facilities

Based on interested party engagement with recycling processing facilities and equipment vendors, contractor's project files, and industry knowledge, the contractor developed a list of equipment and infrastructure that may be used to increase processing capacity for covered materials or reduce end market contamination in separated commodities. Equipment and infrastructure improvements identified here focus on covered materials with plastic components that are required to meet the recycling rate requirements, however, improvements can also help meet the recyclability requirements related to processing for all covered material.

Recycling processing facilities have indicated that limited available space is a barrier to adopting additional processing infrastructure and equipment to recover covered materials for delivery to end markets. Each recycling processing facility will need to evaluate site-specific conditions to understand appropriate adoption measures for that individual facility.

Equipment recommendations and cost estimates shown in Table 2-20 were developed based on facility site visit observations, communication with equipment vendors, and recent projects where similar equipment was purchased and installed. These cost estimates reflect 2024 costs. The estimates vary by equipment type and may require reconfiguration of the existing system to accommodate new equipment, installation of conveyors, platforms, stairs, and integration with control systems. Additional costs may arise from modifications to conveyors, building structures, and compressors.

**Table 2-20: Potential Equipment and Facility Retrofit Costs for Recycling Processing Facilities (2024)**

<b>Capital Upgrades</b>	<b>Estimated Equipment Cost (Procured and Installed)</b>	<b>Estimated Total Facility Retrofit Cost (Equipment and Required Facility Upgrades)<sup>+</sup></b>
<b>Container Line Optical Sorter with AI</b>	\$800,000 - \$1.5 million	\$1.5 million
<b>Fibers Line Optical Sorter with AI</b>	\$1.3 million	\$2 - \$3.2 million
<b>Residue Line Optical Sorter with AI</b>	\$500,000	\$800,000 - \$1.5 million
<b>Outdoor Covered Bale Storage</b>	N/A	\$80 per square foot
<b>Bunkers</b>	\$750,000	\$750,000 – \$2.25 million
<b>Glass Cleanup Systems</b>	\$600,000 - \$1 million	\$1 million
<b>Building Modifications</b>	N/A	\$400 per square foot
<b>Building Expansion</b>	N/A	\$500 per square foot

### **Container, Fiber, and Residual Line Optical Sorter**

Optical sorting with AI software is the best available technology to identify processing contamination and increase the diversion capacity of covered materials. Existing optical systems use near-infrared (NIR) lenses to identify material composition and pixels to create shapes that adjust the pneumatic system operation for separation. As discussed with equipment vendors, the newer optical systems that use AI are ideal for identifying abnormal shapes. AI software can be trained to identify material and shapes, which is a tool to reduce process loss and end market contamination in bales. These systems can be integrated with a manual sort line to enhance material capture. Older optical sorters can also be repurposed to recover materials that are not high in volume or have not historically been targeted (e.g., cartons and paper cups). This equipment is especially valuable in residual lines where they can be programmed to recover multiple material types that may be missed by conventional sorting.

### **Glass Cleanup Systems**

MRFs may receive higher value for the glass they are producing by investing in a glass cleaning system to help remove contaminants before sending it to an end market for glass recycling (beneficiation plant). By removing nonglass components, the secondary processor for glass has less material to dispose of and a higher glass yield. Secondary processors for glass are discussed in section 2.4.1. When the glass is crushed and removed from the process line, it is removed based on size; therefore, it still contains other materials less than about 2 inches in size (e.g., rocks, dirt, bottle caps, corks, small format paper and plastics). A glass cleanup system further separates nonglass

material less than a certain size (approximately 1 inch), to remove the smaller dirt, gravel, and small glass shards that can't be recycled. Often a trommel screen or a rubber screen may be used to avoid plugging. A magnet can be used to recover marketable ferrous metal, and an eddy current separator may be used to recover nonferrous metal. Next, light material such as small format paper may be removed possibly with an air knife or blower or possibly a vacuum system leaving behind a high concentration of glass by weight that can be sent to end markets and is a more desirable commodity. The light-format paper may be recoverable, or if too wet, may be sent to organics processing facilities for composting.

### **Storage and Building Enhancements**

Building envelope enhancements and expanded storage capacity were also considered in the planning model to project potential costs of facility upgrades. Facility operators consistently cited space constraints as a major challenge when planning operational and storage upgrades. Many facilities lack room for physical expansion, and extending permitted boundaries can be a long and costly process. For that reason, real estate costs were excluded from the tonnage flow model. The contractor only included building and covered storage capacity costs, and an average area and cost per square foot was applied based on facility type.

### **AI Optical Sorting Systems**

AI optical sorting systems can be challenging to integrate into existing recycling processing facility infrastructure. They require supporting conveyance and deposition systems to ensure proper material flow. Continuous software updates are needed to maintain and optimize operational efficiency. Additionally, material detection accuracy is critical to system performance and real-world conditions bring occlusion, deformation, and motion blur, which can degrade recognition quality. Consistent and thorough maintenance is recommended.

## **2.3.2 Organics Processing Facilities (OPFs)**

### **2.3.2.1 Access to OPFs for Covered Materials**

OPFs reported receiving certain covered materials, including OCC, mixed paper, kraft paper, molded pulp, plastics and polymers designed for compostability (flexibles, films, and rigid), and untreated wood. Some surveyed facilities accept and incorporate certain covered materials into a recycled organic product (e.g., finished compost), while others screen out covered materials. Most facilities reported that plastic covered materials were screened out, including items that may be designed for compostability but are not easily distinguishable between noncompostable look-alikes. This is a challenge for plastics and polymers designed for compostability as they are currently difficult to distinguish from conventional plastics at the required scale and are considered contaminants. Some facilities use untreated wood to produce mulch, animal bedding, or similar products.

Some packaging designed for compostability may be processible if it is sourced from known generators or within-venue systems, as OPFs can confirm that the material meets specifications prior to acceptance.

The contractor identified barriers, actions, and investments for OPFs to manage additional types of certain covered material. The contractor gained an understanding of OPFs through site visits, interviews, surveys, discussions with equipment suppliers, internal data files, and industry experience.

### 2.3.2.1.1 Estimated Inbound Tons to Organics Processing Facilities in Milestone Years

The contractor estimated the amount of material likely to reach OPFs based on the amount of covered material collected accounting for material redesign, including the removal of plastic components from paper and fiber materials (e.g., kraft paper) to make them be more acceptable at OPFs.

Table 2-21 summarizes the estimated quantities of select CMC Processing Groups that OPFs will receive.

**Table 2-21: Estimated Inbound Quantities of Select CMC Processing Groups for OPFs by 2032**

CMC Processing Group	Estimated Inbound Tons in 2024	Projected Inbound Tons in 2028	Projected Inbound Tons in 2030	Projected Inbound Tons in 2032
OCC	77,400	46,100	75,400	118,600
Kraft Paper	13,400	8,300	8,100	7,200
Mixed Papers	73,600	65,900	63,900	175,400
Molded Pulp	42,000	52,600	53,700	53,800
Plastics/Polymers Designed for Compostability – Flexibles/Films	25,100	Not Modeled	Not Modeled	Not Modeled
Plastics/Polymers Designed for Compostability – Rigid Items	1,200	Not Modeled	Not Modeled	Not Modeled
Wood – Untreated	80,700	151,500	232,900	312,900
<b>Total Statewide</b>	<b>313,400</b>	<b>324,400</b>	<b>434,000</b>	<b>667,900</b>

Based on an evaluation included in the Current State of Processing Report, approximately 313,400 tons per year (TPY) of these covered materials are currently received at organics facilities statewide. Not all that material was processed into an end product for delivery to markets, based on feedback from interested parties. Some of the covered materials are screened out for disposal, and some are incorporated into

finished products such as mulch or compost. Inbound quantities of covered materials are modeled to increase by approximately 113%, to approximately 667,900 TPY of covered materials received at organics facilities statewide by 2032. Some materials, including kraft paper, are anticipated to decrease between 2024 and 2032, while OCC, mixed papers, molded pulp, and untreated wood are anticipated to increase. This is consistent with industry trends. Plastics and polymers designed for compostability are identified as materials that may be replaced unless significant investments are made to ensure there are adequate markets to recycle the material.

Based on an evaluation of permitted and actual capacity of organics facilities statewide (as discussed in the Current State of Processing Report), there is sufficient statewide capacity to process the modeled increase in covered materials.

### **2.3.2.1.2 Actions and Investments to Increase Acceptance of Covered Materials at OPFs**

OPF owners and operators cited various reasons that they currently avoid accepting covered materials. The most common reasons included the following:

- Inability to distinguish packaging designed for compostability (particularly plastics) from conventional plastic and other types of packaging.
- Incompatibility with organics processing technology type. For example, material types that do not disintegrate and biodegrade during typical processing times, or material types that cannot be incorporated into a low solids in-vessel digestion system.
- Loss of market and market value, as plastics or paper or fiber with a plastic component are synthetics that are not allowed as an agricultural organic input under the U.S. Department of Agriculture (USDA) National Organics Program (NOP), which prevents the resulting compost from being marketed as approved for organic use.

To better understand facility needs, interested parties were asked what tools and types of operational needs would enable them to begin accepting specific material types, such as plastics and polymers designed for compostability, poly-coated paper food service ware, and various fiber-based covered materials. Their responses are summarized in Table 2-22. Several facilities indicated a willingness to accept covered materials if provided with additional support. Even with such support, some facilities indicated they would remain unwilling to accept covered materials.

**Table 2-22: Operational Needs for OPFs to Accept Covered Materials (Number of Survey Respondents)**

Type of Support Needed to Accept & Incorporate into Finished Product	Plastics and Polymers Designed for Compostability	Poly-coated Paper Food Service Ware	Fiber Packaging
Funding for Equipment, Capital Improvements, Additional Employees, or Education	12	7	5
Operator Training	2	0	1
Feedstock contracts/guarantees	1	1	1
Standardization for Covered Materials Designed for Compostability	1	1	0
Separate Incoming Stream	3	2	2
USDA NOP Modified to Allow Plastics Designed for Compostability <sup>1</sup>	6	3	3
All of the Above	1	0	0
Not Interested in Accepting These Materials Regardless of Funding, Training, or Educational Opportunities	9	8	5

<sup>1</sup>This survey question assessed whether composters viewed feedstock restrictions as a barrier. Facilities noted that with the current USDA NOP prohibitions, accepting certain covered materials could prevent their compost from being approved for organic use, creating operational and marketability concerns. Addressing this constraint could help enable composters to accept additional material types while maintaining access to organic end markets.

The capital and maintenance costs associated with advanced sorting equipment can be prohibitive, especially for small- or mid-sized facilities. Capital investments for sorting technology can range from approximately \$200,000 for a small manual sort line to over \$1 million for more advanced systems.

Support for facilities could take several forms, depending on each facility’s operational needs and readiness to handle covered materials. Assistance may include funding for site expansion (including potential land purchase), additional equipment, or additional capital improvements to expand or adapt processing capacity, as well as staffing support to manage increased volumes or quality control.

In addition to facility upgrades, other strategies are needed to ensure that accepting covered material can minimize associated contamination, which will reduce costs and ensure high quality recycled organic products, such as:

- Education and outreach to help generators and haulers improve source separation and reduce contamination.
- Feedstock contracts or guarantees to provide financial stability and encourage participation.
- Greater standardization of labeling on covered materials to improve identification and sorting of acceptable materials at OPFs.

### 2.3.2.2 Contamination at OPFs for Covered Materials

Contaminants reduce processing efficiency, leading to increased operational costs and lower quality recycled organic products. Facilities receiving covered material frequently encounter contaminants, making it challenging to consistently produce end products that meet market standards and end-user expectations. OPFs that produce finished compost are required to comply with 14 California Code of Regulations (CCR) section 17868.3.1, which requires that finished compost maintain physical contaminants greater than 4 millimeters at levels below 0.5% by dry weight.<sup>85</sup>

OPFs can employ several key strategies to reduce contamination. One method mentioned by some OPFs was conducting quarterly waste evaluations in accordance with 14 CCR section 17867(a)(4) to inspect inbound materials. Since facilities are already required to perform these waste evaluations, including further granularity of covered materials could be a practical and efficient way to leverage existing workflows. Additionally, investment in additional sorting technologies, including optical sorters and manual quality control stations, enables facilities to identify and remove contaminants during intake and throughout processing, which could improve final compost quality.

While compliance with Assembly Bill (AB) 1201 is anticipated to prevent products that do not disintegrate and biodegrade from entering the organics processing stream, several barriers still limit the ability of composting facilities to control contamination effectively, requiring interventions and changes prior to material reaching OPFs. The Current State of Collection Report indicated that consumer confusion caused by inconsistent or misleading product labeling often results in improper source separation of incoming materials. In addition to clear and accurate labeling, public education programs are another strategy to enhance source separation efforts to minimize contamination in inbound materials. Additionally, material redesign of problematic material types can alleviate contamination issues and simplify generator confusion over sorting.

Reducing contamination benefits OPFs by improving the quality and consistency of end products, which increases acceptance among end users in agriculture and landscaping

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<sup>85</sup> “California Code of Regulations (14 CCR 17868.3.1).” *Justia Law*, 1 Jan. 2018.

markets. It enhances operational efficiency by minimizing process losses and reducing downtime caused by contamination-related equipment failures. Furthermore, effective contamination control supports regulatory compliance, boosts diversion rates, and contributes to producing nutrient-rich, beneficial soil amendments.

Ultimately, processing facilities strive to keep outbound end market contamination levels as close to zero as possible to meet market demands. By implementing targeted strategies, while keeping end market requirements in focus, facilities can advance the requirements of the Act and ensure the production of high-quality compost that benefits both the environment and the economy.

### 2.3.2.3 Recovery of Covered Materials from Processing Facilities

#### 2.3.2.3.1 Technology and Infrastructure Improvements

Various types of equipment changes, infrastructure, and operational improvements may support processing of larger quantities of covered materials.

Interested parties were asked what types of tools and support they would need to accept selected covered material types, including plastics and polymers designed for compostability (flexible, film, and rigid), poly-coated paper, and fiber packaging (i.e., molded pulp, kraft paper, mixed paper, OCC, paperboard, small format paper, and uncoated paper). The following equipment types and potential improvements were identified:

- Grinder
- Loader
- Reducer
- Pulverizer
- Additional screens
- Optical sorters
- Additional processing capacity
- Additional processing lines
- Pre-processing/sorting (e.g., depackagers, screens, separators)
- Air, odor, and stormwater control systems
- Facility enclosure, grading, and paving
- Infrastructure (utilities, roads, drainage)

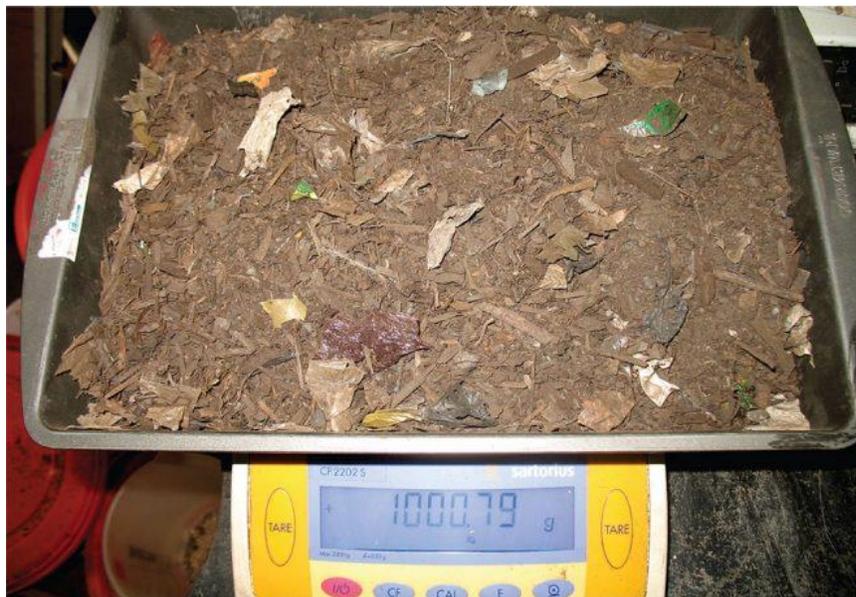
Some compost facilities also reported that if they began processing covered materials, they would set up an entirely separate (bifurcated) operation to accept those materials. In those cases, new buildings or new processing lines may be required. Interested parties reported that bifurcated input streams of NOP-compliant and noncompliant

feedstocks are largely infeasible, particularly for smaller facilities with limited space, staffing, and throughput.

#### 2.3.2.4 Marketability of Covered Materials Sent by OPFs

Processing facilities face challenges in marketing compost products due to end market contamination concerns. According to interested parties, compost containing visible plastics, undegraded packaging, or chemical residues is undesirable for end users, especially in agriculture and landscaping sectors.

While California regulations (14 CCR section 17868.3.1) set a maximum physical contamination limit, market expectations often exceed this threshold, favoring compost that is visually clean and free from synthetic and inorganic residues. Figure 2-1 shows an image of finished compost that meets the requirements of 14 CCR section 17868.3.1, however, this amount of visible contamination may prevent it from being sold to an end user.



**Figure 2-1: Image of Finished Compost that Meets 14 CCR section 17868.3.1<sup>86</sup>  
Photo courtesy of Soil Control Lab.**

Certification programs such as the California Department of Food and Agriculture's (CDFA) Organic Input Material registration and the Organic Materials Review Institute provide further limits than the contamination threshold.

According to interested parties, marketability is limited by several barriers, including variability in feedstock quality, high costs associated with sorting technologies, and skepticism from end users, particularly regarding the inclusion of packaging materials. Even with screening and quality control measures in place, buyers often remain

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<sup>86</sup> Aspray, Thomas J. "Physical Contaminant Testing of Composts." *BioCycle*, 15 Sept. 2016

cautious due to concerns about incomplete degradation and the potential presence of plastics and toxic chemicals like PFAS.

Facilities can improve compost quality and marketability within their existing footprint by installing optical sorters or screens to remove contaminants, tightening feedstock acceptance policies to exclude problematic materials, and standardizing inspection and sampling procedures to ensure consistent, high-quality inputs for composting. Additionally, strengthening coordination with municipalities, RSPs, and producers can further reduce contamination at the source. Financial incentives, grants, or technical assistance can also support the adoption of advanced sorting equipment or limited dual-stream systems, which is meant to help facilities cover costs and scale infrastructure in a way that matches market and operational realities.

### 2.3.2.5 Monitoring and Penalty Programs

Addressing contamination is essential to achieving the goals of the Act, since contamination of collected materials can lead to lower capture rates, increased losses in processing and end markets, and higher costs to operate the system. To implement effective programming to reduce contamination, it is necessary to understand what major contaminants exist in collection programs, who are the largest contributors to contamination, reasons for contamination, and who is or isn't participating in available programs. Once these factors are identified, various contamination responses can be applied. This section discusses considerations for how best to monitor for contamination and methods to reduce future instances of contamination once it is identified in any collection stream. The following strategies can be used to inform generators that they are putting nonrecyclables in the recycling stream, noncompostables in the organics recycling stream, or recyclables and compostables in the solid waste stream.

Of the reviewed studies and methods, the contractor concluded that cart tagging before refusing to pick up contaminated containers is the most effective method of reducing contamination. While nearly all the studies and data discuss the need for an education-first multi-pronged approach, the inconvenience of not having a container collected seemed to be the impetus for timely behavior change. However, reviewing carts, tagging carts, and providing follow up education to generators requires resources and staff time, which should be considered when augmenting or implementing a monitoring program.

#### 2.3.2.5.1 Contamination Monitoring

Without adequate monitoring staff to identify major contaminants and sources of contamination, local jurisdictions are limited in their ability to design effective interventions and direct resources efficiently. Contamination monitoring can take several forms including:

- Route reviews: visual inspections of a generator's individual collection containers prior to collection by a RSP.
- Technical assistance audits: visual inspections of all collection containers for an individual building, property, or business as part of a suite of services offered to support increased participation and reduced contamination.

- Randomized or targeted audits: visual inspections of individual collection containers of generators selected randomly or matching specific criteria (i.e., high-volume generators).
- Waste characterizations: sorting and categorizing materials collected for disposal, recycling, and/or organics recycling in individual containers or after several collection containers are aggregated (e.g. all containers collected from one local jurisdiction, all containers collected from one property).

Each of these monitoring methods requires robust labor resources. The Current State of Collection Report found that the Bay Area and Southern regions had the lowest ratio of population per contamination monitoring staff at 8,300 people per full-time equivalent (FTE) (in other words, the Bay Area and Southern regions had the most FTE per capita). These reported staff are most likely to spend only a fraction of their time specifically on contamination monitoring and reduction initiatives. Therefore, the staffing levels available for contamination monitoring and reduction initiatives may be significantly lower than reported. As identified in the Current State of Collection Report, it is estimated that current efforts to monitor contamination underrepresent the amount of actual contamination within the materials collected for recycling and organics recycling in even the most well-resourced regions of the state. For example, local jurisdictions in the Bay Area and Southern regions reported tagging less than 1% of generators for contamination in 2024.<sup>87</sup>

There are a number of factors that contribute to the variability of staffing needs between local jurisdictions. At the onset of new programs, generators often require more robust engagement and data gathering to track the effectiveness of each program and determine how to adjust or expand the program. In rural areas of the state longer distances between generators may decrease efficiency and necessitate higher staffing levels per capita. To effectively decrease contamination and increase program participation, local jurisdictions may need to employ more resource intensive intervention strategies such as technical assistance audits and door-to-door engagement. Use of monitoring technology may impact the number of staff required to manage monitoring programs.

In the absence of clear data to estimate potential staffing needs across the state, the following subsections discuss considerations and case studies for how to implement effective programs and the estimated cost and staffing levels to do so. The purpose of this section is to provide examples of effective monitoring and contamination reduction strategies that may be replicated or scaled throughout the state. The costs and staffing levels described in the subsections should be considered in addition to ongoing education and outreach activities and would require ongoing funding either on an annual basis or periodically to ensure results are sustained over time.

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<sup>87</sup> HF&H Consultants, LLC. *Current State of Collection Report*. 2025.

### 2.3.2.5.2 Monitoring Technologies

As discussed in the Current State of Collection Report, the use of monitoring technology, such as cameras on trucks and accompanying artificial intelligence (AI) software, is increasing. There are additional costs, beyond labor hours, to consider that are associated with the use of this technology. These costs include both the hardware (e.g., cameras) and software required to utilize camera monitoring services, installation, and maintenance costs. In 2018, the city of Livermore received a \$236,000 grant for installing cameras inside 170 commercial bins over two years. The grant covered hardware and software costs. The city reported a 3% reduction in contamination during the term of the grant. After the initial grant period, Livermore reported paying approximately \$750 per month, or \$9,000 annually, for the software subscription service allowing staff to review camera footage for contamination in 50 commercial bins. This cost was incurred for a subsequent three years until the program was discontinued. The city of Livermore ended the in-bin camera program, believing that the majority of remaining contamination was recurring from the same commercial generators.

In 2025, the city of San Francisco was piloting on-truck cameras supported by AI software. The city's RSP estimated the cost to be \$227,000 to \$248,000 to install cameras on six trucks, pay for ongoing software subscriptions, and monitor and administer the program over a three-year period. The city's RSP shared that one FTE would be hired to monitor the camera output.<sup>88</sup> In a presentation to the city, the contractor noted that the limitations on the technology are improving but are not yet reliable without additional staff reviewing each instance flagged as contamination.

WM reported that in one area in Northern California cameras were added to trucks to monitor commercial customers. Any instance of contamination resulted in a written follow up to the generator. WM reported an 89% reduction in contamination in three months. There was little additional information on how contamination is defined, if other education tactics such as direct engagement were deployed in the same area for the same time, and if that reduction was sustained over time.<sup>89</sup>

Regina, Saskatchewan in Canada and East Lansing, Michigan reported 23% and 42% reductions, respectively, in contamination due to cameras on collection trucks with accompanying postcards mailed to generators, with the latter results occurring in a three-month period. Regardless of these results, the emergent nature of the technology and the inability to replicate these results means that more testing and studies are needed before implementing at scale.<sup>90</sup>

As the use of monitoring technologies increases, it may also be necessary to further increase staff to oversee and analyze the data received. In the short term, it is likely this

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<sup>88</sup> Recology. *Rate Change Request Refuse Rate Board Hearing #1*. 21 Feb. 2025.

<sup>89</sup> Staub, Colin. "Contamination Fines Gain Steam around U.S." *Resource Recycling*, 11 Dec. 2018. Accessed Nov. 2025.

<sup>90</sup> The Recycling Partnership, and Cascadia Consulting Group. "Cost-Effective Contamination Reduction Methods (Oregon DEQ Multi-Sector Recycling Contamination Study)."

staff will be in addition to the number of staff required for in-person monitoring efforts, but as technology improves there may also be opportunity to reduce staffing levels. Ultimately, the use of monitoring technologies may be an effective way to monitor contamination on an ongoing basis, especially as the technology improves. Based on the research, monitoring technologies will need to be paired with another form of follow-up education and outreach in order to truly be effective.

### **2.3.2.5.3 Contamination Fees**

The assessment of contamination fees was identified by Collection Survey respondents as one of the most effective strategies for reducing contamination. Numerous local jurisdictions allow the assessment of fines or fees on generators for contamination. However, there is minimal evidence that it is effective in discouraging contamination when used on its own<sup>91</sup>.

There is evidence that a significant investment in education prior to the assessment of fines is effective for generator buy-in or compliance. Contamination fees in the city and county of San Francisco for single-family homes were eventually refunded due to customer complaints about the lack of information on what contamination was found and how to correct their behavior.<sup>92</sup> However, in the SeaTac, Washington, the city implemented a robust program including auditing, technical assistance, phone calls, and written warnings prior to issuing contamination charges (at \$10 per yard). If contamination was found in the first audit of the year, monthly audits were conducted until no contamination was found. In 2019 at the launch of the program, the city found, “183 contaminated containers during 217 visual audits. Due to repeated contamination, 2,087 visual inspections were completed with an average contamination of 42%. The city issued 465 contamination fines.” By January 2022, only 22 properties had contamination, and the contamination was measured at 6.5%. The city issued zero contamination fines in 2022. While successful, it is difficult to determine to what degree the frequent and consistent hands-on education was responsible for the change in behavior versus the contamination charge.

The assessment of fines and fees may result in additional, indirect costs to communities through increases in administrative burden to track fines and fees, send required notices, and follow up to ensure payment. It can also result in increased labor costs for a local jurisdiction’s code enforcement officers. Fines and fees may also place a direct and additional financial burden on generators, which may discourage participation if generators aren’t informed well enough to understand why they are receiving fines and fees on their bill. This may be especially true for priority populations where hesitancy around cost, which is identified as barrier for participation in the Current State of Collection Report, may outweigh the emotional, social, and environmental benefits of

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<sup>91</sup> The Recycling Partnership, and Cascadia Consulting Group. “Cost-Effective Contamination Reduction Methods (Oregon DEQ Multi-Sector Recycling Contamination Study).”

<sup>92</sup> Solid Waste Association of North America (SWANA). *Best Practices for Reducing Curbside Recycling Contamination and Code Enforcement*. Solid Waste Association of North America (SWANA), Sept. 2025.

correctly sorting materials. The Recycling Partnership consistently advocates that tagging carts with “oops tags” and noncollection of contamination are more effective than fines and fees for reducing contamination.<sup>93</sup>

Despite the prevalence of allowable contamination fees, the lack of evidence supporting it as an effective strategy for contamination reduction on its own makes it a less attractive option to initially pursue. It is recommended that more evidence-based strategies are utilized first. Use of contamination fees and charges requires significant additional study to determine if it is an effective market-based instrument for behavior change specifically related to contamination, at what amount a fee or charge may be effective for different generators (commercial vs. residential), and how charges and fines may or may not disproportionately impact priority populations.

#### **2.3.2.5.4 Cart Tagging and Cart Refusal**

The Recycling Partnership and the Solid Waste Association of North America (SWANA) published a report stating that contamination charges, fines, and fees were less effective than other methods such as cart tags, refusing to pick up contaminated carts, and camera-identified contamination with an automatic postcard.<sup>94</sup> The report cited one study in Fort Worth, Texas, that found financial incentives reduced contamination by 15% in six months while refusing to pick up contaminated carts resulted in a 30% reduction in contamination in three months.<sup>95</sup> Fort Worth utilizes six staff to inspect single-family households at a cost of \$1.71 per household. When assessing communities across the U.S., the report stated that a notification and refusal showed a percent reduction in contamination of between 42% and 68%.

In another collaborative study with the Oregon Department of Environmental Quality (DEQ), the Recycling Partnership reported that tagging a cart two to four times in addition to rejecting contaminated carts with a mailed contamination reminder can result in a 19% to 62% contamination reduction in single-family residences at a cost of four to seven dollars per household.<sup>96</sup> This large range appears to be directly due to the difference in the number of tags a generator received over the course of the study. The reductions in this study lasted 10 months to three years after the initial measurements were conducted. The Recycling Partnership recommends the consistent rejection of carts as the best way to achieve a significant reduction in contamination amongst repeat

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<sup>93</sup> Staub, Colin. “Contamination Fines Gain Steam around U.S.” *Resource Recycling*, 11 Dec. 2018. Accessed Nov. 2025.

<sup>94</sup> Solid Waste Association of North America (SWANA). *Best Practices for Reducing Curbside Recycling Contamination and Code Enforcement*. Solid Waste Association of North America (SWANA), Sept. 2025.

<sup>95</sup> Ibokette, Akan Ime, et al. “The Impacts of Curbside Feedback Mechanisms on Recycling Performance of Households in the United States.” *World Journal of Biology Pharmacy and Health Sciences (WJBPHS)*, vol. 17, no. 2, 26 Feb. 2024, pp. 366–386. Accessed Nov. 2025.

<sup>96</sup> The Recycling Partnership, and Cascadia Consulting Group. “Cost-Effective Contamination Reduction Methods (Oregon DEQ Multi-Sector Recycling Contamination Study).”

offenders. A second study cited in the report concluded that cart tags and cart refusal reduced contamination severity by 59% while showing that violators were 75% less likely to commit a future violation.<sup>97</sup>

Scaling the cost of cart tagging and refusal programs has many limitations. This type of enforcement in Texas cost as little as \$1.71 per household with six staff, while the Oregon DEQ paper, which reviewed multiple studies outside of California, reported \$4 to \$7 per household. Factors impacting the cost of this type of program are similar to those described at the beginning of this section related to different staffing needs. Additionally, these costs are for one-time, annual implementation of these programs.

Evidence reviewed by the contractor indicates that combining cart tagging/service refusal with outreach is the most effective and cost-efficient strategy for reducing contamination. Repeated education, especially when paired with enforcement, helps drive behavior change. These strategies work best as part of a comprehensive PE&O campaign that informs generators of their responsibilities before any notices, fines, fees, or service refusals occur.

While this strategy may significantly reduce contamination of covered materials collected for recycling and organics recycling, it relies on the generator having an acute knowledge of what covered materials are allowed in each collection container. This strategy holds generators ultimately responsible for consistent and proactive review of each product or package they plan to discard. Additionally, none of the above-mentioned studies indicate whether providers charge a fee to return to pick up refused containers or if contaminated containers are billed as trash. This potential financial burden may inequitably impact generators in disadvantaged communities. Consequently, to reduce the financial burden on generators local jurisdictions may opt to continue just providing cart tags for contamination. Reducing the complexity and variable types of packaging in the market through redesign and design improvements could significantly reduce generator confusion, diminishing the need for intensive monitoring and penalty programs. This also would shift the burden away from generators and onto producers of covered material.

### **2.3.2.5.5 Cart Tagging Only**

Cart tagging is a common method for communicating with generators during periods of PE&O and contamination monitoring efforts. As previously discussed, some local jurisdictions may choose to use cart tagging alone as their main source of contamination monitoring. In Spokane, Wash., cart tagging alone reduced contamination by 10.9 percentage points. The study calculated that it costs from \$2.17 to \$4.13 per household to conduct the study. Time to review containers ranged from a little over four minutes per household in the city to just under seven minutes per household in more rural areas. The Recycling Partnership and SWANA report cited a study that cart tagging alone reduced contamination by 25% over six months but did not

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<sup>97</sup> McKie, Erin C, et al. "How Do Curbside Feedback Tactics Impact Households' Recycling Performance? Evidence from Community Programs." *Production and Operations Management*, vol. 33, no. 5, 14 Feb. 2024, pp. 1064–1082. *Sage Journals*. Accessed Nov. 2025.

include how many cart tags were distributed to achieve this result. The report also stated “warning only” communications in communities in Massachusetts and Oregon reduced contamination by 30% and 32%, respectively. The report did not provide over what period, how many cart tags were distributed, or the costs for any of the cited studies to achieve lowered contamination levels.

The collected data on cart tagging alone supports that while this may be an effective method on its own, it may not have the same memorability or staying power as cart tagging and cart refusal. The nature of data being collected from multiple communities means that determining effectiveness of a singular method is challenging. Many of the studies cited throughout this section attempt to isolate a singular method but note that other standard forms of PE&O are being conducted at the same time (media campaigns, signage improvements, labels, etc.) which further shows that contamination monitoring is not singular or separate from other PE&O efforts.

### **2.3.3 Public Health, Environmental, and Community Impacts of Processing Facilities**

To evaluate environmental and public health impacts of processing in California, the contractor compiled information from the facility surveys, interviews, site visits, desktop research, engagement with regional and national trade associations, results from the Community Recycling and Composting Survey and listening sessions with CBOs, EJ groups, and Tribes, as described in the Current State of Processing Report. The following summarizes the environmental and public health impacts related to processing and presents methods to enhance positive outcomes and mitigate negative effects.

Mitigating impacts to communities that are already affected by industrial activity or other pollution burdens is crucial to siting facilities equitably. OPFs are required to meet various environmental regulations and may use odor and vector control measures such as aerated static pile composting systems, biofiltration, and effective materials management to reduce impacts on surrounding communities. Transportation impacts, including emissions from collection vehicles, should be minimized through optimized routing and use of low- or zero-emission fleets.

#### **2.3.3.1 Facility-Level Concerns and Impacts**

Facility-level environmental and public health impacts associated with managing materials, including both covered and noncovered materials, at processing facilities were found to be as follows:

- **Facility Fires:** Recycling processing facilities are prone to fires due to the types of materials being managed and improper disposal of hazardous materials, including common items like lithium-ion batteries.
- **Challenging Working Conditions:** Workers in the industry can be exposed to difficult working conditions, including long shifts and strenuous physical demands, which can be magnified by extreme weather conditions and events. Older recycling processing facilities with fewer automated processes require more labor and hand-picking materials from conveyor belts or inbound tip floors,

which can be physically demanding. Some facilities also require operations in confined spaces.

### **2.3.3.1.1 Facility Fires**

Increasing the quantity of certain covered materials for processing at recycling processing facilities may result in the delivery of additional noncovered materials that present challenges for facility operators and increase the risk of facility fires. Based on engagement with interested parties, additional processing contamination in inbound material may contain batteries (e.g., lithium-ion), aerosol cans, propane or butane tanks, and putrescibles (e.g. food). These processing contaminants may ignite due to high heat and dust conditions, human factors (e.g., cigarettes), or combust due to crushing by heavy equipment, balers, or compactors.

To combat the increasing number of facility fires, which have increased 20% nationally at recycling processing facilities and transfer stations in 2024 over the prior year, recycling processing facilities can add fire control systems and operating procedures.<sup>98</sup> Fires at OPFs are especially challenging to manage. These fires are often triggered by excessive microbial activity, which can be difficult to detect early. High levels of nitrogen in feedstocks can accelerate microbial metabolism, generating significant heat during decomposition. If this heat accumulates, especially in large, dense, or poorly aerated piles, it can lead to spontaneous combustion. This risk increases when carbon-to-nitrogen (C:N) ratios are poorly balanced. Once ignited, fires can cause substantial air emissions and are often difficult to extinguish, requiring the excavation of smoldering material. This not only interrupts operations for extended periods but can degrade product quality. Proactive pile management, including monitoring temperature, moisture, and feedstock composition, is critical to mitigating this risk and maintaining safe and consistent facility operations.

Technology and equipment such as infrared sensors and fire-suppression equipment can be deployed to supplement standard fire safety mechanisms such as interior and exterior sprinkler systems. Infrared or heat detection cameras and automated targeted deployment of fire suppression provide a proactive approach to catching fires which may not be visible (e.g., ignite within a pile of material) or intervening more expeditiously than personnel may be able to. Additionally, operational approaches such as workplace trainings, establishment of standard operating procedures, and implementation of signage in key areas can provide reminders and details on how employees can minimize fires from starting and identify them faster.

### **2.3.3.1.2 Challenging Working Conditions**

Workers in the industry can be exposed to difficult working conditions. Safety is critical for all aspects of the solid waste industry. Lack of safety contributes to challenges

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<sup>98</sup> Staub, Colin. "Recycling Facility Fires Increase Substantially in 2024." *Resource Recycling*, March 18, 2025.

related to workforce development, employee recruitment and retention, and insurance costs.

Some processing contaminants received at recycling processing facilities can be safety hazards for sorters, causing injuries or exposure to harmful substances. Based on engagement from interested parties, contaminants can include aerosol containers, lithium-ion batteries, needles or other sharp objects, hazardous chemicals, biomedical waste, diapers, pet waste, and other materials. Additionally, oversized or overweight objects can cause strains and injury when removing or damage equipment if not removed in the presort area. Based on responses from interested parties, MRFs are considering installing increased equipment and subsystems that use automated sorting equipment, AI, and/or robotics to minimize the amount of manual sorting. These technologies can replace manual labor required for repetitive tasks resulting in fewer health and workplace safety impacts on workers.

To increase recovery of covered material at processing facilities, material delivered in bags may need to be redirected to facilities that currently do not process bagged material. Currently, recycling processing facilities that do not have bag breakers (e.g., slow speed shredders that expose bagged material to the facility) may require laborers to open bags by hand in order to recover the contents. Opening plastic bags by hand is time consuming and there's a risk for puncture or repetitive motion injuries; adding bag breakers both increases employee safety and processing efficiency as it meters material onto the processing lines.

Heat illness is an increasing concern at recycling processing facilities, especially when considering increased labor demands for the processing of increased quantities of inbound materials. Some facilities process materials both indoors and outdoors. At outdoor facilities, employees are exposed to the elements, including extreme weather such as heat, wind, flooding, or other uncontrollable weather events. At OPFs, the increase of plastic packaging and other contaminants may require manual picking or automated sorting in outdoor conditions. Indoor facilities also need to address proper ventilation, and other means to control temperatures and humidity. Temperatures rise indoors when elevated temperatures occur outside; in cases of limited ventilation indoor temperatures can often exceed outdoor temperatures. Dust may also impact workers and cause respiratory concerns, furthering the need for sufficient ventilation and cooling systems.

To minimize challenges related to extreme weather, facilities can provide enclosed areas to protect employees from weather conditions and develop infrastructure to prevent unplanned facility downtime due to heat, wind, flooding or other uncontrollable events. Upgrades to heating, cooling, and ventilation systems and installation of air-conditioned areas at indoor facilities can minimize heat illness and reduce overall exposure to extreme heat. Providing access to water and proper training regarding the signs of heat exhaustion should also be considered. Operational approaches, such as increased number of breaks, dedicated heat illness trainings, and provision of personal protective equipment (PPE) and other supplies (e.g., cooling breathable fabric, emergency ice treatment), along with the establishment of standard operating

procedures that consider increased extreme weather events can increase employee safety.<sup>99</sup>

MRFs and OPFs operate in space constrained environments. With increased tonnage requiring processing, the challenges of space constrained operations can become significant. Additional bale types for covered materials may need to be processed and stored separately causing further space constraints. Whenever possible, implementing capital upgrades to increase space would minimize the need to store commodities outdoors or in locations that cause safety hazards or impact commodity quality.

### 2.3.3.2 Community and Environmental Impacts

The contractor assumed that the most substantive public health, environmental, and community (PHEC) impacts from expanded processing operations will be in communities where new regional facilities are developed or expanded, or where multiple solid waste facilities may develop or expand in close proximity, as this is where communities may experience a disproportionately high level of collection truck traffic, as identified in the Current State of Collection Report. Communities with potential increases in traffic, due to the expansion of existing facilities or development of new secondary processing facilities, may benefit from targeted strategies to minimize air pollutants from diesel exhaust and particulate matter (PM), such as dust, soot, and metals, all of which are known to have adverse impacts on human health.<sup>100</sup>

Transitioning to cleaner fuel, electric, or other zero-emission vehicles and retrofitting homes and buildings with items such as effective air cleaner and filtration systems may help reduce these pollutants.<sup>101</sup>

The impacts of processing facilities on communities vary depending on the facility's location, size, volume and type of material delivered and processed, and its impact management methods (e.g., odor control, traffic queueing on property, interior versus exterior unloading). The population density surrounding the facility may influence impacts on the community as well. For example, in rural areas, facilities may face less opposition from the surrounding community but can strain local resources and infrastructure, such as roads and water supply, or cause noise disturbances and odor impacts. Over 65% of CBO and EJ group respondents and 75% of Tribal respondents feel environmental problems disproportionately affect certain groups in their area (e.g., low-income residents, minorities, people of color, youth).

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<sup>99</sup> Hawley, Neil, and Patricia A. Strizak. *Heat / Cold Injury and Illness Prevention (Presentation)*.

<sup>100</sup>“State of California Office of Environmental Health Hazard Assessment.” *CalEnviroScreen 4.0 Indicator Maps*, Oct. 2021. Accessed 13 Nov. 2025.

<sup>101</sup> US EPA. “Improving Indoor Air Quality.” *US EPA*, 9 Sept. 2025. Accessed 10 Nov. 2025.

Environmental and public health impacts associated with processing materials, building new facilities, safety, worker conditions, and other environmental impacts are identified as follows:

- **Traffic congestion:** Increasing volumes of material accepted at facilities and/or the building of new facilities could increase the number of trucks and local traffic congestion and wear and tear on roadways.
- **Illegal dumping and litter:** This may occur due to accidental litter from trucks delivering materials or as a result of losses from facility operations (e.g., wind blowing material away from processing facility).
- **Noise pollution:** Processing facilities can increase noise pollution through operations of large machinery, increasing the size of a facility, or the significant inflow and outflow of traffic.
- **Dust and odors:** Dust and odor emissions are caused by material handling and processing, vehicle movement, and particles from materials in facilities which can have environmental impacts for employees and neighboring communities.
- **Water quality and contamination:** Processing facilities can increase water quality issues and contamination due to discharge of effluents, nonpoint source pollution such as water runoff flowing over surfaces that has chemicals or other toxic items.

The following subsections summarize the community and environmental impacts associated with processing, with a focus on impacts that might be magnified with increase flow of materials through processing facilities, as well as the methods to enhance positive outcomes and mitigate potential negative effects.

#### **2.3.3.2.1 Traffic Congestion**

Increasing the amount of inbound covered material received by processing facilities may result in an increased number of vehicles delivering materials. Respondents to the Community Recycling and Composting Survey reported that traffic congestion and accidents were a negative neighborhood and community impact (22% of CBO and EJ group respondents and 13% of Tribe respondents) and should be a priority consideration for the siting of new processing facilities.

A 2025 report by Cambridge Systematics<sup>102</sup> lists the following impacts from truck traffic: congestion during morning commutes, infrastructure deterioration such as potholes on roads that were not designed for heavy traffic, and safety hazards arising from conflicts between large trucks and people walking, riding bikes, or on the side of the road, This

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<sup>102</sup> Bream, MPP, Baird, et al. "Mitigating Truck Traffic Impacts: A Framework for Action." *Cambridge Systematics*, 16 July 2025. Accessed Nov. 2025.

report demonstrates how real and immediate the perceived negative community impacts are from truck traffic congestion.

The following mitigation strategies can be employed to enhance positive outcomes and mitigate negative impacts related to traffic congestion at processing facilities:

- **Implement one-way traffic pattern:** Separate trucks and cars entering and exiting the facility.
- **Create segregated traffic areas:** Designate separate entry, unloading, and exit zones for the general public and commercial vehicles.
- **Plan for severe weather.** In regions prone to snow or other extreme conditions, include areas for snow storage and arrange for snow removal from key pathways.
- **Add turn lanes:** Incorporate deceleration lanes and acceleration lanes for trucks entering and exiting the site.
- **Adjust delivery schedules:** Coordinate timing for trucks to deliver or transfer material.

#### 2.3.3.2.2 Illegal Dumping and Litter

According to the Community Recycling and Composting Survey, littering (57% of CBO and EJ group respondents) and illegal dumping (44% of CBO and EJ group respondents) were seen as the largest perceived impacts from solid waste activities.

- Littering can be intentional or accidental and can be seen near solid waste facilities due to material flying out of vehicles (e.g. not being properly covered). The following provides considerations for how to enhance positive outcomes and mitigate negative impacts related to littering that occurs near processing facilities:<sup>103</sup>Education and training on how to properly tarp or cover material to keep it contained within vehicles.
- Additional education to individuals and children about the impacts of litter to help create awareness and behavior change. This could include use of social media to raise awareness about littering and proper disposal options and facility locations.
- Site management and maintenance, including more intensive litter clean up, nets/screens, street sweepers, and other items that can capture and clean up litter.

According to the U.S. EPA's 2025 report on the National Strategy to Prevent Plastic Pollution: Part Three of a Series on Building a Circular Economy for All, strong support from local leaders, including collaboration between authorities, communities, and

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<sup>103</sup>Ehinger, Benjamin. "Solutions for Littering: Effective Strategies to Combat Waste." *Waste Removal USA*, 19 Aug. 2024. Accessed Oct. 2025.

facilities can enhance positive outcomes and mitigate negative impacts related to illegal dumping at, or near, processing facilities. Recommendations to build this support and collaboration between community members and leaders include, but are not limited to<sup>104</sup>:

- Effective communication that ensures feedback from surrounding communities is heard and promptly addressed, such as in listening sessions with community members, local leaders, and facility representatives.
- Ensuring community members are part of decision-making processes so that initiatives are inclusive and community driven. Participation from community members is key in every phase of decision-making and implementation. These opportunities should be provided within time frames that allow for maximum participation and any concerns or feedback to be addressed. This ensures that community members have opportunities to influence project design and planning that benefit them, which is essential to building trust.
- Hosting meetings in an accessible format for community members by scheduling multiple meetings at different times throughout the day, providing options to attend or virtual feedback, and providing meeting materials and information in multiple languages.
- Tracking metrics for improvement, accountability, and publicity. These metrics may include occurrence rates (incidents per area/time), volume/weight of waste, material composition, using a hotspot map, leveraging technology (e.g., cameras, drones, remote sensing) for detection and accumulating data (e.g., Litterati). Key indicators would include frequency, quantity, types of litter, or illegally dumped material that would change over time.

### **2.3.3.2.3 Noise Pollution**

The most frequently selected negative impact identified by CBOs and EJ groups in the Community Recycling and Composting Survey was noise pollution (34% of CBO and EJ group respondents). The facility planning and development process assesses noise pollution (e.g. evaluating the impact of construction/operational noise on nearby homes, health, wildlife and property values using tools like environmental impact assessments to predict noise levels, identify sensitive receptors, and mandate mitigation such as site layout) as an impact on the public and environment. Local zoning and municipal codes often closely regulate noise levels for operational activities. Land uses surrounding a facility are assessed and the proximity of sensitive receptors can dictate conditions of noise pollution. Conditions, typically set in a conditional use permit, can have specific attenuation measures applied to protect these sensitive receptors from facility-generated noise.

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<sup>104</sup> [10 Strategies to Build and Strengthen Leadership Communities - Douglas Ebenstein Leadership – Doug Ebenstein's Executive Vision & Strategy](#)

The following provides methods that should be considered to mitigate negative impacts related to noise pollution at or near processing facilities:

- Adopt use of electric transfer and collection fleets, which produce less noise and also lower climate pollutant emissions.
- Conduct operations within enclosed buildings, which is often required with organic material handling, and limits off-site noise impacts.
- Routinely check that ear protection devices are worn by all employees subject to excessive noise levels in the enclosed facility.
- Engage affected communities through participatory monitoring (e.g. collecting noise data and working with the facility reviewing their own collected data), co-design workshops and community forums to create dialogue between residents and businesses.
- Ensure mobile equipment has mufflers to minimize noise impacts.
- Adopt additional Best Management Practices (BMPs) for noise control measures such as sound walls, vegetative buffers, and concrete barriers. Engineering controls such as shielding and acoustic barriers can be used to further reduce noise exposure.
- Perform regular maintenance on HVAC systems and equipment to make sure they are well maintained to reduce noise.

#### **2.3.3.2.4 Dust and Odors**

Dust and odor emissions at solid waste facilities are caused by a variety of sources, such as material handling and processing, sand, grit or dirt from outdoors, vehicle movement, and particles from materials in the facility. Potential solutions to effectively minimize dust include organizing a facility to reduce unnecessary movement of material or vehicles, having a water-based dust suppression system, installing a ventilation system to reduce dust in the working environment, and dividing up the facility into zones to reduce dust impact.

Dust emissions at organics processing sites are typically limited due to the inherent moisture content of organic waste; however, BMPs are implemented to ensure compliance with air quality standards and mitigate potential nuisance conditions. To control dust emissions, organics material handling and transfer activities can be conducted within fully enclosed structures to minimize the potential for fugitive particulate emissions. Misting systems can also be installed to help control dust. For facilities that generate substantial dust and odor, the operating building can be maintained under negative pressure through a mechanical ventilation system, which prevents the escape of odorous or particulate-laden air. If the facility is particularly odorous, the exhaust air can be routed through a biofiltration system, to mitigate odorous compounds and volatile organic compounds (VOCs).

Community engagement, as discussed in previous sections, can include hosting workshops or meetings to understand community concerns and gather ideas, raise awareness on sources for odor and dust impacts, share clear information and provide feedback loops to build trust, and use sensors for real-time data to localize air quality monitoring and share with the community.

The following provides methods on how to enhance positive outcomes and mitigate the negative impacts related to dust and odors at or near processing facilities.

- **Use Advanced Odor Control Solutions:** Using misting systems with odor-neutralizing solutions, odor and dust suppression systems and other odor control systems will reduce odors, improve worker health and safety, and improve air quality (Ritter 2025). These systems include modular designs where systems can be easily adapted and expanded as needs change, smart technologies that integrate sensors and automation to optimize performance and minimize water usage, and durable materials built to withstand harsh conditions.
- **Use Covered Static Pile Technology (for OPFs):** This technology is used to reduce odors and pathogens, minimize stormwater contamination, reduce processing time for organic materials, and reduce emissions of volatile organic compounds and odors, contributing to better air quality (Woods 2022).
- **Use Dust Reduction Strategies:** These strategies may include regularly spraying dusty areas with water or dust suppressants, planting grass, using mulch, applying gravel to bare soil to prevent erosion, reducing vehicle speeds on unpaved roads and limiting vehicle numbers, using tarps or sheets for soil, sand and manure piles to block wind, and erecting artificial or natural windbreaks (e.g. trees, hedges) to slow wind at ground level.

#### 2.3.3.2.5 Water Quality and Contamination

The top environmental concerns related to facilities are water quality and contamination (70% of CBO and EJ group respondents and 75% of tribal respondents), neighborhood cleanliness (68% of CBO and EJ group respondents), and soil contamination (63% of Tribal respondents). Management of water quality and contamination at solid waste facilities involves a combination of regulatory compliance, effective waste management practices, and innovative treatment technologies. Key solutions and strategies to enhance positive outcomes and mitigate the negative impacts related to water quality and contamination at or near processing facilities include:

- Proper leachate and stormwater management systems to protect groundwater and surface water quality.
- Groundwater monitoring systems to evaluate the performance of solid waste disposal facilities and ensure compliance with environmental standards.
- Proper disposal of solid waste material in a manner that minimizes the risk of water contamination. Proper segregation, separation, and disposal of hazardous and nonhazardous waste.

- Implementing state-of-the-art treatment technologies such as reverse osmosis and advanced oxidation processes.

### 2.3.3.3 Improving Community Engagement

Engagement with CBOs, EJ groups, and Tribes was an integral part of collecting data for this report. The contractor engaged with these groups with the primary objective of having these communities share their experiences and provide their expertise related to waste practices.

The following section highlights the actions and barriers for improving community engagement with processing systems and ensuring that priority populations are not negatively impacted with the projected increase in the amount of covered material reaching recycling processing facilities in future years. According to the Community Recycling and Composting survey, 44% of CBOs and EJ groups said they felt they had an opportunity to express their feelings about the facility with their local community leaders, elected officials or facility staff. To increase opportunities for engagement, the contractor identified various approaches to community outreach and implementation of mitigation measures based on feedback provided by the CBOs, EJ groups, and Tribes that participated in this study.

Participants voiced a lack of trust that plastic gets properly recycled, citing reports of plastic being shipped out of the country. Education campaigns highlighting recycling and composting activities, the current markets and the impact the community has on recycling will create more transparency and can foster more trust in the collection and processing system. Providing tours of the facilities for the community will provide an in-depth look at the process and the level of effort to clean materials in the recycling stream and send them to market.

Communities show concern over environmental issues and want to transition away from the single-use economy, but there are gaps in both the waste systems and people's knowledge or ability to effectively participate in them. In order to address the gaps in knowledge, educational campaigns, training programs, waste management plans, and collaboration with communities on waste management efforts will need to be developed. Behavior change is driven by educating communities on what is accepted, how best to recycle and/or manage material, the importance of choosing different products, and a general understanding of sustainability. Transitioning away from the single-use economy will require conscious efforts by community members to develop new habits and routines (e.g. using reusable bags, supporting sustainable brands), which can be supported by municipalities (e.g. provide incentives, encourage adopting eco-friendly practices). Education and support can also emphasize how adopting sustainable practices can be cost effective through reuse and reducing the amount of waste to manage. Education on the benefits of sustainable packaging can also help communities understand and make informed decisions about their purchasing habits and encourage sustainable practices.

Participants advocated for ensuring that environmental justice perspectives are heard and involved in the implementation of the Act, which includes communities' concerns over the negative health effects of plastic pollution. Environmental justice and public

health should be at the core of engagement, enacted through intentional, specific engagement with priority populations and communities impacted by facilities (e.g., odor and noise from facilities, illegal dumping). Outreach should maximize inclusivity by providing multiple methods by which to provide feedback in multiple languages, such as online surveys, virtual meetings, and in-person meetings at workplaces and/or community centers. It is crucial to understand and alleviate any barriers to participation to allow community members to participate.

The following are strategies to engage communities as facilities expand or accept more material and as new facilities are sited.

- Conduct a thorough assessment of the current or planned facility to understand its physical condition and engage employees, interested parties, and members of surrounding communities to gather feedback and identify areas that require attention.
- Create a master plan that outlines future building projects and factor in potential expansions and minimize operational impacts during future construction. Include surrounding communities and priority populations in the development of these plans and foster transparent communication between all involved and affected parties.
- Pick an advantageous site in a location that accommodates expansion in an area that has the least possible impact to surrounding communities.

Soliciting ongoing feedback from affected communities could take the form of surveys, focus groups, town hall meetings, and social media outreach. The process of outreach should create a culture where community members feel comfortable sharing thoughts and opinions through multiple channels, ensuring that feedback collection methods are accessible to all community members, especially those with different language preferences and abilities. Trust can be built with communities through transparency by demonstrating that their feedback is valued and will be acted upon in the decision-making process.<sup>105</sup> Local community leaders, elected officials, and facility staff should create consistent opportunities for priority populations and community members to voice concerns, feedback, and ideas to ensure their input is valued and leads to immediate, tangible improvements. Compensation should be considered for the significant hours and expertise that community members may dedicate during these engagement processes.

Building trust in recycling and composting systems involves mitigating potential impacts from facilities and demonstrating to the community through public engagement that there are benefits of recycling and composting. Transparency by the municipality, collector, processor and producer by clearly communicating the processes and outcomes of the recycling system to the public is essential.

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<sup>105</sup> [5 Community Engagement Strategies to Make Nonprofit Programs More Inclusive](#)

## 2.4 End Markets for Covered Materials

Using the tonnage flow model, the estimated quantities of plastic covered material, by CMC end market group, that need to be accepted by responsible end markets based on the proxy recycling rate were projected for each milestone year. This accounted for losses at end markets (i.e. CMC conversion rate). Using survey results, expert engagement, and desktop research, this section of the report, the contractor evaluated actions and investments to expand and enhance recycling of plastic covered material at end markets. Existing end market capacity that is available and additional needed capacity were estimated. Additionally, this section provides an analysis on improvements to reduce contamination, the advancements needed to improve recovery, and an evaluation of environmental and public health impacts of end markets.

The contractor did not evaluate end market facilities for consideration as responsible end markets. Whether any end market will be considered a responsible end market is only established when an approved producer responsibility plan identifies it as such. For the purposes of this report, the contractor assumed that international end markets would not be considered responsible end markets and that domestic end markets were assumed to be responsible. For this analysis, material identified as exported internationally is assumed to be managed domestically. The impact of this assumption is described throughout this section.

### 2.4.1 Access to End Markets for Covered Materials

#### 2.4.1.1 Quantitative Analysis of New End Market Capacity Needed

The objective of this section is to project the weight of plastic covered material that will be accepted into end markets to meet the proxy recycling rates and evaluate the capacity needed to manage the estimated amount of material. The contractor started with the estimated tons of each CMC collection group collected in all material streams for each milestone year, as estimated in the tonnage flow model. The contractor converted the estimate from CMC collection group to CMC end market group for the purposes of this analysis. Based on the estimated amount collected, proxy recycling rates (i.e., 30% by 2028, 40% by 2030, and 65% by 2032) and the estimated CMC conversion rates for different materials,<sup>106</sup> the contractor estimated the tons of each CMC end market group which needs to be accepted into responsible end markets for the rates to be met in each milestone year.

For example, if 100 tons of a CMC end market group were estimated as collected in all material streams, then 65 tons of that material would need to be recycled to meet a 65% proxy recycling rate. If an end market facility can achieve an 85% conversion rate, then 76.5 tons need to be accepted into the end market to result in 65 tons of recycled material. This calculation uses a proxy recycling rate given available data and is not the

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<sup>106</sup> The conversion rate is the total recycled output produced by an end market facility divided by the total quantity of a CMC accepted by that specific facility.

same as the recycling rate estimated as part of implementation of the Act. See section 2.2 for more information on the proxy recycling rate and these calculations.

Finally, based on the estimated weight of each CMC end market group that needs to be accepted into end markets, the contractor determined the needed capacity of end market facilities. The needed capacity was compared to current and available capacity to understand if more end market facilities might be required based on the modeling. The current used and available capacity of end market facilities was based on the primary and secondary research conducted on facilities presented in the Current State of End Markets Report.

#### **2.4.1.1.1 CMC End Market Groups in the Plastic Material Class**

As described in section 2.1, some CMCs in the plastic material class were not included in the tonnage flow model, including PVC, plastics and polymers designed for compostability, some types of flexibles and film plastics, and some types of rigid plastic. The analysis of end market capacity and investments was not performed for these CMCs.

After modeled material replacement, the following CMC end market groups were evaluated:

- Plastic #1 - PET clear bottles, jugs, jars - Non CRV.
- Plastic #1 - PET pigmented bottles, jugs, jars - Non CRV.
- Plastic #1 - Other PET rigid.
- Plastic #2 - HDPE (pigmented and natural) bottles, jugs, jars - Non CRV.
- Plastic #2 - HDPE pails and buckets.
- Plastic #2 - HDPE flexibles and films.
- Plastic #2 - Other HDPE rigid.
- Plastic #4 - LDPE bottles and jugs.
- Plastic #4 - Other LDPE rigid.
- Plastic #4 - Mono LDPE flexibles and films.
- Plastic #5 - PP rigid items.
- Plastic #5 - Mono PP flexibles and films.
- Small Format - Plastics.

##### **2.4.1.1.1.1 Rigid PET**

Rigid PET includes three CMC end market groups, including PET clear and pigmented bottles, jugs, and jars and other rigid PET. Table 2-23 shows the estimated PET CMC end market groups collected in all material streams in 2024 and the projected amounts that will be collected in all material streams in the milestone years. The contractor

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estimated that the weight of material collected for some of the CMC end market groups will be lower in future years, due to source reduction of plastic covered material required under the Act. Other CMC end market group amounts may increase, as those CMCs are assumed to replace the CMCs that are not included in the tonnage flow model. Overall, the amount of PET CMC end markets groups collected is estimated to grow from 334,300 tons in 2024 to 395,000 tons in 2032. One of the main reasons for this estimated increase in collection in all material streams is because PET rigid CMCs were found to be good potential alternatives for CMCs that were not included in the tonnage flow model.

**Table 2-23: Estimated PET CMC End Market Groups Collected in All Material Streams in 2024 and Milestone Years (Tons)**

CMC End Market Group	2024	2028	2030	2032
Plastic #1 - PET Clear Bottles, Jugs, Jars - Non CRV	98,900	128,700	117,100	112,200
Plastic #1 - PET Pigmented Bottles, Jugs, Jars - Non CRV	33,800	47,200	43,900	42,600
Plastic #1 - Other PET Rigid	201,600	267,200	248,100	240,200
<b>Total</b>	<b>334,300</b>	<b>443,100</b>	<b>409,100</b>	<b>395,000</b>

As shown in Table 2-24, PET CMC end market groups were estimated to have a 2024 CMC conversion rate between 59% and 67% in the Current State of End Markets Report, which are assumed to improve to 85% by 2032 with investments made to end markets. Section 2.4.4 includes more information on improving recovery and covered material conversion rates.

**Table 2-24: Estimated Current and Future CMC Conversion Rates for PET CMC End Market Groups**

CMC End Market Group	2024	2028	2030	2032
Plastic #1 - PET Clear Bottles, Jugs, Jars - Non CRV	67%	67%	75%	85%
Plastic #1 - PET Pigmented Bottles, Jugs, Jars - Non CRV	59%	65%	75%	85%
Plastic #1 - Other PET Rigid	67%	67%	75%	85%

Table 2-25 provides two sets of quantities. First, it shows the estimated quantity of each PET CMC end market group that needs to be accepted into end markets in the milestone years to meet the proxy recycling rates. The contractor estimated these figures based on the proxy recycling rates, the estimated amounts collected in all material streams in Table 2-23, and future improvements to the CMC conversion rates, as outlined in Table 2-24. Second, the table shows the modeled tons of each CMC end market group projected to be accepted by end markets in each milestone year. The amount projected to reach end markets may be higher than the amount required to reach end markets because of the following reasons:

- Existing collection rates for some CMCs may result in a proxy recycling rate that exceed the requirement for the milestone year
- Collection rates were not modeled to decrease between milestone years. For example, if the collection rate estimated as needed for 24\_P1P to meet the recycling rate in 2028 is 71%, this collection rate was not modeled to decrease in 2030 upon improvement of processing loss and CMC conversion rates..
- Improvements modeled for processing facilities to capture a specific covered material may decrease processing loss of other covered materials. For example, addition of optical sorters or re-processing materials may capture multiple covered materials.

Using Plastic #1- PET clear bottles, jugs, jars – non-CRV as an example, if 112,200 tons were collected in all material streams in 2032 (see Table 2-23), then 72,930 tons would need to be recycled to achieve the 65% proxy recycling rate in 2032. Given improvements to PET end markets, it is assumed that the CMC conversion rate will be 85% in 2032 (see Table 2-24), meaning that 85% of PET covered material that is accepted by those end markets is effectively converted into a recycled product to be used in lieu of virgin material (e.g., pellet). This means that more than 72,930 tons need to be accepted at responsible end markets to result in that amount being recycled.

Table 2-25

**Table 2-25: Estimated Inflows of PET CMC Groups Accepted by or Sent to End Markets in 2024 and Estimated Inflow Accepted by End Markets Based on Tonnage Flow Model in Milestone Years (Tons)\***

<b>CMC End Market Group</b>	<b>2024 Projected Tons Sent to End Markets</b>	<b>2028 Projected Tons Sent to End Markets</b>	<b>2028 Tons Required by End Markets to Meet 30% Recycling Rate</b>	<b>2030 Projected Tons Sent to End Markets</b>	<b>2030 Tons Required by End Markets to Meet 40% Recycling Rate</b>	<b>2032 Projected Tons Sent to End Markets</b>	<b>2032 Tons Required by End Markets to Meet 65% Recycling Rate</b>
Plastic #1 - PET Clear Bottles, Jugs, Jars - Non CRV	17,500	57,600	57,600	62,500	62,500	85,800	85,800
Plastic #1 - PET Pigmented Bottles, Jugs, Jars - Non CRV	2,200	21,800	21,800	23,400	23,400	32,600	32,600
Plastic #1 - Other PET Rigid	11,600	119,700	119,600	157,100	132,300	183,700	183,700
<b>Total</b>	<b>31,300</b>	<b>199,100</b>	<b>199,000</b>	<b>243,000</b>	<b>218,200</b>	<b>302,100</b>	<b>302,100</b>

\*Table totals may not sum due to rounding.

Table 2-26 shows the estimated total local capacity (i.e., capacity identified for in-state end markets which currently manage California covered material in addition to capacity for a few domestic end markets identified as managing California material as found in the Current State of End Markets report) in 2024 as well as the amount of that capacity which is estimated as available in 2024. Estimated local capacity includes end market capacity for both covered and noncovered materials. These estimates do not include current international exports or capacities of domestic end markets that do not accept California material as identified in the Current State of End Markets report. While out-of-state end markets that do not manage California materials were not included in local capacity, available capacities in the U.S. and Canada are included in the narrative later in this subsection.

The 2024 local capacity does include the capacity of facilities that recently announced their closure, since closed facilities could find new owners and resume operation quickly. Blue Polymers has already indicated its acquisition of one of the closing facilities (the Evergreen facility<sup>107</sup>), but, as of this report, rPlanet Earth has not been acquired. The rPlanet Earth facility is responsible for approximately half of the PET Grade B (curbside collected PET) total capacity outlined in the table.

Table 2-26, for each milestone year, also shows the estimated needed capacity of responsible end markets to manage PET rigid CMC end market groups. The needed capacity is the total capacity required to manage the material needed to reach the proxy recycling rates. For two reasons, the total needed capacity in Table 2-26 is not the same as the amount required to be accepted by end markets to meet a given milestone year's recycling rate in Table 2-25. First, the total needed capacity is based on projected tons sent to end markets rather than the tons required to be sent, since the former is sometimes greater than the latter. Second, since the projected tons sent to end markets excludes contamination and other nontarget material but end markets will nonetheless receive such nontarget material, the contractor derived needed capacity as the projected tons plus expected contamination. Expected contamination was assumed to be the maximum allowed in relevant bales according to ReMA's Institute of Scrap Recycling Industries (ISRI) bale specification guide.<sup>108</sup> International end markets currently receiving covered material were assumed to not be responsible end markets when estimating total capacity needed in milestone years as they are unlikely to be considered responsible end markets without significant investments. In 2024, it was estimated that 7,500 tons of PET were exported internationally and this weight does not significantly impact the needed capacity.

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<sup>107</sup> Rachal, Maria. "Blue Polymers Takes over Food-Grade RPET Pellet Production in California." *Packaging Dive*, 19 Aug. 2025, [www.packagingdive.com/news/blue-polymers-republic-services-rpet-pellet-california/757933/](http://www.packagingdive.com/news/blue-polymers-republic-services-rpet-pellet-california/757933/).

<sup>108</sup> Recycled Materials Industry. (n.d.). ISRI Specifications [Website]. Retrieved October 23, 2025, from <https://www.isrispecs.org/>

**Table 2-26: Estimated Current Capacity for PET End Markets and Needed PET End Market Capacity for Covered Material (Tons)**

<b>Material Grade</b>	<b>Local Capacity 2024<sup>1</sup></b>	<b>Available Local Capacity 2024<sup>1</sup></b>	<b>Total Capacity Needed 2028</b>	<b>Total Capacity Needed 2030</b>	<b>Total Capacity Needed 2032</b>
PET Grade A	290,400	156,900	0	0	0
PET Grade B or B with Thermoform	72,000	33,000	219,600	268,400	333,200
<b>Total</b>	<b>362,400</b>	<b>189,900</b>	<b>219,600</b>	<b>268,400</b>	<b>333,200</b>

<sup>1</sup>Local capacity includes capacity for both covered and noncovered material. Capacity needed includes the amount needed for covered material and associated residue.

As outlined in the Current State of End Markets Report, the majority of PET end market facilities identified are currently only managing PET Grade A material, most of which is supplied through the Beverage Container Recycling Program, which are not covered materials under the Act. These facilities manage nearly 140,000 tons of PET beverage containers and will likely continue to manage these materials, meaning most of the current state capacity for PET is used for materials not covered by the Act. The available capacity in these facilities currently managing Grade A material could cover an estimated 157,000 tons of the needed capacity for PET covered material in 2032, but they would need investments in additional sorting, cleaning, and recycling infrastructure to manage Grade B material and thermoforms. The cost of these upgrades is covered under the funding discussion in the following section 2.4.2.

The additional capacity could also be found in end markets outside of the state, whether it be in nearby states or international end markets, if those end markets meet the criteria to be considered responsible end markets. A recent report from the Association of Plastics Recyclers (APR) found that there is 330,000 tons of PET recycling capacity available in the U.S. and Canada<sup>109</sup>. Subtracting the available local capacity in 2024 from this amount, the contractor estimated that 140,100 tons of available capacity is located at U.S. and Canada facilities which were not identified as accepting California material.

All facilities are likely to require investments in upgrades to manage the likely greater share of thermoforms in the PET recycling stream. California could meet its 2032 capacity needs of 333,200 tons through current PET Grade B with Thermoform capacity (around 72,000 tons), utilizing and adapting available capacity at PET A facilities (around 157,000 tons), and utilizing capacity at other U.S. and Canadian facilities (around 140,000 tons). If only local capacity for PET Grade B end market facilities is

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<sup>109</sup> APR. "Informational Report: Plastics Recycling Capacity across US and Canada." 2025.

used, it is estimated that three large facilities (around 100,000 tons per year) or nine small- to medium-sized facilities (around 30,000 tons per year) would be needed.

#### 2.4.1.1.1.2 HDPE, LDPE, and PP Rigid

HDPE, LDPE, and PP Rigid includes six CMC end market groups, including the rigid forms of HDPE, LDPE, and PP other than utensils and small format items. Table 2-27 shows the estimated HDPE, LDPE, and PP CMC end market groups collected in all material streams in 2024 and the projected amounts that will be collected in all material streams in the milestone years. The contractor estimated that the weight of material collected for some of the CMC end market groups will be lower in future years, due to source reduction of plastic covered material required under the Act. Overall, the amount of collected HDPE, LDPE, and PP CMC end market groups are estimated to increase slightly from 562,500 tons in 2024 to 613,300 tons in 2032.

**Table 2-27: Estimated HDPE, LDPE, and PP CMC End Market Groups Collected in All Material Streams 2024 and Milestone Years (Tons)**

CMC End Market Group	2024	2028	2030	2032
Plastic #2 - HDPE (pigmented and natural) Bottles, Jugs, Jars - Non CRV	214,800	214,800	190,500	180,300
Plastic #2 - HDPE Pails and Buckets	50,400	50,400	47,000	45,500
Plastic #2 - Other HDPE Rigid	40,700	40,600	37,900	36,700
Plastic #4 - LDPE Bottles and Jugs	7,100	7,100	6,600	6,400
Plastic #4 - Other LDPE Rigid	15,500	15,500	14,400	14,000
Plastic #5 - PP Rigid Items	234,000	374,400	343,400	330,400
<b>Total</b>	<b>562,500</b>	<b>702,800</b>	<b>639,800</b>	<b>613,300</b>

As shown in Table 2-28, HDPE and PP CMC end market groups were estimated to have a CMC conversion rate between less than 1% and 90% as found in the Current State of End Markets Report, which are assumed to improve to 85% by 2032 for those currently below this rate. Section 2.4.4 includes more information on improving recovery and covered material conversion rates.

**Table 2-28: Estimated Current and Future CMC Conversion Rate for HDPE, LDPE and PP CMC End Market Groups**

<b>CMC End Market Group</b>	<b>2024</b>	<b>2028</b>	<b>2030</b>	<b>2032</b>
Plastic #2 – HDPE (pigmented and natural) Bottles, Jugs, Jars – Non CRV	90%	90%	90%	90%
Plastic #2 – HDPE Pails and Buckets	85%	90%	90%	90%
Plastic #2 – Other HDPE Rigid	<1%	85%	85%	85%
Plastic #5 – PP Rigid Items	56%	65%	75%	85%
Plastic #4 - LDPE Bottles and Jugs	N/A	65%	75%	85%
Plastic #4 - Other LDPE Rigid	N/A	65%	75%	85%

Table 2-29 shows the estimated weight of each HDPE, LDPE, and PP CMC end market group that needs to be accepted into end markets. The contractor estimated these figures based on the proxy recycling rates, the estimated amounts collected in all material streams in Table 2-27, and future improvements to the CMC conversion rates, as outlined in Table 2-28.

**Table 2-29: Weight of HDPE, LDPE, and PP CMC End Market Groups Estimated to be Accepted by or Sent to End Markets in 2024 and Estimated Weight to be Accepted by Responsible End Markets in Milestone Years (Tons)\***

<b>CMC End Market Group</b>	<b>2024 Projected Tons Sent to End Markets</b>	<b>2028 Projected Tons Sent to End Markets</b>	<b>2028 Tons Required by End Markets to Meet 30% Recycling Rate</b>	<b>2030 Projected Tons Sent to End Markets</b>	<b>2030 Tons Required by End Markets to Meet 40% Recycling Rate</b>	<b>2032 Projected Tons Sent to End Markets</b>	<b>2032 Tons Required by End Markets to Meet 65% Recycling Rate</b>
Plastic #2 - HDPE (pigmented and natural) Bottles, Jugs, Jars - Non CRV	41,700	144,800	71,600	144,000	84,700	142,300	130,200
Plastic #2 - HDPE Pails and Buckets	200	16,800	16,800	20,900	20,900	32,900	32,900
Plastic #2 - Other HDPE Rigid	4,200	14,300	14,300	19,300	17,800	28,100	28,100
Plastic #4 - LDPE Bottles and Jugs	0	3,300	3,300	3,500	3,500	4,900	4,900
Plastic #4 - Other LDPE Rigid	100	7,200	7,200	7,700	7,700	10,700	10,700
Plastic #5 - PP Rigid Items	17,200	184,300	172,800	190,800	183,100	252,800	252,700
<b>Total</b>	<b>63,400</b>	<b>370,700</b>	<b>286,000</b>	<b>386,200</b>	<b>317,700</b>	<b>471,700</b>	<b>459,500</b>

\*Table totals may not sum due to rounding.

As shown in Table 2-29, there are significant gaps between estimated current recycling of HDPE, LDPE, and PP CMC end market groups and what is projected to be accepted in the future to meet the proxy recycling rates. It is estimated that end markets will accept nearly six times more material in these CMC end market groups in 2028 than 2024. This is challenging for PP rigid covered material, since there are limited local end markets and much of the material identified in the Current State of End Markets Report is exported internationally (13,000 tons of 17,200 tons accepted by or sent to end markets). However, these materials have proven methods to be recycled and there are industry coalitions seeking to improve recycling of polypropylene<sup>110</sup>. Investments will also be required for end markets to accept LDPE rigid items, which were found to currently have limited end markets. However, LDPE rigid items could be managed and recycled, if only in limited quantities, since LDPE rigid material could be included as part of an HDPE color grade and recycled accordingly. The contractor found that this is currently a less common practice as there is likely enough HDPE to fulfill current capacity.

Table 2-30 shows the estimated total local capacity (i.e., capacity identified for in-state end markets which currently manage California covered material in addition to capacity for a few domestic end markets identified as managing California material as found in the Current State of End Markets report) in 2024 as well as the amount of that capacity which is estimated as available in 2024. These estimates do not include current international exports or capacities of domestic end markets that do not accept California material as identified in the Current State of End Markets report. While out-of-state end markets that do not manage California materials were not included in local capacity, available capacities in the U.S. and Canada are included in the narrative later in this subsection.

For each milestone year, Table 2-30 also shows the estimated needed capacity of responsible end markets to manage HDPE, LDPE, and PP rigid end market groups. The needed capacity is the total capacity required to manage the material in Table 2-29 to reach the proxy recycling rates. The total needed capacity is based on the projected tons sent to end markets from Table 2-29, but increased to account for contamination, as described in subsection 2.4.1.1.1.1 International end markets that received covered material were assumed to not be responsible end markets when estimating total capacity needed in milestone years as they are unlikely to be considered responsible end markets without significant investments.

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<sup>110</sup> The Recycling Partnership. Polypropylene Recycling Coalition.  
<https://recyclingpartnership.org/polypropylene-coalition/>.

**Table 2-30: Estimated Current Capacity for HDPE, LDPE, and PP End Markets and Needed HDPE, LDPE, and PP End Market Capacity for Covered Material (Tons)**

Material Grade	Local Capacity 2024 <sup>1</sup>	Available Local Capacity 2024 <sup>1</sup>	Total Capacity Needed 2028	Total Capacity Needed 2030	Total Capacity Needed 2032
HDPE, LDPE, and PP	46,000	20,000	408,700	425,800	522,000

<sup>1</sup>Local capacity includes capacity for both covered and noncovered material. Capacity needed includes the amount needed for covered material and associated residue.

In addition to the local capacity identified in the table, both the Lyondell Basell and Blue Polymers facilities will become operational in the next several years and will potentially have a combined capacity of about 120,000 tons per year.

Despite that, the available capacity is likely not enough to manage the additional material that needs to be accepted by responsible end markets. The estimated current in-state capacity and soon to be operational facilities is approximately 32% of the needed capacity of 2032. APR estimates that there are 360,000 tons of available capacity for HDPE and PP in the U.S. and Canada<sup>111</sup>, but upgrades are likely necessary. Subtracting the available local capacity in 2024 from this amount, it was estimated that 340,000 tons of available capacity is located at U.S. and Canada facilities which were not identified as accepting California material.

California could meet a majority of its 2032 capacity needs (about 506,000 of 522,000 tons) through current HDPE and PP capacity (around 46,000 tons), through the Lyondell Basell and Blue Polymers facilities (around 120,000 tons), and utilizing capacity at other U.S. and Canadian facilities (around 340,000 tons). The remaining 16,000 tons of capacity can be obtained through one average sized facility. If only local capacity plus Lyondell Basell and Blue Polymers facilities is used, it is estimated that about 356,000 tons of additional capacity would be needed, which was estimated to require four to 18 new HDPE, PP, and LDPE facilities based on average facility sizes found through the contractor’s data collection efforts (20,000 to 100,000 tons annually).

#### 2.4.1.1.1.3 Flexible and Film Plastics

Flexible and film plastics include two CMC end market groups that include PE film (HDPE and LDPE flexibles and film) and mono PP flexible and film items. Other types of flexible and film plastics were not included in the tonnage flow model and were assumed to be replaced with these types. Although limited end markets were found for PP flexibles and film, technologies do exist to recycle these materials and investment in end markets were found to outweigh the options for designing these materials out of the

<sup>111</sup> APR. “Informational Report: Plastics Recycling Capacity across US and Canada.” 2025.

system. PP flexibles and film comprise more than a third of the estimated 2024 plastic film generation and this material offers certain properties such as its stiffness for standup pouches or heat resistance for microwavable products that are difficult to replicate in other resin types. Therefore, it was assumed that it is more likely investments would be made for this material to be recycled rather than large shifts in consumer packaging design for this resin.

Table 2-31 shows the estimated flexibles and films CMC end market groups collected in all material streams in 2024 and the projected amounts that will be collected in all material streams in the milestone years. The contractor estimated that the weight of material collected for some of the CMC end market groups will be lower in future years, due to source reduction of plastic covered material required under the Act. Overall, the amount of collected flexibles and film plastics CMC end market groups are estimated to increase from 616,000 tons in 2024 to 1,306,200 tons in 2032.

**Table 2-31: Estimated Plastic Flexibles and Films CMC End Market Groups Collected in All Material Streams in 2024 and Milestone Years (Tons)**

CMC End Market Group	2024	2028	2030	2032
PE Film – HDPE and LDPE Flexibles and Films	546,500	984,700	904,300	870,700
Plastic #5 – Mono PP Flexibles and Films	70,100	484,300	449,800	435,500
<b>Total</b>	<b>616,600</b>	<b>1,469,000</b>	<b>1,354,100</b>	<b>1,306,200</b>

As shown in Table 2-32, the CMC conversion rate for flexible and film plastic CMC end market groups was assumed to improve to 85% by 2032. Unlike other plastic materials, the contractor cannot provide estimated CMC conversion rates for flexibles and films. Although the contractor estimated a covered material conversion rate for PE film for the Current State of End Markets Report of 89%, the contractor acknowledges that most of this material was from the commercial sector. In the future state, more residential film will need to be recycled; therefore, the current state estimate for the conversion rate is less applicable here.

**Table 2-32: Estimated Current and Future CMC Conversion Rate for Flexibles and Films CMC End Market Groups**

CMC End Market Group	2024	2028	2030	2032
PE Film – HDPE and LDPE Flexibles and Films	Variable	65%	75%	85%
Plastic #5 – Mono PP Flexibles and Films	N/A	65%	75%	85%

Table 2-33 shows the estimated weight of each flexible and film plastics CMC end market group that needs to be accepted into end markets. The contractor estimated these figures based on the proxy recycling rates, the estimated amounts collected in all material streams in Table 2-31, and future improvements to the CMC conversion rates, as outlined in Table 2-32. In 2024, the contractor estimated that 33,700 tons were accepted by or sent to end markets, all of which was PE Film. By 2032, it was projected that 1,001,300 tons of flexibles and film plastic covered material will be accepted into responsible end markets. Plastic #5 – mono PP flexibles and films requires significant growth in acceptance at end markets, rising from an unknown (but likely small) amount in 2024 to 225,000 tons in 2028 and eventually 334,700 tons in 2032.

**Table 2-33: Weight of Flexibles and Film Plastic CMC End Market Groups Estimated to be Accepted by or Sent to End Markets in 2024 and Weight to be Accepted by Responsible End Markets in Milestone Years (Tons)\***

<b>CMC End Market Group</b>	<b>2024 Projected Tons Sent to End Markets</b>	<b>2028 Projected Tons Sent to End Markets</b>	<b>2028 Tons Required by End Markets to Meet 30% Recycling Rate</b>	<b>2030 Projected Tons Sent to End Markets</b>	<b>2030 Tons Required by End Markets to Meet 40% Recycling Rate</b>	<b>2032 Projected Tons Sent to End Markets</b>	<b>2032 Tons Required by End Markets to Meet 65% Recycling Rate</b>
PE Film – HDPE and LDPE Flexibles and Films	33,700	456,200	454,400	519,900	482,300	666,600	665,700
Plastic #5 – Mono PP Flexibles and Films	Not found	225,000	223,500	302,300	239,900	334,700	333,000
<b>Total</b>	<b>33,700</b>	<b>681,200</b>	<b>677,900</b>	<b>822,200</b>	<b>722,200</b>	<b>1,001,300</b>	<b>998,700</b>

\*Table totals may not sum due to rounding.

Table 2-34 shows the estimated total local capacity (i.e., capacity identified for in-state end markets which currently manage California covered material in addition to capacity for a few domestic end markets identified as managing California material as found in the Current State of End Markets report) in 2024 as well as the amount of that capacity which is estimated as available in 2024. These estimates do not include current international exports or capacities of domestic end markets that do not accept California material as identified in the Current State of End Markets report. While out-of-state end markets that do not manage California materials were not included in local capacity, available capacities in the U.S. and Canada are included in the narrative later in this subsection.

Several film end markets that the contractor identified did not share their capacity during the survey phase of this report, and the contractor could not identify any reasonable capacity estimates available through secondary research. Therefore, the total capacity is only what is known, while the actual available capacity is likely higher.

Table 2-34, for each milestone year, also shows the estimated needed capacity of responsible end markets to manage flexible and film end market groups. The needed capacity is the total capacity required to manage the material in Table 2-33 to reach the proxy recycling rates. The total needed capacity is based on the projected tons sent to end markets from Table 2-33, but increased to account for contamination, as described in subsection 2.4.1.1.1.1. International end markets that received covered material were assumed to not be responsible end markets when estimating total capacity needed in milestone years as they are unlikely to be considered responsible end markets without significant investments.

**Table 2-34: Estimated Current Capacity for Flexibles and Films End Markets and Needed Flexibles and Films End Market Capacity for Covered Material (Tons)**

<b>Material Grade</b>	<b>Local Capacity 2024</b>	<b>Available Local Capacity 2024</b>	<b>Total Capacity Needed 2028</b>	<b>Total Capacity Needed 2030</b>	<b>Total Capacity Needed 2032</b>
PE Film Mixed Grades	47,000	12,000	615,900	701,800	899,900
Flexibles	0	0	303,800	408,100	451,900
<b>Total</b>	<b>47,000</b>	<b>12,000</b>	<b>919,700</b>	<b>1,109,900</b>	<b>1,351,800</b>

<sup>1</sup>Local capacity includes capacity for both covered and noncovered material. Capacity needed includes the amount needed for covered material and associated residue.

APR estimates that there is 300,000 tons of available flexible and film recycling capacity in the U.S and Canada. Subtracting the available local capacity in 2024 from this amount, it was estimated that 288,000 tons of available capacity is located at U.S. and Canada facilities which were not identified as accepting California material.

There is a significant need for flexible and film capacity in future years as around 1.35 million tons of capacity is estimated to be needed by 2032. If local capacity (47,000 tons) and estimated capacity at other U.S. and Canadian facilities is used (around 288,000 tons), the remaining capacity needed would be about 1 million tons which is estimated to require 10 to 51 additional facilities to manage the material in 2032, based on average capacities of 20,000 to 100,000 tons per year.

#### **2.4.1.1.2 Other Plastic Covered Materials: Nonplastic Material Classes with a Plastic Component**

In addition to covered materials that are in the plastic material class, there are also plastic covered materials that are primarily nonplastic material (e.g., metal, glass) with a plastic component. As described in section 2.1, some CMCs in these material classes were modeled as being replaced or having the plastic components removed so they are no longer plastic covered material. The analysis of end market capacity and investments was not performed for CMCs assumed to be replaced or redesigned such that they are no longer covered material.

CMC end market groups developed for the Current State of End Markets Report analysis grouped CMCs that had and did not have a plastic component together, since, for most covered material, there is not a reliable estimate on the quantity of material that contains a plastic component. In this analysis, the contractor assumed an equal split between material with and without a plastic component for CMCs in nonplastic material classes. Refer to Appendix A, section 2.G for additional information on this assumption.

##### **2.4.1.1.2.1 Ceramic Material Class**

Given the challenges with processing, limited end markets, and the relatively small amount of ceramic covered material, all ceramic covered material was modeled as replaced with glass CMCs. Given this, actions and investments to expand ceramic end markets were not considered.

##### **2.4.1.1.2.2 Glass Material Class**

Glass includes three CMC end markets groups which encompass all plastic covered material in the glass material class:

- Mixed Glass Bottles and Jars - Non-CRV
- Other Forms of Glass
- Small Format - Glass

Table 2-35 shows the estimated plastic covered material in the glass material class collected in all material streams in 2024 and the projected amounts that will be collected in all material streams in the milestone years.

**Table 2-35: Estimated Glass Covered Material with a Plastic Component, by CMC End Market Group, Collected in All Material Streams in 2024 and Milestone Years (Tons)**

<b>CMC End Market Group</b>	<b>2024</b>	<b>2028</b>	<b>2030</b>	<b>2032</b>
All Glass CMCs with a plastic component	127,600	119,900	108,900	99,700

Table 2-36 shows the estimated weight of plastic covered material in the glass material class that needs to be accepted into end markets. Using the proxy recycling rates, the contractor estimated these figures based on the estimated amounts collected in all material streams in Table 2-35 and the estimated CMC conversion rate of 97% from the Current State of End Markets report. The contractor estimated glass accepted by or sent to end markets for the Current State of End Markets Report as 222,300 tons, with a majority sent to end markets in California. The exact split between glass with and without a plastic component was not found. Hence, the 2024 column in Table 2-36 is “not found.” For the purposes of estimating future tons into end markets, it was assumed that 50% of glass CMCs had a plastic component.

**Table 2-36: Estimated Weight of Glass CMC Groups with a Plastic Component Accepted by End Markets and Estimated Weight to be Accepted by Responsible End Markets in Milestone Years (Tons)**

<b>CMC End Market Group</b>	<b>2024 Projected Tons Sent to End Markets</b>	<b>2028 Projected Tons Sent to End Markets</b>	<b>2028 Tons Required by End Markets to Meet 30% Recycling Rate</b>	<b>2030 Projected Tons Sent to End Markets</b>	<b>2030 Tons Required by End Markets to Meet 40% Recycling Rate</b>	<b>2032 Projected Tons Sent to End Markets</b>	<b>2032 Tons Required by End Markets to Meet 65% Recycling Rate</b>
All Glass CMCs with a Plastic Component	Not found	40,600	37,100	47,300	44,900	67,600	66,800

Based on the analysis in the Current State of End Markets Report, end markets are currently accepting MRF glass and unprocessed cullet that contains glass covered materials with and without a plastic component. Some end markets reported small format plastic being a contaminant resulting from a plastic component on glass packaging or missorted plastic at a recycling processing facility. Glass end markets also reported nonplastic contamination, such as foil coatings on bottles as particularly difficult to manage. Overall, glass end markets are assumed to manage glass covered materials with and without a plastic component and achieve an estimated 97% CMC conversion rate. To achieve a 65% recycling rate, the necessary infrastructure investment and system changes are primarily related to effectively collecting and properly processing the material, rather than end market development.

As found in the Current State of End Markets report, overall, glass end market facilities identified in California are currently operating below capacity. This indicates that there is available capacity to process additional glass covered materials in California end market facilities, especially if improvements were made at collection and processing stages to reduce contamination of the glass outflow and maximize capture of glass.

#### 2.4.1.1.2.3 Metal Material Class

Metal includes some plastic covered material in the metal material class (i.e., metal covered material with a plastic component). For one metal CMC end market group, other aluminum with a plastic component, two of its component CMC (24\_M2P, or aluminum foil sheets, and 24\_M3P, or aluminum foil molded containers), were modeled to be redesigned by removing the plastic component. For the purposes of the tonnage flow model, other aluminum with a plastic component therefore comprises the remaining single CMC (24\_M5P, or other aluminum with a plastic component). The analysis on end markets is based on the CMCs which were assumed to remain in use, which includes six CMC end markets groups:

- Aluminum container – non-CRV (w/ plastic component).
- Other aluminum (w/ plastic component).
- Tin/steel/bimetal – non-CRV (w/ plastic component).
- Other nonferrous (w/ plastic component).
- Other ferrous (w/ plastic component).
- Small format – metal (w/ plastic component).

Table 2-37 shows the estimated plastic covered material in the metal material class collected in all material streams in 2024 and the projected amounts that will be collected in all material streams in the milestone years.

**Table 2-37: Estimated Metal Covered Material with a Plastic Component, by CMC End Market Group, Collected in All Material Streams in 2024 and Milestone Years (Tons)**

<b>CMC End Market Group</b>	<b>2024</b>	<b>2028</b>	<b>2030</b>	<b>2032</b>
Aluminum Containers - Non-CRV	32,700	31,100	28,900	27,100
Other Aluminum	9,800	9,400	8,900	8,400
Tin/Steel/Bimetal - Non-CRV	144,700	137,400	126,600	117,700
Other Ferrous	87,100	80,800	71,600	64,000
Small Format - Metal	5,400	5,200	4,900	4,600
Other Nonferrous	31,800	29,600	26,200	23,400
<b>Total</b>	<b>311,500</b>	<b>293,500</b>	<b>267,100</b>	<b>245,200</b>

Table 2-38 shows the estimated weight of plastic covered material in the metal material class that needs to be accepted into end markets. The contractor estimated these figures based on the proxy recycling rates, the estimated amounts collected in all material streams in Table 2-37, and the estimated CMC conversion rates that range from 65% to 97% (see Appendix A.2.F.4 for more details on CMC conversion rates for specific CMCs). The contractor estimated 14,450 tons of metal into end markets for the Current State of End Markets Report, but the exact split between metal with and without a plastic component was not found. Hence the 2024 column in Table 2-38 shows “not found.” For the purposes of estimating future tons into end markets, it was assumed that 50% of metal CMCs had a plastic component.

**Table 2-38: Estimated Weight of Metal Covered Material with a Plastic Component, by CMC End Market Group, Accepted by End Markets and Estimated Weight to be Accepted by Responsible End Markets in Milestone Years (Tons)<sup>1</sup>**

<b>CMC End Market Group</b>	<b>2024 Projected Tons Sent to End Markets</b>	<b>2028 Projected Tons Sent to End Markets</b>	<b>2028 Tons Required by End Markets to Meet 30% Recycling Rate</b>	<b>2030 Projected Tons Sent to End Markets</b>	<b>2030 Tons Required by End Markets to Meet 40% Recycling Rate</b>	<b>2032 Projected Tons Sent to End Markets</b>	<b>2032 Tons Required by End Markets to Meet 65% Recycling Rate</b>
Aluminum Containers - Non-CRV with a plastic component	Not found	9,900	9,800	12,500	12,200	18,700	18,500
Other Aluminum with a plastic component	Not found	4,500	4,400	5,100	4,700	6,400	6,400
Tin/Steel/Bimetal - Non-CRV with a plastic component	Not found	43,200	42,500	53,200	52,200	79,500	78,900
Other Ferrous with a plastic component	Not found	45,100	25,000	48,600	29,500	43,500	42,900
Small Format – Metal with a plastic component	Not found	2,400	2,400	2,700	2,600	3,500	3,500
Other Nonferrous with a plastic component	Not found	16,300	13,600	17,600	14,000	17,900	17,900
<b>Total</b>	<b>Not found</b>	<b>121,400</b>	<b>97,700</b>	<b>139,700</b>	<b>115,200</b>	<b>169,500</b>	<b>168,100</b>

<sup>1</sup> Table totals may not sum due to rounding.

Similar to glass, the analysis in the Current State of End Markets Report found that end markets accept metal material grades that contain covered materials with and without a plastic component. Design guidelines report that plastic labels, shrink sleeves, or plastic tops can create some challenges in the recycling process, but metal end markets are still generally able to manage these materials. Overall, based on the Current State of End Markets Report the estimated CMC conversion rate for most metal covered materials is at or above 95%. The contractor was unable to estimate the covered material conversion rate for small format metal and other nonferrous metals however the contractor assumed that these would have a similar CMC conversion rate to other metals. For metal covered material, the contractor found that infrastructure investment and system changes are primarily related to effectively designing, collecting, and sorting the material, rather than end market development.

#### 2.4.1.1.2.4 Paper and Fiber Material Class

Paper and fiber includes some plastic covered material in the paper and fiber material class (i.e., paper and fiber covered material with a plastic component). Two paper and fiber CMC end market groups, small format paper and molded fiber with a plastic component, were modeled to be redesigned by removing the plastic component. These CMC end markets groups are therefore not included in the tonnage flow model. The analysis on end markets is based on the CMCs which were modeled to remain in use, which includes eight CMC end markets groups:

- Other lined paper.
- Aseptic cartons.
- Gable-top cartons.
- Waxed OCC w/ a plastic component.
- OCC w/ a plastic component.
- Paperboard w/ a plastic component.
- Mixed papers w/ a plastic component.
- Kraft paper w/ a plastic component.

Table 2-39 shows the estimated plastic covered material in the paper and fiber material class collected in all material streams in 2024 and the projected amounts that will be collected in all material streams in the milestone years.

**Table 2-39: Estimated Paper and Fiber Covered Material with a Plastic Component, by CMC End Market Group, Collected in All Material Streams in 2024 and Milestone Years (Tons)**

<b>CMC End Market Group</b>	<b>2024</b>	<b>2028</b>	<b>2030</b>	<b>2032</b>
Other Lined Paper	440,300	422,600	396,800	375,400
Aseptic Cartons	64,400	67,400	67,500	67,600
Gable-Top Cartons	96,300	98,700	98,800	99,000
Waxed OCC w/ a plastic component	123,100	115,100	103,200	93,400
OCC w/ a plastic component	2,359,200	2,204,800	1,977,200	1,788,000
Paperboard w/ a plastic component	195,300	187,500	176,000	166,500
Mixed Papers w/ a plastic component	838,200	780,000	693,900	622,300
Kraft Paper w/ a plastic component	205,500	194,100	177,300	163,400
Molded Pulp w/ a plastic component	124,700	118,600	Not Modeled	Not Modeled
<b>Total</b>	<b>4,447,000</b>	<b>4,188,800</b>	<b>3,690,700</b>	<b>3,375,600</b>

No CMC conversion rates for paper and fiber CMC end market groups with plastic components were found in the Current State of End Markets Report. The contractor assumed that paper and fiber CMC end market groups with a plastic component will have a CMC conversion rate of between 65% and 96% in milestone years (see Appendix A.2.F.4 for more details on CMC conversion rates for specific CMCs). In the Current State of End Markets Report, the contractor did not identify tons of recovered products from certain CMC end market groups, including other lined paper, aseptic cartons, gable-top cartons, waxed OCC and molded pulp.

Table 2-40 shows the estimated weight of plastic covered material in the paper and fiber material class that needs to be accepted into end. Using the proxy recycling rates, the contractor estimated these figures based on the estimated amounts collected in all material streams in Table 2-39 and the estimated CMC conversion rate of 85%. The contractor estimated over 5.7 million tons of paper and fiber into end markets for the Current State of End Markets Report, but the exact split between paper and fiber with and without a plastic component was not found. Hence the 2024 column in Table 2-40 mostly shows “not found.” For the purposes of estimating future tons into end markets, it was assumed that 50% of paper and fiber CMCs had a plastic component.

**Table 2-40: Estimated Weight of Paper CMC Groups with a Plastic Component Accepted by End Markets and Estimated Weight to be Accepted by End Markets in Milestone Years (Tons)<sup>1</sup>**

<b>CMC End Market Group</b>	<b>2024 Projected Tons Sent to End Markets</b>	<b>2028 Projected Tons Sent to End Markets</b>	<b>2028 Tons Required by End Markets to Meet 30% Recycling Rate</b>	<b>2030 Projected Tons Sent to End Markets</b>	<b>2030 Tons Required by End Markets to Meet 40% Recycling Rate</b>	<b>2032 Projected Tons Sent to End Markets</b>	<b>2032 Tons Required by End Markets to Meet 65% Recycling Rate</b>
Other Lined Paper	Not found	181,300	181,100	247,600	211,600	287,200	287,000
Aseptic Cartons	3,100	29,200	28,900	41,100	36,000	51,800	51,700
Gable-Top Cartons	2,500	42,500	42,300	60,800	52,700	75,800	75,700
Waxed OCC w/ a plastic component	Not found	50,300	49,300	66,100	55,000	71,600	71,400
OCC w/ a plastic component	Not found	698,500	689,000	1,004,600	823,800	1,213,500	1,210,600
Paperboard w/ a plastic component	Not found	59,000	58,600	88,700	73,300	113,200	112,700
Mixed Papers w/ a plastic component	Not found	372,600	334,300	481,700	370,100	479,400	475,900
Kraft Paper w/ a plastic component	Not found	61,200	60,700	76,000	73,900	111,200	110,600
Molded Pulp w/ a plastic component	Not found	54,700	54,700	Not Modeled	Not Modeled	Not Modeled	Not Modeled
<b>Total</b>	<b>5,600</b>	<b>1,549,300</b>	<b>1,498,900</b>	<b>2,066,600</b>	<b>1,696,400</b>	<b>2,403,700</b>	<b>2,395,600</b>

<sup>1</sup> Table totals may not sum due to rounding.

As found in the Current State of End Markets Report, approximately 83% of covered material in the paper and fiber material class was exported internationally. Covered material currently being exported internationally to end markets were assumed to not be responsible end markets when estimating total capacity needed in milestone years as they are unlikely to be considered responsible end markets without significant investments. It is likely that domestic capacity for end markets will need to be expanded for paper and fiber covered material.

In the Current State of End Markets Report, it was also estimated that there is currently limited capacity to manage certain paper and fiber. For example, only one local facility was identified which will soon begin accepting aseptic and gable-top cartons. There are several other end markets accepting cartons in the U.S., but outreach to these facilities was unsuccessful in identifying their available capacity. It is likely that new facilities would be required to manage these CMC end market groups.

#### 2.4.1.1.2.5 Wood and Other Organic Materials Material Class

Given the challenges with processing and limited end markets, all wood and other organic materials with a plastic component were not included in the tonnage flow model. Given this, actions and investments to expand wood end markets were not considered.

For the purposes of this evaluation, wood materials with a plastic component were assumed to have their plastic components removed. Other CMCs in this material class were assumed to be redesigned to kraft paper without a plastic component. Refer to section 2.1 for more information.

#### 2.4.1.1.3 Covered Material Smaller Than Two Inches

A high proportion of covered materials smaller than 2 inches of all material classes currently end up in the glass material stream during processing and are sent to glass end markets. As found in the Current State of End Markets Report, small format items other than glass are treated as a contaminant at glass end markets. Small format items other than glass are sorted out and either disposed of or sent to another facility for further processing or recycling. Glass end markets identified that they currently remove metal covered materials and send them to metal end markets, so likely no further changes are required for small metal or glass covered materials to reach end markets.

Small format plastic covered materials in the paper and fiber and plastic material classes that are smaller than 2 inches will require investments in processing to reduce the amount of those small format items sent to glass end markets or upgrades at glass end markets to sort out those materials for further processing or to be sent to paper or plastic end markets. More details on material grades that these small format materials could form at end markets and end markets that would accept these materials grades are discussed in section 2.4.4.

Table 2-41 shows the estimated tons of small format plastic covered material in the plastic, paper, and metal material classes that were sent to glass end markets in 2024 and the projected amounts that would continue to be sent to glass end markets in milestone years, if improvements are not made at MRFs to sort out material entering

glass end markets. For small format paper and metal covered material in this table, no differentiation is made for the proportion with and without a plastic component.

**Table 2-41: Estimated Weight of Small Format Covered Material Sent to Glass End Markets in 2024 and Estimated Weight Sent to Glass End Markets as Contamination in Milestone Years (Tons)**

<b>CMC Group</b>	<b>2024</b>	<b>2028</b>	<b>2030</b>	<b>2032</b>
Small Format Plastic	8,700	3,300	3,900	4,800
Small Format Paper	30,300	11,600	13,500	16,700
Small Format Metal	400	200	200	200
<b>Total</b>	<b>39,400</b>	<b>15,100</b>	<b>17,600</b>	<b>21,700</b>

## **2.4.2 Funding, Actions, and Marketability of End Markets**

This section discusses the funding that is required to develop end markets, including improving current facilities and building new facilities, so material collected and processed can be recycled at a scale large enough to meet the recycling rate requirements. First, this section discusses the potential locations of end markets and the associated costs. Next, this section discusses the estimated costs for necessary end market development and the actions the PRO could take to support end market development, including through financial support, market development, and mechanisms to support market stability.

### **2.4.2.1 End Market Location Analysis**

This section analyzes the locations of end markets relative to transportation logistics (e.g., transportation distances between end markets and their suppliers, versus end markets and their customers). This analysis is primarily done for covered material within the plastic material class as this is where the vast majority of end market investment will be required. As described previously, there is available end market capacity throughout the U.S. and Canada, therefore this analysis helps understand whether it would be more cost effective to use this available capacity or develop capacity within or near California.

#### **2.4.2.1.1 CMCs in the Plastic Material Class**

The overall costs in this assessment primarily focus on costs for end markets in the U.S. International end markets currently receiving covered material were assumed not to be responsible end markets when estimating total capacity needed in milestone years as they are unlikely to be considered responsible end markets without significant investments. The contractor assumed that covered material currently exported internationally will be managed domestically in milestone years. The contractor did not consider the cost impact if markets were located internationally in currently utilized market locations such as Mexico and Southeast Asia. Due to international trade laws

and import restrictions specific to different countries, it was not feasible to accurately assess the costs of international end market development.

In this section, the contractor used available statistical data to explore factors on where it might be most efficient to send materials to end market, including lower processing costs versus higher transport costs. Arizona was selected to explore whether use and development of end markets outside of California but nearby would likely be feasible. Arizona was chosen because it is a bordering state and there are examples of plastic end markets in Arizona already receiving plastic materials collected in California. The contractor also selected two other states, Texas and Kentucky, as these are examples of longer transport distances to areas where there is end market availability and likely lower processing costs.

The costs were estimated for a feedstock that costs \$500 per inbound ton to process. This excludes the cost of the feedstock itself. The share of this \$500 cost across different cost categories was based on surveys summarized in Table 2-42. The first column in the table shows the operational costs for an end market facility as reported in Current State of End Markets Report. The second column shows the value used where ranges were presented in the first column. The third column estimates the share of each cost category after excluding the cost of feedstock material purchases.

**Table 2-42: Share of Estimated Costs by Category in Plastics End-Market Facilities**

<b>Cost Category</b>	<b>Estimated Share of Operational Costs</b>	<b>Share of Annual Costs Used in Cost Estimation</b>	<b>Share of Operational Costs Used in Calculation and Rebased to Exclude Feedstock</b>
Feedstock Material Purchases	30-50%	N/A	N/A
Labor	20-30%	25.0%	46.3%
Utilities	5-10%	7.5%	13.9%
Transportation and Logistics	~5%	5.0%	9.3%
Maintenance	~5%	5.0%	9.3%
Land and Building	~3%	3.0%	5.6%
Education and Compliance	~1%	1.0%	1.9%
Other	5-10%	7.5%	13.9%
Total	N/A	54.0%	100.0%

Table 2-43 shows a comparison of estimated labor costs across the selected states and their estimated share of estimated per ton processing costs of \$500 per ton. The final column in the table represents the estimated costs savings per ton from labor, however, this does not indicate overall operational costs are less expensive in any of the analyzed states. California has a \$0 cost savings because it is the reference state.

**Table 2-43: Estimated Labor Cost Differences for Selected States**

<b>State</b>	<b>Unit Labor</b>	<b>Labor Costs' Share of Annual Costs</b>	<b>Cost Per Ton of Feedstock for Labor Costs</b>	<b>Potential Cost Saving (\$) per Ton of Feedstock for Labor</b>
California	\$31	46%	\$231.5	\$0
Arizona	\$23	46%	\$171.9	\$60
Texas	\$30	46%	\$230.8	\$1
Kentucky	\$26	46%	\$198.9	\$33

Table 2-44 shows a comparison of estimated electricity costs across the selected states and their estimated share of estimated per ton processing costs of \$500 per ton. The final column in the table represents the estimated costs savings per ton from electricity,

however, this does not indicate overall operational costs are less expensive in any of the analyzed states. California has a \$0 cost savings because it is the reference state.

**Table 2-44: Estimated Electricity Cost Differences for Selected States**

State	Unit Electricity \$ per KWH (commercial)	Share of Annual Electricity Costs	Cost Per Ton of Feedstock	Potential Cost Saving Per Ton of Feedstock
California	\$0.303	6.5%	\$32.5	\$0.0
Arizona	\$0.131	6.5%	\$14.1	\$18.4
Texas	\$0.091	6.5%	\$9.8	\$4.6
Kentucky	\$0.113	6.5%	\$27.9	\$4.6

Table 2-45 shows a comparison of estimated transportation costs across the selected states. The table provides example distances from California processing facilities to end markets in Arizona, Texas, and Kentucky. It is difficult to estimate the differential between transport distances from an end market to plastic converter or manufacturer compared to the distances from a processing facility to an end market; however, this is likely to be the equivalent distance the feedstock material has traveled and so this scenario is also estimated in Table 2-45. Within Table 2-45, the cost per ton of feedstock for the recycled resin return journey is less than the cost per feedstock ton one way as it assumes an 85% CMC conversion rate.

**Table 2-45: Estimated Transportation Cost Differences for Selected States<sup>1</sup>**

Example Journeys	One-Way Miles	Cost per Ton of Feedstock Ton (One Way)	Cost per Ton of Feedstock for Recycled Resin Return Journey	Total if Both Costs Incurred <sup>2</sup>
California to Arizona	400	\$32	\$27	\$60
California to Texas	1,500	\$121	\$103	\$223
California to Kentucky	2,200	\$177	\$150	\$328

<sup>1</sup>Assuming at unit cost of 8 cents per ton per mile.

<sup>2</sup>Table may not sum to 100% due to rounding.

Table 2-46 compares the cumulative cost estimates in Table 2-43, Table 2-44, and Table 2-45 and whether there will be estimated savings. This analysis estimates that end market costs in all states analyzed are lower, but only in Arizona are the transport costs low enough to realize overall cost savings. In Arizona the costs of recycling a ton of feedstock are estimated to be 16% lower but adding on the transport costs for feedstock would reduce these overall savings to 9%. If recycled resin had to travel the same distance as feedstock these savings would reduce further to 4%.

**Table 2-46: Comparing End Market Operational Costs Across Selected States (\$ per Ton of Feedstock)**

State	Estimated Processing Cost Differential Compared to California	Additional One-Way Transport Cost	Additional Transport - Resin Returned	Overall Cost Saving Assuming One-Way Transport	Overall Cost Saving Assuming Resin Returned
Arizona	\$78	\$32	\$27	\$46 (9%)	\$18 (4%)
Texas	\$5	\$121	\$103	-\$115 (no savings)	-\$218 (no savings)
Kentucky	\$37	\$177	\$150	-\$140 (no savings)	-\$290 (no savings)

The U.S. and Canada available capacities is estimated to be sufficient to manage the additional rigid plastic covered material by 2032 but not sufficient for the additional flexibles and film plastics. As shown in the APR report,<sup>112</sup> most plastic end markets are located east of New Mexico. This analysis shows that it is likely more cost efficient to utilize available markets and develop new end markets in California and Arizona rather than transport material to other available end markets. Although not every state was analyzed, other bordering states such as Nevada and Oregon could also offer cost savings.

The costs presented in the following sections are based on California end market costs in a high and low range. Since the overall cost differential between California and Arizona is minimal, developing end markets in adjacent states likely falls within this range. As the cost estimates in this section use California costs, they may underestimate total costs if a significant portion of material was sent to available capacity in the eastern U.S.

#### 2.4.2.2 Funding and Actions

The following section provides descriptions for how the contractor developed cost estimates associated with actions and investments for end markets to ensure plastic covered material reaches the recycling rate requirements.

##### 2.4.2.2.1 CMCs in the Plastic Material Class

###### 2.4.2.2.1.1 End Market Process and Use Selection

The contractor considered 11 different plastic end market processes and end uses of recycled material to generate the funding estimates, as outlined in Table 2-47. The

<sup>112</sup> APR Recyclers in US & Recycling Facilities Across the United States and Canada Have the Capacity to Canada: Process Significantly More Plastics <https://plasticsrecycling.org/wp-content/uploads/2025/10/CapacityReport20251001.pdf>. 2025.

contractor considered end market processes and uses according to technology readiness and the lowest net costs, as determined through discussions with end market facility operators and industry experts. Although the contractor did not assess manufacturer demand, the contractor selected recycled content end uses with reasonable demand. Design for recycling guidelines produced by PROs in other countries, such as France and Germany, have informed the contractor’s assumptions.

**Table 2-47: Material Grades and End Uses for Plastic CMC Groups**

Process Number	Material Grade	End Use
1	Plastic #1 PET Bottles B Grade	Pellet for food grade bottle
2	Plastic #1 PET Bottles B Grade (colored)	Colored flake for either textiles or thermoforms
3	Plastic #1 PET Thermoforms	Flake for PET Thermoforms (any colors going to textiles)
4	Plastic #2 HDPE Rigid Natural	Pellet for packaging
5	Plastic #2 HDPE Rigid Colored	Pellet for non-pressure pipes
6	Plastic #4 LDPE Rigid	Pellet for pipes (combined in low proportions with HDPE)
7	Plastic #4 LDPE Flexibles (including HDPE)	Pellet for non-packaging flexibles - bin bags, agricultural films, construction films
8	Plastic #4 LDPE Flexibles (including HDPE)	Timber substitute
9	Plastic #5 PP Rigid	Pellet for consumer durable goods
10	Plastic #5 PP Flexibles	Pellet for consumer durable goods
11	Plastic #5 PP Flexibles	Timber substitute

Further assumptions for different material grades are outlined as follows:

- Process numbers 1 and 2:
  - Assumption: PET bottles meet APR guidelines and achieve Grade B bale specifications. There is a low amount of nonbottle PET.
- Process number 3:
  - Assumption: PET trays are more than 80% clear with light tints of PET. There are also mono-PET packages with layers of non-PET, such as PE or EVOH, not included in the tonnage flow model. PE lidding films are acceptable, if they meet designed for recycling guidance.

- Process number 6:
  - Assumption: LDPE end market processes are novel at scale. The contractor determined costs based on LDPE being processed as a blend in HDPE colored pellets, at no more than 10% of the pellet composition. The total volume of LDPE rigid required to meet recycling rate requirements is less than 10% of total HDPE volume. This is likely to still achieve an acceptable resin specification, but there is uncertainty about this approach. Further trials and testing would be necessary to reduce the uncertainty.
  
- Process number 7:
  - Assumption: LDPE flexible material accounts for a large amount of the needed end market development. Recycling this material at scale and with material being used in flexible PE applications is novel. Experience in other geographic locations, such as Europe, suggests the following:
    - The APR model specification for “MRF films” contains too much non-PE material (up to 35%) for an efficient process. Further investments into processing would be necessary to produce a higher quality bale. A quality approaching DSD-310-1 specification<sup>113</sup> would be more appropriate; noting that in European facilities the tolerance of this specification is often missed. Based on this, the contractor allowed for no more than 15% non-mono-PE content in input bales with low levels of incompatible plastics, such as PET, PVC, and EVOH.
    - Even with improved design for recycling and bale compositions, the recycling of LDPE to pellet suitable for film applications still has challenges. Impurities can lead to gels, causing defects in the blown film. Furthermore, the presence of items in feedstock with variable original resin specifications, additives, and inks can result in variable recycled resin specifications. This typically results in a need for blending recycled resin from this type of feedstock with resin.

#### 2.4.2.2.1.2 End Market Unit Cost Estimates

The contractor estimated the costs for utilizing current capacity or developing additional end market capacity for each CMC end market group and related end use.

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<sup>113</sup> DerGrünePunkt. *Rohstofffraktionsspezifikation 310-1 Kunststoff Folien*. [https://www.gruener-punkt.de/fileadmin/Dateien/Downloads/PDFs/Rohstofffraktionsspezifikationen2024/April/DOC-23-50722 - Rohstofffraktionsspezifikation 310-1 Kunststoff-Folien - v1.00.0002.pdf](https://www.gruener-punkt.de/fileadmin/Dateien/Downloads/PDFs/Rohstofffraktionsspezifikationen2024/April/DOC-23-50722_-_Rohstofffraktionsspezifikation_310-1_Kunststoff-Folien_-_v1.00.0002.pdf). 2024.

The contractor selected appropriate end market processes, interviewed recyclers and industry associations, and estimated unit costs of recycling 1 ton of relevant covered material. The unit costs presented in this report are the additional costs necessary for the end markets to be operational and do not include costs that are offset by revenue sales. Unit costs based on the following factors:

- Capital investment is annualized with an interest rate of 11%.
- Costs are nominal based on 2025 costs.
- October 2025 estimates are used for material prices including virgin materials, feedstock prices, and recycled materials prices.
- Both available capacity that will be upgraded or new capacity developed is done in California.
- The per-ton costs are estimated to be similar between upgrading existing available capacity and developing new capacity. Since capital costs are annualized, whether the facility is new or existing this capital cost is distributed over the milestone years and the per-ton estimates take into consideration several cost categories.

The contractor then multiplied the needed tons for each covered material to meet requirements in the milestone years, as outlined in section 2.4.1 by the estimated unit costs.

### **Developing Unit Cost Estimates**

For this section the unit cost refers to the cost per ton required to support the development of end markets. A unit cost of \$100 means the operating cost including feedstock purchases of recycling 1 ton of the material is \$100 higher than the revenue generated from sales of this material. Therefore, this additional \$100 cost is required for the end markets to operate.

The contractor first conducted a literature review when determining unit costs. Typically, end markets view the details of costs as commercially confidential. The literature review produced very little usable information. The contractor then used expert consultant insights to estimate costs, other than feedstock and resin values, and checked the results with various expert stakeholders. This methodology is further discussed in Appendix A, section 4.

The contractor estimated costs for the different material grades and end uses through an analysis of feedstock costs, annualized capital costs, operating costs, and recycled product sales prices. Steps involved in calculating the low and high cost per ton of input feedstock for each material grade for the different resin and end uses are outlined:

1. The operational cost per ton of converting feedstock into recycled resin was calculated by summing the costs per ton of feedstock and the operating and amortized capital expenditure costs per ton.

2. Income per ton of feedstock was calculated by multiplying recycled material resin prices per ton sold by an input yield. The input yield is the amount of recycled resin produced from the inbound feedstock. This is different from the CMC conversion rate which relates to the CMC only. Input yields varied from between 60% and 75% and are based off the contractor's technical industry knowledge and conversations with industry experts.
3. Actual revenue per ton of feedstock was calculated by subtracting the income per ton of feedstock from the operational costs per ton of feedstock.
4. Target revenue per ton of feedstock was calculated by multiplying recycled material prices per ton sold by a target percentage profit on sales revenue. This target profit was 15% in the low-cost scenario and 20% in the high-cost scenario.
5. The cost per ton of recycling feedstock into recycled resins for different material grades and end uses was calculated by subtracting the actual revenue per ton of feedstock from the target revenue per ton of feedstock.

Table 2-48 shows these estimated low and high unit costs of recycling 1 ton of input feedstock for different material grades and end uses. If a unit cost is shown as \$0, this means the estimated sale of the recycled product is higher than the operating costs for recycling; therefore, there is no additional system cost. The significant range in costs highlights opportunities to create more stable material markets providing more long term sustainability.

**Table 2-48: Estimated Cost Per Ton of Input Feedstock for Different Resin and End Uses**

<b>Material Grade</b>	<b>End Use</b>	<b>Cost (Low)</b>	<b>Cost (High)</b>
Plastic #1 PET Bottles B Grade	Pellet for food grade bottle	\$0	\$118
Plastic #1 PET Bottles B Grade	Colored flake for either textiles or thermoforms	\$0	\$118
Plastic #1 PET Thermoforms	Flake for PET Thermoforms	\$0	\$162
Plastic #1 PET Thermoforms	Flake for Polyester textiles	\$0	\$162
Plastic #2 HDPE Rigid Natural	Pellet for Packaging	\$132	\$406
Plastic #2 HDPE Rigid Colored	Pellet for non-pressure pipes	\$0	\$178
Plastic #4 LDPE Rigid	Pellet for pipes (combined in low proportions with HDPE)	\$27	\$167
Plastic #4 LDPE Flexibles (including HDPE)	Pellet for non-packaging flexibles - bin bags, agricultural films, construction films	\$257	\$431
Plastic #4 LDPE Flexibles (including HDPE)	Timber substitute	\$257	\$431
Plastic #5 PP Rigid	Pellet for consumer durable goods	\$0	\$68
Plastic #5 PP Flexibles	Pellet for consumer durable goods	\$332	\$454
Plastic #5 PP Flexibles	Timber substitute	\$332	\$454

2.4.2.2.1.3 Total Costs for Additional Tons of Covered Materials to be Recycled

The material grade per ton costs are estimates of the cost of managing the inbound feedstock which includes covered material, target material, noncovered materials, nontarget material and contamination. To calculate a range of estimated costs to upgrade and expand end markets for each CMC end market group, the estimated tons of each group which needs to be accepted by end markets to meet the recycling rate

requirements was multiplied by the cost per ton of feedstock inputs shown in Table 2-48. International end markets currently receiving covered material were assumed to not be responsible end markets when estimating total capacity needed in milestone years as they are unlikely to be considered responsible end markets without significant investments. The contractor assumed that covered material currently exported internationally will be managed domestically in milestone years.

In some cases, material grades had multiple potential end uses and were therefore split between end uses to provide a weighted estimate across multiple end uses given that different end uses resulted in different costs per ton. Details on which material grades were split and how are shown in Table 2-49 and are based off conversations with industry experts regarding the demand for recycled resin in various end use applications.

**Table 2-49: Percentage Splits for Material Grades with Multiple Potential End Uses**

<b>Material Grade</b>	<b>End Use</b>	<b>Percentage Split</b>
<b>Plastic #4 LDPE Flexibles (including HDPE)</b>	Pellet for non-packaging flexibles - bin bags, agricultural films, construction films	75%
<b>Plastic #4 LDPE Flexibles (including HDPE)</b>	Timber substitute	25%
<b>Plastic #5 PP Flexibles</b>	Pellet for consumer durable goods	75%
<b>Plastic #5 PP Flexibles</b>	Timber substitute	25%

Table 2-50 shows the estimated cost for upgrading existing end markets and developing new end markets to meet the recycling rate requirements for select CMC end market groups in the plastic material class. In 2032, the annual estimated total cost related to end market development to meet the recycling rate requirements for plastics covered materials in the plastic material class is estimated to be between \$238 and \$539 million. Reduction of contamination and further improvements in CMC conversion rates could further reduce costs.

For some covered material groups, if the material is effectively collected and processed into the relevant material grade at ReMA’s ISRI specifications, then the low estimates show there may be no additional cost. For other covered material groups this figure is significantly higher. For example, for PE flexible films the 2032 costs of reaching the 65% recycling rate target are between \$135 and \$287 million per year.

**Table 2-50: Estimated Annual Costs for End Market Development by CMC End Market Group to Reach Recycling Rate Requirements**

<b>CMC End Market Group</b>	<b>2028 Low</b>	<b>2028 High</b>	<b>2030 Low</b>	<b>2030 High</b>	<b>2032 Low</b>	<b>2032 High</b>
Plastic #1 - PET Clear Bottles, Jugs, Jars - Non CRV	\$0	\$6,799,600	\$0	\$7,367,300	\$0	\$10,123,600
Plastic #1 - PET Pigmented Bottles, Jugs, Jars - Non CRV	\$1,426,100	\$4,038,800	\$1,534,700	\$4,346,300	\$2,133,300	\$6,041,400
Plastic #1 - Other PET Rigid	\$0	\$19,334,500	\$0	\$25,377,000	\$0	\$29,669,400
Plastic #2 - HDPE (pigmented and natural) Bottles, Jugs, Jars - Non CRV	\$17,510,900	\$56,002,300	\$16,631,700	\$54,341,200	\$15,649,600	\$52,340,100
Plastic #2 - HDPE Pails and Buckets	\$0	\$2,993,600	\$0	\$3,717,400	\$0	\$5,856,200
Plastic #2 - Other HDPE Rigid	\$0	\$2,554,300	\$0	\$3,437,600	\$0	\$4,996,600
Plastic #4 - LDPE Bottles and Jugs	\$87,800	\$546,400	\$94,500	\$588,000	\$131,400	\$817,600
Plastic #4 - Other LDPE Rigid	\$192,100	\$1,194,900	\$206,700	\$1,285,700	\$287,400	\$1,787,800
Plastic #2 - HDPE Flexibles and Films Plastic #4 - Mono LDPE Flexibles and Films	\$86,342,200	\$137,011,400	\$99,305,100	\$209,537,500	\$135,864,900	\$287,325,300
Plastic #5 - PP Rigid Items	\$0	\$12,544,700	\$0	\$12,988,600	\$0	\$17,203,800

<b>CMC End Market Group</b>	<b>2028 Low</b>	<b>2028 High</b>	<b>2030 Low</b>	<b>2030 High</b>	<b>2032 Low</b>	<b>2032 High</b>
Plastic #5 - Mono PP Flexibles and Films	\$56,710,300	\$82,854,400	\$76,189,300	\$111,313,300	\$84,357,600	\$123,247,300
<b>Total</b>	\$162,269,400	\$325,874,900	\$193,962,000	\$434,299,900	\$238,424,200	\$539,409,100

International end markets currently receiving covered material were assumed to not be responsible end markets when estimating total capacity needed in milestone years as they are unlikely to be considered responsible end markets without significant investments. The contractor assumed that covered material currently exported internationally will be managed domestically in milestone years. To understand the potential impact of this assumption, the contractor estimated the proportional cost of the total cost outlined in Table 2-50 represented by current international exports being managed domestically in the future.

**Table 2-51: Proportion of Annual Total Costs Resulting From Current International Exports of Covered Material Being Recycled Domestically in Milestone Years (%)**

CMC End Market Group	2028	2030	2032
Plastic #1 - PET Clear Bottles, Jugs, Jars - Non CRV	8.7%	8.0%	5.8%
Plastic #1 - PET Pigmented Bottles, Jugs, Jars - Non CRV	6.9%	6.4%	4.6%
Plastic #1 - Other PET Rigid	3.5%	2.7%	2.3%
Plastic #2 - HDPE (pigmented and natural) Bottles, Jugs, Jars - Non CRV	12.2%	12.8%	13.7%
Plastic #2 - HDPE Pails and Buckets	0.0%	0.0%	0.0%
Plastic #2 - Other HDPE Rigid	17.7%	13.2%	9.1%
Plastic #4 - LDPE Bottles and Jugs	0.0%	0.0%	0.0%
Plastic #4 - Other LDPE Rigid	0.0%	0.0%	0.0%
Plastic #2 - HDPE Flexibles and Films Plastic #4 - Mono LDPE Flexibles and Films	0.9%	0.7%	0.6%
Plastic #5 - PP Rigid Items	11.4%	11.7%	10.5%
Plastic #5 - Mono PP Flexibles and Films	1.3%	1.0%	0.9%
<b>Average</b>	5.7%	5.1%	4.3%

As shown in Table 2-51, the estimated cost of managing covered material in the plastic material class currently sent to international end markets domestically is approximately 4% to 6% of the total cost in the future. For some CMC groups the proportional cost is 0% as it is currently estimated that those materials are not exported internationally. For Needs Assessment Report on The Needed State of Collection, Processing, and End Markets

others such as HDPE #2 (pigmented and natural) bottles, jugs, jars and or PP #5 rigid items, this cost is estimated to be greater than 10% of total costs.

The costs presented in this section do not represent the cost of one specific action or technological upgrade. If end markets were provided financial support equivalent to these amounts, then they would be able to make the necessary upgrades to reach necessary CMC conversion rates and recycle enough material at scale to meet the recycling rate requirements.

#### 2.4.2.2.1.4 Actions to Support Plastic End Markets and Achieve Statutory Requirements

This section provides actions the PRO could take to support end markets. These include both actions that would require funding and investment in addition to supporting actions that do not require significant funding.

##### **Actions that Require Significant Funding**

There are two main actions that require significant funding. These include providing ongoing financial support, typically as a per ton payment, or providing capital expense support. Although one is ongoing financial support and the other is upfront investment, both of these funding actions are covered in Table 2-50.

##### *Provide Financial Support for Ongoing Operations to Utilize Available Capacity*

Providing incentives to reduce production costs and to ensure the financial security of end markets could be beneficial in meeting the recycling rate requirements by providing stability of available end markets to accept and recycle plastic covered material.

The PRO could seek to utilize and upgrade all available capacity in the U.S. and Canada to manage the additional material required to meet recycling rate requirements. The analysis of capacity shows that there is likely enough available capacity in the U.S. and Canada to recycle the needed weight of all rigid plastic resin, however, there is not sufficient capacity for flexible and film plastics.

The PRO could offer payments that offset the operating costs on a per-ton basis. If end market facilities had long-term security of ongoing operational support payments, they could upgrade their facilities to be able to manage a slightly different grade of material. For example, a PET end market facility which previously only accepted PET bottles may be able to accept PET thermoforms as well. Changes in market dynamics or reaching economies of scale could also alter these payments. For example, if the value of recycled resin increased then the operating payments could be lower in the future. Another example is that scale efficiencies can lower per-unit production costs by spreading fixed costs such as equipment, labor, and overheads across larger output volumes. As facilities expand or consolidate operations, they often realize improved economies of scale and reduced marginal processing costs.<sup>114</sup> This can make recycled

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<sup>114</sup> The Circulate Initiative. *Pricing transparency in the recycled plastics supply chain*. <https://www.thecirculateinitiative.org/wp-content/uploads/Pricing-Transparency-in-the-Recycled-Plastics-Supply-Chain-Oct-2023.pdf>. 2023.

materials more price competitive in markets where virgin resin prices are volatile. In addition, incentives or other mechanisms that create market stability could entice companies to build a facility in California or nearby to accept covered material.

There are barriers and limitations to providing ongoing operational payments and relying on current available capacity. If market conditions improve, end market facilities outside of California with available capacity may fill their available capacity with locally sourced feedstock. This means these facilities may no longer be available to California. Alternatively, if market conditions get worse and facilities close then this capacity will also no longer be available to California. Furthermore, utilizing end market capacity in the eastern U.S. will require additional transportation which may limit the environmental benefits of recycling this material.

#### *Provide Financial Support for Capital Expenses to Build New Capacity*

The PRO could also support the development of new facilities in California and nearby states. This capital expenditure support can be achieved through blended finance mechanisms or capital expenditure grants, which could attract private investment by de-risking projects and providing consistent revenue. An investor may find investing in recycling markets risky as they may not foresee a good return on investment, but if a portion of the capital investment was covered through a grant, they may have a greater likelihood on their return on investment, therefore “de-risking” the investment. By de-risking the investment, more facilities could be built in California as their lower capital investment costs will allow them to operate more effectively under current market conditions.

As noted, APR estimates that there is 300,000 tons of available film capacity in the U.S and Canada, but it is estimated that more than 900,000 tons will need to be recycled for the recycling rate requirements to be met. Therefore, new end market facilities are more likely to be needed for flexible and film plastics that are not otherwise managed by other actions and investments. Given that it can take several years for an end market facility to acquire necessary permits, build out facility infrastructure, and become operational, this option is more realistic for 2030 and 2032 requirements. However, planning should start immediately for new facilities to be online as soon as possible. Capital expenses support would be provided as an upfront sum rather than an ongoing per-ton payment.

Developing new end market facilities has several barriers. Addressing the administrative and permitting burden associated with recycling infrastructure can also influence production costs. Lengthy permitting processes and complex requirements can delay facility expansion and increase costs. Streamlining permitting recycling and reprocessing facilities, particularly those producing high-quality resins, could reduce barriers to market entry and facilitate capital investment, ultimately lowering production costs and supporting more stable and competitive pricing.<sup>115</sup> This barrier is especially relevant to consider for flexible and film plastics as there is not currently enough available capacity to manage the needed tons.

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<sup>115</sup> Eunomia Interviews with Industry Experts.

#### 2.4.2.2.1.5 Actions to Support Marketability of End Markets

The following actions do not require significant funding, but they can help support marketability of end markets. These actions are mainly focused on ensuring that end markets have sufficient quality feedstock and to ensure there is demand for the recycled resin the end markets produce.

##### *Support Feedstock Security for Local End Markets*

Many end market facilities in California are operating at a reduced capacity. For PET, one reason for this is the increased international exports of PET material grades. As part of the reimbursement program to MRFs, the PRO could create incentives to encourage MRFs to send their material to local end markets which could help ensure that local end markets operate at a level close to their total capacity. Additionally, these reimbursement payments to MRFs could be tied to specific quality standards in their material grade outputs ensuring that feedstock for end markets meets a standard, including low contamination, needed for end markets to produce high-quality resin.

##### *Support End Market Resin Sales*

End markets face variable prices for their recycled resins sales and stiff competition from virgin resin. The PRO can help facilitate long-term contracts for end markets in California to help them ensure long-term stability. If an end market facility can be matched with a business that needs long-term security for recycled resins, then the end market facility will have long-term security in its price which can help them make effective strategic decisions and investments. This can be especially useful if the end market facility can be matched with a business that needs high-grade resin for packaging applications rather than other applications like textiles or piping as resin for packaging typically yields a higher price. Given the recycled content commitments many large companies have made, these companies may be more open to securing their recycled content through long-term contracts ensuring they will meet their internal targets.

##### *Promote the Use of Recycled Content to Increase Demand*

Incentives for recycled content can come in the form of government policies (e.g., recycled content mandates policies) or through incentives supported by industry or the PRO.

Key constraints that limit the impact of recycled content incentives include:

- **Supply and quality mismatch:** Available PCR volumes and material quality often lag targets because curbside collection, sorting, and reprocessing systems were not designed to meet large, rapid increases in demand for food-grade or high-quality PCR.<sup>116</sup>

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<sup>116</sup> Beveridge & Diamond. *Tracker of recycled content laws*.

<https://www.bdlaw.com/content/uploads/2025/02/Beveridge-Diamond-Tracker-of-Recycled-Content-Laws.pdf>. Feb. 2025.

- **Leakage to alternative end uses and long supply chains:** Availability of PCR does not automatically displace virgin feedstock within the same supply chain (i.e., it could displace recycled content for plastic furniture instead of plastic covered material).
- **Financial market dynamics:** If the cost of using recycled content is higher than the base fees for a covered material, the use of recycled content is much less likely without incentives.

Actions and investments by the PRO and other third parties to improve outcomes can help encourage the reuse of recycled content plastic. The PRO can initiate concurrent investment in collection, sorting, and domestic reprocessing capacity and require or incentivize PCR certification to ensure material quality.<sup>1</sup> It can utilize ecomodulation to reduce producer fees for covered materials which use recycled content. Furthermore, the PRO can set standards or recommended levels of PCR utilization by covered material and help provide technical assistance to producers who may want to utilize more PCR but are not sure where in the portfolio they are able to. Finally, the PRO can promote the use of recycled content through the source reduction alternative compliance formula which is a mechanism to meet the plastic source reduction requirements in the Act. The alternative compliance formula “offers source reduction credit on a sliding scale based on the ratio of virgin plastic to postconsumer recycled content plastic to producers who incorporate postconsumer recycled content” (PRC section 42057(a)(2)(B)). For example, the formula could require recycled content to be sourced from domestic or local sources to be eligible.

#### **2.4.2.2.2 Covered Materials with a Plastic Component**

##### 2.4.2.2.2.1 Ceramic Material Class

Covered material within the ceramic material class are assumed to be replaced with glass. Therefore, there are assumed to be no plastic covered material in this material class in the milestone years that are required to meet the recycling rate requirements.

##### 2.4.2.2.2.2 Glass Material Class

As described in the previous section, the investments necessary for plastic covered materials in the glass material class to reach recycling rate requirements are primarily related to the collection and processing of the material. The system costs associated with increasing glass recovery to meet the 65% recycling rate requirements are driven primarily by transportation. Specifically, recycling processing facilities typically incur a per-ton cost to transport glass from their facilities to the end market or beneficiation facility. Therefore, the incremental system cost is calculated as the recycling processing facility’s per-ton glass transportation cost multiplied by the additional tons of glass (including glass-containing covered materials) that would need to be managed to achieve the target. If a \$0.25 per-ton transportation cost is assumed for the transportation of glass covered materials from recycling processing facilities to end market facilities, then the total cost for this in 2032 would be \$16,900 and this cost would likely be seen at processing facilities and not end market facilities.

#### 2.4.2.2.2.3 Metal Material Class

As described in the previous section, the investments necessary for plastic covered materials in the metal material class to reach recycling rate requirements are primarily related to the collection and processing of the material. Metal covered materials, if collected and properly sorted, can be effectively recycled at no additional system cost as this process is typically profit-generating.

#### 2.4.2.2.2.4 Wood and Other Organics Material Class

Covered material within the wood and other organic material class are assumed to no longer have plastic components. Therefore, there are assumed to be no plastic covered material in this material class in the milestone years that are required to meet the recycling rate requirements.

#### 2.4.2.2.2.5 Paper and Fiber Material Class

Paper and fiber covered materials that have a plastic component generally have common features in that they are predominately fiber-based items with associated quantities of plastics, waxes, and sometimes other materials such as metal. The end market processes for papers and fibers without plastics or waxes are nearly all based on processing the feedstock back into a fiber pulp which can be converted back into fiber products. However, if the paper and fiber covered material with plastic components are processed through these processes there are two key impacts:

- Fibers that are lined with plastics or have coatings and high wet strength additives do not adequately pulp in these processes; therefore, pulp yield would likely be too low to achieve an overall 65% recycling rate.
- The plastic components will not pulp and will be screened out. The resulting screened waste is difficult to recycle due to the high amounts of fibers included with them.

The fiber yield can be improved but processing the relevant covered materials in a pulping process would necessitate a much longer residence time in the pulping process. The costs of these processes are higher, and plastic components are still not likely to be recycled.

An alternative is to recycle the materials to construction materials, such as roof insulation panels. A new end market in Lodi is expected to begin operations in 2026 that will recycle aseptic cartons and gable-top cartons into an insulation product. This process does not involve pulping, so it has reduced process losses compared to processes that pulp the material.

Discussions with industry experts led the contractor to assume that end markets could be developed that could process paper and fiber covered materials with plastic components, with a covered material conversion rate exceeding 85% into building products. This process would also include some polyolefin scrap which could include some of the lower value PE and PP covered materials. Due to the likelihood of high conversion rates and relatively low cost of the processes this was selected as an end market process.

Through discussions with industry experts for covered materials with plastic components, it was established that end markets would likely not need a subsidy per ton of feedstock input to be able to process these materials and could do so if wider enabling factors were allowed. As this may require adjusting their process to manage additional paper and fibers with plastic components, an investment subsidy may be required for research and development to identify how to properly recycle this material.

### **Actions to Support Paper and Fiber with Plastic Component End Markets**

Through secondary research and conversations with industry experts, the contractor identified that it will be effective to see the implementation of a paper (with plastics) end market in order to achieve a 65% recycling rate for these materials. Potential strategies to improve willingness of operators to accept this material include:

- Long-term feedstock supply agreements: Contractual guarantees ensuring stable and sufficient feedstock volumes, supported by a predictable pricing mechanism. Such agreements should include a consistent, low-bale price over the lifetime of the contract to provide certainty for capital recovery and operational planning. This stability would help mitigate exposure to market volatility in recycled material prices and ensure continuous feedstock availability. The PRO could help provide technical assistance in finding end market locations and permitting process guidance.
- Assistance with site selection and permitting: Support with zoning, environmental review, and infrastructure access can significantly reduce development timelines and upfront costs, improving project feasibility. The PRO could help provide technical assistance in finding end market locations and permitting process guidance.

#### **2.4.2.2.3 Less than 2 inch CMCs (i.e., small format)**

##### **Costs of Separating Small Format Plastic Covered Material (Plastic and Paper Material Classes)**

A proportion of plastic and paper covered materials that are less than 2 inches on two or more sides (i.e., small format) are currently processed into glass grades that are sent to glass end markets. To achieve the requirements there likely will need to be new sorting infrastructure developed at glass end markets to separate and recycle small format paper and plastic.

The contractor identified six glass end market facilities in California that currently process glass covered material. As found in the Current State of End Markets Report, these facilities currently sort out small format aluminum and steel and send those to the respective metal end markets. However, paper and plastics covered material that are small format are currently sorted out and then disposed of.

To meet the required recycling rate for these small format plastic and paper covered materials, the contractor proposed new sorting infrastructure to sort two grades of materials.

1. A mixed paper product

## 2. A mixed polyolefin product (including PE and PP)

The process would likely need to be built as an extension of the processing for the current glass residue streams. It would remove small format plastic and glass materials and leave the remaining material as residues. This would involve further screening using a trommel to remove material smaller than 3/8ths of an inch. The larger fraction would then be sorted using optical sorters. The contractor assumed six near-infrared (NIR) units would be able to process the material into the two grades. The contractor assumed that sorting efficiency would need to be high for this covered material to achieve the necessary recycling rates so the process for each material would sort the existing residue stream positively for the wanted fraction and then would repeat that process with a second machine. The resulting sorted fraction would then pass by a final machine that will quality control the fraction by positively selecting unwanted materials. The fractions would then be stored, and the contractor has allowed bunkering for the separate streams but not baling as it is unclear how well this material will bale. The costs of adding the equipment to sort small format plastics and paper at glass end market facilities is shown in Table 2-52. These costs are inclusive of all covered materials, which are less than 2 inches, as they would be managed in similar ways.

**Table 2-52: Estimated Costs of Adding New Equipment to a Glass Facility to Sort Small Format Covered Material of All Types**

Total Annual Per Glass End Market Facility	Total Annual Cost
\$364,500	\$2,187,000

The total cost per year for managing small format material based on the method previously detailed is estimated at approximately \$364,500 per year per end market facility. If this cost is applied to all six end market facilities in California, the total cost per year is approximately \$2,187,000. The costs shown were calculated using equipment costs, maintenance, depreciation and energy usage figures from a confidential source. These costs were annualized.

### 2.4.3 Contamination at End Markets for Covered Materials

Contamination occurs when material that is not intended to be recycled enters the recycling stream. This may include materials intentionally included in a product that are removed during the recycling process, as well as materials that incidentally or accidentally end up in the recycling stream (or in the incorrect recycling stream). It may also include materials that are deleterious to facilities or consumers. Contamination may encompass various situations and materials:

- A material that a collection program does not accept.
- A material that a receiving processing facility or end market does not accept or is not designed, permitted, or authorized to recycle.
- A material that a receiving processing facility or end market accepts but that is destined for disposal.

The following sections of the report discuss contamination within feedstock entering end markets (referred to as end market contamination). The majority of end markets contaminants are tolerated to a certain extent, and this is defined partially by a specific end markets strategy, facility design, commercial view on the qualities of feedstock, and by using industry agreed-upon specifications where available.

The contractor assumes that where end-market grades comply with recognized ReMA ISRI material-grade specifications,<sup>117</sup> no modifications are necessary. These specifications are designed to enable end markets to effectively manage the grades they receive and maintain quality standards. By reducing contamination within material grades to meet ReMA ISRI material-grade specifications, the likelihood of achieving higher CMC conversion rates at end markets increases. Cleaner material streams not only minimize processing efficiencies but ensure the delivered material contains a greater proportion of the commodities targeted by the respective end market, thereby supporting improved recycling outcomes and market stability. This means that the investment to reduce contamination should be made at processing facilities to ensure grades meet the ReMA ISRI specifications.<sup>118</sup>

Table 2-53 summarizes the main types of end market contamination and the primary solutions that exist if contamination levels are assumed to need to be reduced. Proposed solutions, such as improving processing and pre collection sorting, improve the quality of material being sent to end market facilities. As previously mentioned, this can increase CMC conversion rates at end-market facilities resulting in an increased production of high-quality PCR.

**Table 2-53: Types of Contamination with Primary Solutions**

Type of Contamination	Detail	Primary Solution
Missorted materials	Materials that may or may not be plastic but are not the right plastic format, polymer type or color to be recycled at that end market facility.	Improvements to material design, collection, and processing such as clearer labeling, improving sorting at processing facilities, and reducing the number of material types to make incoming material stream less complex.

<sup>117</sup> Recycled Materials Industry. (n.d.). *ISRI Specifications* [Website]. Retrieved October 23, 2025, from <https://www.isrispecs.org/>

<sup>118</sup> Recycled Materials Industry. (n.d.). *ISRI Specifications* [Website]. Retrieved October 23, 2025, from <https://www.isrispecs.org/>

Type of Contamination	Detail	Primary Solution
Product residues, dirt, and moisture	Product residues, dirt and moisture resulting from consumer use of the products are likely to remain until end markets unless they are cleansed before collection.	Education and outreach to improve collection of clean recyclables may provide some improvement, but generally end markets need to be designed to deal with these materials through the installation or equipment such as wash and rinse systems, drying systems and density separation equipment.
Design choice	There are a range of design choices that can influence the compatibility of the covered material with the end market facility, including incompatible resins, chemicals, and materials.	Design change is the primary driver to reduce intentionally added components that are incompatible or challenge for recycling processes.

**2.4.3.1 Quantitative Analysis of the Reduction in Contamination Needed**

Survey responses did not indicate any clear and decisive need to reduce contamination in end-market feedstock. Some responses made relatively vague assertions that if feedstock quality improved then they could either improve their financial position and/or produce a higher grade of recyclable material.

Table 2-54 shows existing contamination level estimates from the Current State of End Markets Report compared to contamination allowances from ReMA’s ISRI specifications.

**Table 2-54: Comparison of Estimated Contamination from Current State of End Markets Report and ReMA’s ISRI Contamination Allowances**

Material Grade	Contamination from Current State	ReMA ISRI Contamination Allowances	Contamination Exceeds Specification
PET Grade A (Redemption Center)	3.04%	6.00%	No
PET Grade B (MRF)	6.87%	7% to 17%	No
PET Grade B With Thermoforms	3.18%	7% to 17%	No
PET Thermoforms Only	1.82%	6.00%	No

Material Grade	Contamination from Current State	ReMA ISRI Contamination Allowances	Contamination Exceeds Specification
HDPE Natural	12.10%	5.00%	Yes
HDPE Colored	18.38%	5.00%	Yes
Other HDPE Packaging	8.47%	5.00%	Yes
PP Rigid	40.22%	15%	Yes
Plastics #3-7	Variable	15%	Yes
PE Film Mixed	Not Identified	35%	N/A

Five material grades on average exceed the specified overall contamination levels:

- HDPE Natural.
- HDPE Colored.
- Other HDPE Packaging.
- PP Rigid.
- Plastics #3 through #7.

It is likely that these grades exceed specifications because they contain too much missorted materials from processing facilities. Plastics #3 through #7 is noted as having variable contamination in the current state as this is mainly due to the varied resin within the grade. For example, if the end market is only targeting PP Rigid material within the grade, then contamination would be nearly 40%.

In the case of PE Mixed Film, very little of these grades are estimated to be currently collected and new processing capacities will need to be implemented for the needed state. The 35% contamination allowance for MRF films in ReMA’s ISRI specifications<sup>119</sup> is, in the contractor’s view, too high for sustainable end-market use. A more suitable specification would be closer to a 15% maximum, with low tolerances for unwanted plastics. This assumption was tested with industry experts and recyclers through interviews carried out as part of the needed state research.

**2.4.3.2 Technologies to Reduce Contamination**

**2.4.3.2.1 Missorted Materials**

Well-designed processing facilities equipped with advanced sensor-based sorting systems and robust quality control measures are capable of meeting required grade

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<sup>119</sup> Recycled Materials Industry. (n.d.). *ISRI Specifications* [Website]. Retrieved October 23, 2025, from <https://www.isrispecs.org/>

specifications. In many cases, end markets also incorporate additional processes to remove missorted materials, ensuring that the feedstock entering subsequent stages is suitable for producing the desired end products. These processes typically employ technologies similar to those used in recycling processing facilities, including:

- Screens for sizing.
- Manual picking for targeted removal of contaminants.
- Sensor-based sorting equipment, often using near-infrared or visual light detection paired with air separation or robotic systems.
- Eddy current and magnetic separators for metallic and non-metallic separation.

#### **2.4.3.2.2 Dirt, Residue, and Fine Contaminants**

All grades of post-consumer plastic inevitably contain varying levels of dirt, residues, and fine contaminants that result from both product use and the collection and processing stages. Typical sources of contamination include food residues, paper or cellulose fibers, glass fragments, and other nonplastic particles introduced during mixed collection or mechanical handling. These impurities can negatively affect the quality, color, and mechanical performance of recycled polymers, limiting their suitability for high-value applications.<sup>120</sup>

To achieve the material purity required for reprocessing and end-market applications, recycling and reprocessing facilities employ a combination of advanced cleaning and separation technologies. These may include hot washing and friction cleaning to remove organic residues, density separation for isolating plastics from nonplastics, and filtration, melt filtering, and degassing systems during extrusion to eliminate fine particulates and volatiles.<sup>121</sup> Additionally, optical and sensor-based sorting using near-infrared, visual spectrum, or X-ray technologies are commonly used to further refine material streams before pelletizing. By integrating these systems, facilities can produce recycled plastics that meet the stringent specifications required by end users, particularly for food-contact and high-performance packaging applications. Table 2-55 lists these contamination separation techniques and the technologies used to employ them.

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<sup>120</sup> Al-Salem, S. M., Lettieri, P., & Baeyens, J. *Recycling and recovery routes of plastic solid waste (PSW): A review*. *Waste Management*, 29(10), 2625–2643. <https://doi.org/10.1016/j.wasman.2009.06.004>. 2017.

<sup>121</sup> Ellen MacArthur Foundation. *The circular economy in detail: Plastics and packaging*. <https://ellenmacarthurfoundation.org/>. 2020.

**Table 2-55: Contamination Separation Techniques used by End Markets**

Separation Technique	Technology Example
Screening/Vacuum Density Separation	Zig-zag air classifiers or rotary screens used to remove dirt, dust, and small unwanted fractions introduced during collection and processing
Density Separation (Float Sink)	Separation based on material density relative to a liquid medium (e.g., separating PET from polyolefins using water or saline solutions)
Washing	Dry friction-based washing, ambient temperature wash, cyclone washing (friction raises temperature, and hot caustic washing).
Extrusion	Fine filtration and de-gassing.
Further Decontamination	Removal of volatiles through holding pellets or flakes in silos and passing heated gas through the material

#### 2.4.3.2.3 Design Choice

End-market contaminants that are a result of design choices are those that are intentionally introduced as part of covered material design but can interfere with recycling of that item. They include pigments, colorants, additives, and multilayers or composite structures such as laminates, lidding films, and labels that are not compatible with the base polymer. For example, certain colorants and carbon black pigments can hinder optical sorting processes, while additives such as fillers, flame retardants, or stabilizers may alter melt behavior and degrade polymer quality during reprocessing.<sup>122,123</sup>

Multilayer packaging, commonly used to improve barrier properties or extend shelf life, often combines incompatible resins such as PET, PE, EVOH, and nylon. These structures are difficult to separate through mechanical processes, leading to decreased yield and poorer performance of the recycled resin.<sup>124</sup> Similarly, labels, adhesives, and lidding films can contribute to end-market contamination when they do not detach or

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<sup>122</sup> Al-Salem, S. M., Lettieri, P., and Baeyens, J. *Recycling and recovery routes of plastic solid waste (PSW): A review. Waste Management*, 29(10), 2625–2643. <https://doi.org/10.1016/j.wasman.2009.06.004>. 2017.

<sup>123</sup> Hopewell, J., Dvorak, R., & Kosior, E. *Plastics recycling: Challenges and opportunities. Philosophical Transactions of the Royal Society B: Biological Sciences*, 364(1526), 2115–2126. <https://doi.org/10.1098/rstb.2008.0311>. 2009.

<sup>124</sup> Ellen MacArthur Foundation. *The circular economy in detail: Plastics and packaging*. <https://ellenmacarthurfoundation.org/>. 2020.

disperse cleanly during washing, leaving residues or introducing nontarget polymers into the recycled stream.<sup>125</sup>

Efforts to reduce design-related contaminants are increasingly focused on improving product design to enable circularity. This includes using single-material constructions, water-soluble adhesives, removable labels, and transparent or light-colored packaging. Design-for-recycling guidelines published by organizations like APR and the Plastics Recyclers Europe (PRE) provide specific criteria to minimize the introduction of these contaminants at the design stage, supporting higher-quality recycled outputs and greater circularity.<sup>126,127</sup>

### 2.4.3.3 Barriers to Reducing Contamination

Much of the change to reduce end-market contamination is needed in material redesign and processing facilities. Existing end markets are currently able to produce materials that meet the quality specifications required for many end users. These facilities typically employ a combination of washing, separation, sorting, and extrusion processes to manage contamination levels effectively. In some instances, however, there may be benefits to introducing new technologies or process modifications that further reduce contamination or improve the economic efficiency of material recovery. Such enhancements can increase product purity, broaden the range of acceptable feedstocks, and enable higher-value applications for recycled materials.

Implementing these improvements in existing facilities is often challenging. Financial constraints, the high cost of retrofitting or upgrading processing equipment, and the complexity of integrating new technologies within operational workflows can limit feasibility. Additional practical barriers include the need for physical space, planned downtime for installation, and retraining personnel to operate new systems. As a result, many facilities prioritize incremental process improvements over major technological overhauls.

Conversely, new end markets can be purposefully designed from the ground up to minimize contamination and produce recycled materials that meet specific quality targets. These facilities can incorporate advanced washing, separation, and sorting technologies at optimal stages of the process, allowing for better control over material purity and product specifications. The primary barriers to expanding such markets are developing sufficient end-market capacity requires investment, supply chain coordination, and the establishment of reliable feedstock streams. Overcoming these

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<sup>125</sup> Plastics Recyclers Europe. *Recycling process description and best practices*. <https://www.plasticsrecyclers.eu/>. 2021.

<sup>126</sup> Association of Plastic Recyclers (APR). *APR design® guide for plastics recyclability*. <https://plasticsrecycling.org/>, 2022.

<sup>127</sup> Plastics Recyclers Europe. *Recycling process description and best practices*. <https://www.plasticsrecyclers.eu/>. 2021.

barriers is essential to scaling the use of recycled materials and improving the overall circularity of plastics systems.<sup>128,129</sup>

#### 2.4.3.4 Funding Required to Achieve the Contamination Reduction at End Markets

Reducing contamination at end-market facilities involves reducing contamination levels during collection and at processing facilities prior to the arrival of materials at end markets. Processing costs to reduce contamination are discussed in section 2.3. Section 2.4.2, which outlines the funding required to expand capacity and meet recycling targets and is inclusive of funding end markets that can manage contamination in line with ReMA's ISRI specifications and therefore additional funding is not required.

Market incentives can also help offset the costs of advanced sorting, washing, and decontamination technologies at end market facilities that reduce contamination of outbound commodities. The Plastic Market Development Payment (PMDP) Program is a market incentive in California for end markets producing plastic flakes or pellets. It provides financial incentives to reclaimers and manufacturers to encourage the recycling of CRV-eligible post-consumer plastic beverage containers and the production of recycled plastic products within the state. Administered by CalRecycle, the program offers tiered payments based on material type and quality, prioritizing high-quality PET containers and post-consumer resin use in new products.<sup>130</sup> Reclaimers receive payments for processing CRV-eligible materials into flakes or pellets, while manufacturers receive incentives for using these recycled materials in new products. By linking financial rewards to material quality and domestic reuse, the program supports cleaner recycling streams, increases end-market demand for recycled CRV plastics, and strengthens California's domestic recycling infrastructure. Similar types of incentives could be implemented by the PRO or other entities.

#### 2.4.4 Increasing Recovery of Covered Materials Sent to End Markets

##### 2.4.4.1 Quantitative Analysis of the Increase in CMC Conversion Rates Needed

Table 2-56 shows the estimated current CMC conversion rates for CMC end market groups in the plastic material class as found in the Current State of End Markets Report. This focuses on the plastic material class as this is where the improvements need to be

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<sup>128</sup> Waste and Resources Action Programme (WRAP). *Plastics recycling technical guide*. <https://wrap.org.uk/>. 2022.

<sup>129</sup> Hopewell, J., Dvorak, R., & Kosior, E. *Plastics recycling: Challenges and opportunities*. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 364(1526), 2115–2126. 2009.

<sup>130</sup> CalRecycle. *Plastic Market Development Payment Program Instructions*. <https://www2.calrecycle.ca.gov/Docs/Web/114204>, 13 Feb. 2018.

made. Overall, end markets will need to achieve an 85% CMC rate for each covered material to meet the 65% recycling rate target. This is aligned with regulatory frameworks in other jurisdictions (e.g., Canada).<sup>131</sup>

For the CMC end market groups that have not yet achieved the required conversion rate for an overall 65% recycling rate, an indication of feasibility has been provided based on discussions with end markets and industry experts. The categories reported as “Improvements Needed” indicate that this research did not find other markets where 85% has been achieved, but at least a 60% CMC conversion rate exists in California or elsewhere.

**Table 2-56: Current State’s CMC Conversion Rate and Needed CMC Conversion Rate to Reach 65% Overall Recycling Rate For Plastic Material Class**

CMC End Market Group	Estimated Current CMC Conversion Rate	Improvements to CMC Conversion Rate Needed (i.e., less than 85%)?
Plastic #1 - PET Clear Bottles, Jugs, Jars - Non CRV	67%	Yes
Plastic #1 - PET Pigmented Bottles, Jugs, Jars - Non-CRV	60%	Yes
Plastic #1 - Other PET Rigid	67%	Yes
Plastic #2 – HDPE (pigmented and natural) Bottles, Jugs, Jars - Non-CRV	90%	No
Plastic #2 - HDPE Pails and Buckets	85%	No
Plastic #2 - Other HDPE Rigid	<1%	Yes
Plastic #5 - PP Rigid Items	56%	Yes <sup>132</sup>
PE Film	89%	No

<sup>131</sup> Environment and Climate Change Canada. *Recycled content and labelling rules for plastics*. Government of Canada. <https://www.canada.ca/en/environment-climate-change/services/canadian-environmental-protection-act-registry/recycled-content-labelling-rules-plastics.html>. 2025.

<sup>132</sup> The Association of Plastic Recyclers. (n.d.). *APR Design® Guide – PP rigid packaging*. <https://plasticsrecycling.org/apr-design-hub/apr-design-guide/>

#### 2.4.4.2 Methods for Increasing CMC Conversion Rates

Once contamination has been removed, increasing conversion rates at facilities depends on optimizing processing efficiency and material recovery. Facilities can improve yields by improving extrusion and melt filtration processes to capture more usable polymers and minimize loss. This can be done by adding advanced melt filtration systems, such as self-cleaning or rotating drum filters, which allow continuous operation with minimal melt loss, improving both yield and quality. Process control automation including real time monitoring of temperature, pressure, and melt flow helps maintain consistent polymer quality and prevents degradation that would otherwise reduce usable output. Regular equipment calibration and maintenance ensure machinery operates efficiently, minimizing downtime and off-spec batches. In some facilities, multi-stage extrusion and pelletizing systems enable reprocessing of fines or rejected fractions into high-quality pellets, enhancing overall material recovery. Similarly, optimized drying and cooling systems prevent clumping or overheating losses, while closed loop systems that reuse offcuts or regrind within the same production line further increase total conversion efficiency. Together, these process-level improvements can significantly boost conversion yields in clean, presorted polymer streams such as PET bottles and PP rigids.

#### 2.4.4.3 Barriers to Increasing CMC Conversion Rates

Even with clean, presorted feedstock, recycling facilities face several barriers to increasing CMC conversion rates. Many existing facilities use older extruders or melt filters not optimized for fine filtration or high throughput, resulting in polymer loss during processing. Upgrading to advanced filtration or multi-stage extrusion systems requires substantial capital investment and downtime for retrofitting, which many operators find financially prohibitive. Additionally, energy intensity is a major challenge: Achieving higher conversion rates often demands tighter temperature control and additional heating or cooling steps, raising operational costs and emissions.<sup>133</sup>

Another constraint is limited market demand, which discourages processors from pushing conversion efficiency if output cannot command sufficient price premiums. Finally, workforce and maintenance capacity play a role. Maintaining high conversion rates requires skilled technicians, consistent monitoring, and rigorous preventive maintenance. Together, these economic and technical barriers constrain the scalability of high-yield recycling operations, even when feedstock quality is high.<sup>134</sup>

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<sup>133</sup> Meneses, D., Silva, J., and Cardoso, M. *Plastic recycling and their use as raw material for new products*. *Sustainability*, 14(5). <https://pmc.ncbi.nlm.nih.gov/articles/PMC8941171/>. 2022.

<sup>134</sup> "Plastic Recycling: Cost Efficiency in Melt Filtration." *Global Recycling*, Feb. 2023, [global-recycling.info/archives/8544](https://global-recycling.info/archives/8544)

#### 2.4.4.4 Funding To Increase CMC Conversion Rates

Section 2.4.2.2 of this report outlines the funding required to meet the recycling rate requirements and is inclusive of the funding end markets need to achieve CMC conversion rates of 85%.

### 2.4.5 Public Health, Environmental, and Community Impacts of End Markets

This section evaluates the broader environmental and public health implications associated with upgraded and new end market facilities to manage additional quantities of covered material.

#### 2.4.5.1 Public Health Impacts

The expansion of end market facilities and associated infrastructure will enable increased in-state recycling capacity, but efforts should be made to reduce the environmental and public health impacts, while maximizing environmental and community benefits. Impacts should be considered for end-market facility construction and operation and the transportation of material across the state to more distant end markets (e.g., out of state or export markets).

##### 2.4.5.1.1 Considerations Associated with End Market Facility Construction

New and expanded end-market facilities may result in short-term construction-related impacts, such as noise, dust, and disturbance resulting from use of heavy construction equipment. California's SB 1383 Final Environmental Impact Report identifies that construction for new or modified organic waste recovery and processing facilities could generate emissions for reactive organic gases (ROG), nitrogen oxides (NO<sub>x</sub>), particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>), and greenhouse gases (GHGs) from ground-disturbing activities and heavy-duty equipment.<sup>135</sup> While the SB 1383 EIR focuses on organic waste recovery and processing facilities, the cited potential construction-related impacts are expected to be broadly similar for end-market facilities due to the similar nature of construction processes and equipment used. ROGs, NO<sub>x</sub>, and particulate matter have adverse effects on the environment and public health. Exposure to NO<sub>x</sub> and particulate matter is associated with respiratory illnesses.<sup>136</sup> Chronic and acute exposures to mixtures of NO<sub>x</sub>, particulate matter, and carbon dioxide (primary GHG emitted through

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<sup>135</sup> CalRecycle. "SB 1383 Regulations, Short-Lived Climate Pollutants: Organic Waste Methane Emission Reductions Environmental Impact Report." 17 Nov. 2021.

<sup>136</sup> Taha, Sara Sami, et al. "Comprehensive Review of Health Impacts of the Exposure to Nitrogen Oxides (NO<sub>x</sub>), Carbon Dioxide (CO<sub>2</sub>), and Particulate Matter (PM)." *Journal of Hazardous Materials Advances*, vol. 19, Aug. 2025, p. 100771. *ScienceDirect*, [www.sciencedirect.com/science/article/pii/S2772416625001822](http://www.sciencedirect.com/science/article/pii/S2772416625001822), <https://doi.org/10.1016/j.hazadv.2025.100771>.

human activities)<sup>137</sup> can exert synergistic effects, exacerbating oxidative stress, systemic inflammation, and risk for respiratory and cardiovascular diseases beyond what would result from individual pollutant exposure alone.<sup>138</sup>

As identified in the SB 1383 EIR, to prevent exposure to hazardous substances and reduce potentially significant impacts for workers, proponents of new end-market facilities should identify and avoid hazardous waste sites during construction, coordinate with state or local land use agencies, search hazardous waste databases (e.g., Department of Toxic Substances Control [DTSC] Cortese List)<sup>139</sup> and conduct a Phase I Environmental Site Assessment (ESA).<sup>140</sup> Through these actions, proponents of new end markets may identify feasible mitigation actions that can lessen the environmental and public health impacts of developing new end market infrastructure. Implementing all feasible mitigation actions to reduce exposure to hazardous waste will also reduce impacts on public health and the environment.<sup>141</sup>

Integrating environmental justice screening tools, such as CalEnviroScreen, into the siting process may help ensure that new development does not disproportionately affect sensitive receptors, priority populations, and communities burdened by multiple sources of pollution.<sup>142</sup> Sensitive receptors may include children, the elderly, and others who are at a heightened risk of negative health outcomes due to air pollution exposure<sup>143</sup> and cumulative pollution burdens. While end-market locations are limited to areas that are zoned for industrial use, expansion of end-market capacity requires careful planning to avoid adding on to pollution burdens for communities already hosting one or more end-market facility. CalEnviroScreen provides census tract-level information on pollution exposure, environmental conditions, and population vulnerability, enabling project proponents and permitting agencies to evaluate whether the proposed sites fall within

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<sup>137</sup> US EPA. “Carbon Dioxide Emissions.” *Epa.gov*, [www.epa.gov/ghgemissions/carbon-dioxide-emissions](http://www.epa.gov/ghgemissions/carbon-dioxide-emissions).

<sup>138</sup> Taha, Sara Sami, et al. “Comprehensive Review of Health Impacts of the Exposure to Nitrogen Oxides (NOx), Carbon Dioxide (CO<sub>2</sub>), and Particulate Matter (PM).” *Journal of Hazardous Materials Advances*, vol. 19, Aug. 2025, p. 100771. *ScienceDirect*, [www.sciencedirect.com/science/article/pii/S2772416625001822](http://www.sciencedirect.com/science/article/pii/S2772416625001822), <https://doi.org/10.1016/j.hazadv.2025.100771>.

<sup>139</sup> “DTSC’s Hazardous Waste and Substances Site List - Site Cleanup (Cortese List).” *Department of Toxic Substances Control (DTSC)*, [dtsc.ca.gov/dtscs-cortese-list/](http://dtsc.ca.gov/dtscs-cortese-list/).

<sup>140</sup> CalRecycle. “SB 1383 Regulations, Short-Lived Climate Pollutants: Organic Waste Methane Emission Reductions Environmental Impact Report.” 17 Nov. 2021.

<sup>141</sup> CalRecycle. “SB 1383 Regulations, Short-Lived Climate Pollutants: Organic Waste Methane Emission Reductions Environmental Impact Report.” 17 Nov. 2021.

<sup>142</sup> “Permitted Sites on CalEnviroScreen.” *Department of Toxic Substances Control (DTSC)*, [dtsc.ca.gov/permitted-sites-on-calenviroscreen-2/](http://dtsc.ca.gov/permitted-sites-on-calenviroscreen-2/).

<sup>143</sup> California Air Resources Board. “Sensitive Receptor Assessment.” *Ca.gov*, [ww2.arb.ca.gov/capp/cst/rdi/sensitive-receptor-assessment](http://ww2.arb.ca.gov/capp/cst/rdi/sensitive-receptor-assessment).

communities that already face elevated environmental impacts. These data can be used to compare multiple potential sites, assess whether a proposed facility may be sited near sensitive receptors, and identify alternatives that would not exacerbate existing pollution burdens.

Other tools, such as CARB's Pollution Mapping Tool and local General Plan Environmental Justice Elements developed under SB 1000 for jurisdictions that contain disadvantaged communities,<sup>144</sup> can provide further guidance for considering cumulative impacts and supporting equitable siting decisions.

#### **2.4.5.1.2 Considerations Associated with End-Market Facility Operations**

The operation of end-market facilities can also create pollution that impacts the environment and surrounding communities. Depending on the material handled by the end-market facility, recycling activities may involve mechanical, thermal, and chemical processes that can release air pollutants, contaminated wastewater, residues, and other by-products that have adverse environmental and public health impacts.

For example, glass end markets require operation of high-temperature furnaces and can release pollutants such as nitrogen oxides, sulfur oxides, and particulate matter.<sup>145</sup> These air pollutants can aggravate respiratory systems and lead to respiratory illnesses.<sup>146</sup> As discussed in the Current State of End Markets Report, plastic recycling processes can emit volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons, and nuisance odors. These air pollutants can pose serious environmental risks and public health consequences if not mitigated.

The Current State of End Markets Report identified that certain end market operations, such as plastics and paper and fiber recycling, may contribute to the generation or release of microplastics and PFAS-containing wastewater. To reduce these risks, facilities may consider process upgrades such as capture systems to prevent untreated wastewater releases and advanced wastewater treatment technologies, such as membrane filtration, to reduce microplastics in the wastewater.<sup>147</sup> For PFAS, solutions may include upstream supplier requirements that limit PFAS-containing inputs and enhanced feedstock screening. As the U.S. EPA continues to develop and evaluate

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<sup>144</sup> "SB-1000 Land Use: General Plans: Safety and Environmental Justice." *California Legislative Information*, 24 Sept. 2016, [leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill\\_id=201520160SB1000](https://leginfo.ca.gov/faces/billTextClient.xhtml?bill_id=201520160SB1000).

<sup>145</sup> NSG Group. "Air Emissions." *Nsg.com*, [www.nsg.com/en/sustainability/environment/natural-capital/air-emissions#](https://www.nsg.com/en/sustainability/environment/natural-capital/air-emissions#)

<sup>146</sup> EarthJustice, et al. "Owens-Brockway: An Environmental Justice Problem in Portland."

<sup>147</sup> Puteri, Mentari Noviyanti, et al. "Technologies to Eliminate Microplastic from Water: Current Approaches and Future Prospects." *Environment International*, vol. 199, May 2025, p. 109397. *ScienceDirect*, [www.sciencedirect.com/science/article/pii/S0160412025001485#s0120](https://doi.org/10.1016/j.envint.2025.109397), <https://doi.org/10.1016/j.envint.2025.109397>.

technologies for wastewater treatment and disposal of PFAS-containing materials,<sup>148</sup> future solutions for end-market facilities may include adopting treatment technologies to eliminate PFAS concentrations in process water and integrating emerging best practices as they become technically and economically feasible.

Transportation activities associated with end-market operations can also contribute to local air quality and GHG emissions. The movement of inbound feedstock and outbound recovered materials often relies on medium- and heavy-duty trucks, which are often powered by diesel fuels and have higher emissions than passenger cars. Medium- and heavy-duty diesel trucks are a major source of diesel particulate matter and nitrogen oxides, which are associated with adverse health impacts.<sup>149</sup>

End-market facilities may be subject to applicable federal, state, and local requirements to mitigate their environmental impacts. The following general information provides some background on existing laws that address certain pollutant types:

- Solid Waste.
- End market facilities may require a solid waste facility permit or other tiered permit consistent with Title 14 and Title 27 California Code of Regulation (CCR).<sup>150,151</sup> These permits are administered by CalRecycle in coordination with local enforcement agencies and are designed to ensure protection of public health and safety and the environment.<sup>152</sup> Applicants for new or expanded facilities must demonstrate compliance with all applicable environmental and public health laws and regulations including the CEQA.<sup>153</sup> Furthermore, the local enforcement agency LEA may incorporate additional limits and conditions in the permit as necessary to protect the public health and safety and the environment as well as to ensure the end market facility's ability to comply with State Minimum Standards.<sup>154</sup>

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<sup>148</sup> US EPA. "Research on Per- and Polyfluoroalkyl Substances (PFAS)." *Epa.gov*, [www.epa.gov/chemical-research/research-and-polyfluoroalkyl-substances-pfas](http://www.epa.gov/chemical-research/research-and-polyfluoroalkyl-substances-pfas).

<sup>149</sup> California Air Resources Board. "Overview: Diesel Exhaust & Health." *Ca.gov*, [ww2.arb.ca.gov/resources/overview-diesel-exhaust-and-health](http://ww2.arb.ca.gov/resources/overview-diesel-exhaust-and-health).

<sup>150</sup> CalRecycle. "Writing a Solid Waste Facility Permit." *CalRecycle*, [calrecycle.ca.gov/swfacilities/permitting/permittype/fullpermit/writepermit/](http://calrecycle.ca.gov/swfacilities/permitting/permittype/fullpermit/writepermit/).

<sup>151</sup> CalRecycle. "Full Solid Waste Facilities Permits." *CalRecycle*, [calrecycle.ca.gov/swfacilities/permitting/permittype/fullpermit/](http://calrecycle.ca.gov/swfacilities/permitting/permittype/fullpermit/).

<sup>152</sup> CalRecycle. "Full Solid Waste Facilities Permits." *CalRecycle*, [calrecycle.ca.gov/swfacilities/permitting/permittype/fullpermit/](http://calrecycle.ca.gov/swfacilities/permitting/permittype/fullpermit/).

<sup>153</sup> CalRecycle. "Writing a Solid Waste Facility Permit." *CalRecycle*, [calrecycle.ca.gov/swfacilities/permitting/permittype/fullpermit/writepermit/](http://calrecycle.ca.gov/swfacilities/permitting/permittype/fullpermit/writepermit/).

<sup>154</sup> CalRecycle. "Writing a Solid Waste Facility Permit." *CalRecycle*, [calrecycle.ca.gov/swfacilities/permitting/permittype/fullpermit/writepermit/](http://calrecycle.ca.gov/swfacilities/permitting/permittype/fullpermit/writepermit/).

- Air Emissions.
- The U.S. Clean Air Act, as amended in 1990, (U.S. Code [USC] Title 42, Chapter 85) regulates air pollution from stationary and mobile sources and Title V of the Clean Air Act established a mandatory operating permit program for each state.<sup>155</sup> End markets with the potential to emit significant amounts of air pollutants may be required to have a Title V permit.
- The California New Source Review permit program is derived from the California Clean Air Act and applies to new and modified stationary sources of pollutants, which may include end-market facilities, to ensure that it does not further deteriorate ambient air quality.<sup>156</sup> Most new and modified stationary sources are also required to use the Best Available Control Technology (BACT) or Lowest Achievable Emission Rate (LAER).<sup>157</sup>
  - To mitigate transportation-related impacts, California has put other regulations and incentive programs in place, such the Clean Truck Check program and California’s Low-Carbon Fuel Standard.
- Water Emissions.
- To address concerns related to water quality and soil contamination, the National Pollutant Discharge Elimination System (NPDES) permitting program regulates stormwater discharges from industrial facilities, which may include end-market facilities.<sup>158</sup> Compliance with NPDES permitting programs is overseen by the State Water Resources Control Board and the Regional Water Quality Control Boards.
- Overall environmental impact.
- CEQA provides opportunities for public involvement and input during environmental review. It requires state and local governments to inform the public about potentially significant environmental effects of a proposed project, which may include the development of new or expanded end-market facilities, and

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<sup>155</sup> California Air Resources Board. “Federal Clean Air Act- Title v Operating Permits.” *Ca.gov*, [ww2.arb.ca.gov/our-work/programs/federal-clean-air-act-title-v-operating-permits](http://ww2.arb.ca.gov/our-work/programs/federal-clean-air-act-title-v-operating-permits).

<sup>156</sup> California Air Resources Board. “Federal New Source Review.” *Ca.gov*, [ww2.arb.ca.gov/our-work/programs/new-source-review-permitting-programs/federal-new-source-review](http://ww2.arb.ca.gov/our-work/programs/new-source-review-permitting-programs/federal-new-source-review).

<sup>157</sup> California Air Resources Board. “New Source Review.” *Ca.gov*, [ww2.arb.ca.gov/our-work/programs/new-source-review-permitting-programs/new-source-review](http://ww2.arb.ca.gov/our-work/programs/new-source-review-permitting-programs/new-source-review).

<sup>158</sup> California State Water Resources Control Board. “National Pollutant Discharge Elimination System (NPDES) - Wastewater.” *Ca.gov*, [www.waterboards.ca.gov/water\\_issues/programs/npdes/](http://www.waterboards.ca.gov/water_issues/programs/npdes/).

ways to minimize those effects as well as alternatives to the project.<sup>159</sup> If a project may cause adverse environmental effects, CEQA requires public review and comment on environmental documents such as initial studies and Environmental Impact Reports.<sup>160</sup>

- Hazardous Waste.
- At the federal level, the Resource Conservation and Recovery Act , Subtitle C, establishes standards for waste classification, storage, transportation, and disposal.<sup>161</sup>
- In California, these requirements are implemented and expanded through the Hazardous Waste Control Law (California Health and Safety Code §§ 25100 – 25259) and its implementing regulations in Title 22 of the CCR, Division 4.5.<sup>162</sup>

#### 2.4.5.2 Community Impacts

As actions and investments are made, their community, environmental, and public health impacts should be considered. Disposal facilities and end markets both have environmental and public health implications. While both types of facilities can produce emissions and localized impacts during operation, end markets may potentially provide net environmental benefits by diverting materials from landfills, reducing raw material extraction, and lowering lifecycle GHG emissions associated with virgin production.<sup>163</sup> In many cases, manufacturing a product with recycled inputs requires less energy than manufacturing with virgin inputs.<sup>164</sup> Additionally, removing organic waste from landfills prevents methane from being generated through anaerobic breakdown and eventually becoming fugitive emissions.<sup>165</sup> These emissions represent at least 21% of California's

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<sup>159</sup> "California Environmental Quality Act (CEQA)." *California State Lands Commission*, [www.slc.ca.gov/ceqa/](http://www.slc.ca.gov/ceqa/).

<sup>160</sup> "California Environmental Quality Act (CEQA)." *California State Lands Commission*, [www.slc.ca.gov/ceqa/](http://www.slc.ca.gov/ceqa/).

<sup>161</sup> US EPA. "Resource Conservation and Recovery Act (RCRA) Overview." *Epa.gov*, [www.epa.gov/rcra/resource-conservation-and-recovery-act-rcra-overview](http://www.epa.gov/rcra/resource-conservation-and-recovery-act-rcra-overview).

<sup>162</sup> "Division 4.5. Environmental Health Standards for the Management of Hazardous Waste." *Westlaw.com*, [govt.westlaw.com/calregs/Browse/Home/California/CaliforniaCodeofRegulations?guid=81CB6A705B6111EC9451000D3A7C4BC3&originationContext=documenttoc&transitionType=Default&contextData=\(sc.Default\)](http://govt.westlaw.com/calregs/Browse/Home/California/CaliforniaCodeofRegulations?guid=81CB6A705B6111EC9451000D3A7C4BC3&originationContext=documenttoc&transitionType=Default&contextData=(sc.Default)).

<sup>163</sup> US EPA. "Documentation for Greenhouse Gas Emission and Energy Factors Used in the Waste Reduction Model (WARM) Background Chapters." Nov. 2020.

<sup>164</sup> US EPA. "Documentation for Greenhouse Gas Emission and Energy Factors Used in the Waste Reduction Model (WARM) Background Chapters." Nov. 2020.

<sup>165</sup> CalRecycle. "SB 1383 Regulations, Short-Lived Climate Pollutants: Organic Waste Methane Emission Reductions Environmental Impact Report." 17 Nov. 2021.

methane emissions annually, therefore diverting organic waste from landfills to end markets can help reduce methane emissions and support progress towards the State's Short-Lived Climate Pollutant Reduction Strategy goals.<sup>166</sup>

Many CBOs, EJ groups, and Tribes agree there are positive environmental and community benefits to recycling and composting. However, participants in listening sessions also indicated that not all forms of managing waste materials are considered ethical or acceptable by communities, such as incineration and other energy generation and fuel production technologies because studies have shown that these technologies may cause more health issues in the communities in which they are operated<sup>167</sup>. This was further expanded upon during the CBO and EJ group listening sessions with discussion of the negative legacy left by incinerators that may prevent communities from trusting that trash and recyclables are being ethically and environmentally disposed of or reused.

As discussed in the Current State of End Markets Report, end-market facilities are predominantly located in areas with lower median household income, which may indicate that these areas are more likely to experience localized environmental and public health impacts arising from end-market facility operations. This observation aligns with existing research that priority populations, identified in part by lower-income census tracts, are often located near industrial pollution sources.<sup>168</sup>

Increasing recycling rates of covered material will require new or expanded end-market facilities, which may introduce localized environmental and public health impacts for surrounding communities. In addition to the environmental and health impacts identified in the previous section, priority populations in California also have identified additional concerns such as noise pollution, water quality and contamination, neighborhood cleanliness, and soil contamination. The results of engagement activities with priority populations are discussed in the next section. If not carefully planned or left unaddressed, such impacts may potentially exacerbate cumulative pollution burdens in communities already affected by end-market facilities and/or other industrial activity.

#### **2.4.5.2.1 Methods to Improve Outcomes and Minimize Impact**

Efforts to minimize the cumulative public health, environmental, and community impacts of end markets while also maximizing community benefits requires a multifaceted

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<sup>166</sup> CalRecycle. "SB 1383 Regulations, Short-Lived Climate Pollutants: Organic Waste Methane Emission Reductions Environmental Impact Report." 17 Nov. 2021.

<sup>167</sup> Jimenez, Greta. "Incineration: Reducing Pollution through Waste Management." *ShunWaste*, 16 Dec. 2024.

<sup>168</sup> Aslebagh, Shadi, et al. "New Method for Mapping Air Pollution Reveals Disproportionate Burden in Disadvantaged Communities." *UC Berkeley Public Health*, 11 Sept. 2024, [publichealth.berkeley.edu/articles/spotlight/research/new-method-for-mapping-air-pollution-reveals-disproportionate-burden](https://publichealth.berkeley.edu/articles/spotlight/research/new-method-for-mapping-air-pollution-reveals-disproportionate-burden).

approach. Key considerations include strategic siting of facilities, enhanced community engagement, and the promotion of economic development opportunities.

#### 2.4.5.2.1.1 Siting Considerations

About one third of Community Recycling and Composting Survey respondents (34%, 22 respondents) who reported living near a recycling or composting facility had a neutral perspective about how the facility impacts their health and local environment. A smaller proportion (26%, 17 respondents) felt the facility had a positive impact and only 14% (9 respondents) reported a negative impact. The remaining 26% (17 respondents) were unsure of the perceived impact. This uncertainty may suggest that residents lack access to clear information about facility operations, potential impacts, or available mitigation measures, highlighting the importance of early communication and transparent engagement with affected communities during siting and expansion efforts. These mixed responses may also indicate that community experiences with recycling and composting facilities vary, and that concerns, particularly for those experiencing negative impacts, should be proactively explored to ensure that the issues are identified and addressed. It should be noted that the survey did not ask questions specific to facility siting or the types of impacts associated with end-market operations. As a result, the responses provide a general indication of community perceptions rather than a comprehensive understanding of siting-related concerns.

Implementing project-specific mitigation measures, such as traffic management plans, enclosed or covered operations, dust-control practices, and the use of cleaner or zero-emission vehicles can further reduce potential localized impacts on surrounding communities. Integrating these considerations early in the siting and design process provides pathways for expanding end-market capacity while limiting additional burdens on priority populations.

#### 2.4.5.2.1.2 Community Engagement

Noise pollution was the top negative impact identified across CBOs and EJ groups (34% of Community Recycling and Composting Survey respondents). Noise pollution may occur during the construction phase of new facilities, including end-market facilities, and during operation. Furthermore, the top environmental concerns related to facilities were water quality and contamination (70% of respondents from CBOs and EJ groups, 75% of survey respondents from Tribes), neighborhood cleanliness (68% of Community Recycling and Composting Survey respondents), and soil contamination (63% of survey respondents from Tribes).

Community engagement serves as a key mechanism to identify and address potential localized environmental and public health concerns, helping to mitigate against disproportionate impacts on disadvantaged communities and maximize community benefits. This process helps to proactively reduce the cumulative community and environmental burdens, especially for communities already burdened by industry.

Recommended approaches for continued engagement include establishing regular communication channels and keeping communities informed about operational changes or mitigation measures that have been implemented. Regular communication may take

the form of periodic community meetings, dedicated facility points of contact, and clear mechanisms for submitting and tracking community complaints. Providing updates on inspection outcomes, corrective actions, and any changes in facility operations can help communities stay informed about issues that may affect them. These practices support transparency, strengthen community trust, and help ensure that facilities remain responsive to the needs and concerns of affected communities over time.

#### **2.4.5.2.2 Economic Opportunities**

End markets present opportunities for enterprise development and job creation, particularly in materials recovery and manufacturing. Several facilities reported that local sourcing and processing support regional economies. For example, one paper and fiber end market sources most of its material within a 30-mile radius. By purchasing material locally, these facilities help retain revenue within the community and reduce transportation costs.

Financial impacts and incentives were a common theme amongst CBOs, EJ groups, and Tribes. Roughly half of all Community Recycling and Composting Survey respondents indicated they were financially impacted by waste management challenges in some capacity, which means addressing these impacts is essential to alleviating burdens on priority populations.

A majority of Community Recycling and Composting Survey respondents felt that increasing recycling and composting programs will create green jobs (67% of CBOs and EJ groups and 88% of Tribe respondents). End market facilities generate a range of employment opportunities across planning, construction, operations, maintenance, and oversight. Jobs span various skill levels, from entry-level roles in materials handling and facility upkeep to specialized positions in environmental monitoring, equipment operation, and quality assurance.

- Job training and workforce development initiatives can help ensure that employment opportunities are accessible to a broad cross-section of residents. Local hiring practices, contractor preference policies, and community benefit agreements can help ensure that economic value generated by end-market infrastructure is reinvested locally. Outreach to disadvantaged and overburdened communities can support inclusive participation.

Expanding both existing and emerging end markets within California presents a significant opportunity for economic growth. End markets generate direct economic activity through facility employment, contracting with local haulers and service providers, and contributing to tax revenues through business operations and capital investment. The presence of end-market facilities may also stimulate related manufacturing activity by supplying recycled feedstock to local producers, thereby attracting or retaining manufacturers that benefit from reduced material costs and more reliable access to materials, supporting in-state production and reducing transportation-related costs. The construction and operation of these markets would stimulate local investment and infrastructure development. The development or expansion of an end market often requires upgrades to utilities, stormwater systems, electrical capacity, and equipment,

which would direct new construction spending and infrastructure investment into the surrounding community.

For example, a new end market facility that recycles cartons is being developed in Lodi, Calif., through a partnership between the Carton Council, Elof Hansson USA Inc., and the Upcycling Group. The facility will serve as an end market for post-consumer food and beverage cartons and convert them into durable building materials. The facility is expected to process approximately 750 tons of recovered cartons per month and employ about 15 people,<sup>169</sup> representing a direct capital investment in California's recycling infrastructure and new processing capacity that supports broader materials recovery within the state. In addition to expanding in-state recycling infrastructure, the facility sources cartons within California and other regions of the West Coast and contracts with nearby service providers, which contributes to local economic activity and supports continued investment in the surrounding region.

#### **2.4.6 Methods to Assess Features of End Markets**

Through primary and secondary research, the contractor identified potential assessment methods for features of end markets, with a focus on end-market responsibility. The contractor identified current and proposed assessment methods in six U.S. states with EPR laws (California, Oregon, Colorado, Maine, Minnesota, Maryland, and Washington). Additionally, research on international end markets identified that current and proposed assessment methods vary widely based on the end-market location. Examples of identified programs are included here-in, but a comprehensive analysis or synthesis of existing programs worldwide is not included.

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<sup>169</sup> "New California Recycler Will Produce Sustainable Building Materials Using Recycled Food and Beverage Cartons." *Carton Council*, 29 Jan. 2025, [recyclecartons.com/new-california-recycler-will-produce-sustainable-building-materials-using-recycled-food-and-beverage-cartons/](https://recyclecartons.com/new-california-recycler-will-produce-sustainable-building-materials-using-recycled-food-and-beverage-cartons/).

**Table 2-57: Methods Identified to Assess Various Features of End Markets**

Feature Name	Description
Legal Compliance	Methods to assess compliance with all necessary permits, licenses, and other legal requirements.
Transparency	Methods for assessing end markets' willingness to be audited and maintenance of records that document permits, chain of custody, recycling of materials, complaints regarding the end market, and enforcement actions taken against the end market.
Environmental, Public Health, and Worker Safety	Methods for assessing end markets' effects on the environment, public health, and worker safety. This includes managing pollution (emissions, effluents, residuals) and minimizing the amount of material sent for disposal.
Conversion Efficiency	Methods for assessing end markets' conversion rates of accepted materials into recycled organic products or feedstock to be used in lieu of virgin material for the creation of new or reconstituted products

#### 2.4.6.1 Methods for Evaluating Legal Compliance

Methods for assessing legal compliance may vary widely based on where end markets are domiciled. Requirements for legal compliance will be different between cities, counties, and states domestically, and will contain an even wider array of considerations internationally. To assess whether end markets are complying with permits, licenses, and other legal requirements, it's first necessary to define what the requirements are. Legal compliance attributes to be considered may include, but not be limited to, compliance with the following bulleted items.

- Environmental permits and ongoing compliance – This may include air, water, waste, hazardous waste, or other permits, in addition to meeting ongoing compliance requirements.
- Business licenses and registrations – This may include forming a corporation, registering with the state or government entity, paying taxes, and obtaining a business license.
- Occupational health and safety (OHS) compliance – varies based on location. In California, Cal/OSHA administers and enforces workplace safety standards. Federal OSHA administers and enforces workplace safety standards nationally.
- Land use and zoning approvals – This may include zoning designation and use classification, conditional use permits, site plan review and approval, zoning clearance and certificate of occupancy, and building and grading permits.
- Import/export authorizations (where applicable) – This could include import and export permits, which are dependent on the origination of inflows and the

destination of outflows. Import/export of material may require additional authorizations.

While this list is not exhaustive, it is used for demonstration purposes on the types of items that need be assessed for legal compliance. As previously described, the vast array of legal requirements must first be defined for each end market location. As end market locations are considered in different states domestically, or internationally, the volume of legal compliance attributes will compound and increase the required efforts for monitoring.

There are multiple potential avenues for verifying legal compliance. The first avenue identified for assessing legal compliance is through end market self-attestation forms. End markets (e.g., a reclaimer or mill) could submit a formal declaration affirming their compliance with a defined set of criteria. As previously noted, defining these criteria may become cumbersome if end markets are located across several regions. Oregon DEQ's responsible end-markets self-attestation forms have been published online as a reference point.<sup>170</sup> This is the first step in a two-part process in the program plans in Colorado and Oregon; but may be operated as a stand-alone evaluation process. However, sole reliance on self-attestation may introduce risk that end markets are not compliant with legal compliance attributes and are misreporting their compliance status.

#### **2.4.6.1.1 End Market Legal Compliance Verification and Auditing**

Another potential avenue for verifying legal compliance is compliance verification and auditing, which can be used in addition to self-attestation, or as a stand-alone program. Colorado and Oregon utilize a two-part process where onsite audits are conducted at least once every five years and interim years include a desktop review; these frameworks use a pass fail for legal compliance. These programs offer a few of the verification and auditing programs identified that could be used for assessing legal compliance.

The contractor identified two primary methods for compliance verification and auditing:

- Desk-based reviews.
- On-site audits.

##### **2.4.6.1.1.1 Desk Reviews**

A desk review is an audit or evaluation that is conducted remotely by reviewing submitted documents, records, and data from the auditor or reviewer's office without a physical on-site visit. Data regarding international, federal, state, and/or local permits (depending on end-market location) would need to be submitted by end markets which would in turn be verified. End markets in different locations would require obtaining different legal compliance documents.

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<sup>170</sup> Oregon Department of Environmental Quality, 'Oregon Responsible End Markets Screening and Self Attestation Form', 2025, <https://www.oregon.gov/deq/recycling/Documents/remSelfAttest.pdf>.

Approaches to verification will be dependent on the location of end markets. End markets located within California or domestically could be verified more easily against readily available databases such as:

- **EPA Facility Registry Service:** A central database that identifies and geospatially locates facilities, sites, or places subject to environmental regulations.<sup>171</sup>
- **Enforcement and Compliance History Online:** Provides integrated inspection, violation, and enforcement data for the Clean Air Act, Clean Water Act, and Resource Conservation and Recovery Act for over 800,000 regulated facilities.<sup>172</sup>
- **Toxic Release Inventory:** Tracks the management of toxic chemicals that may pose a threat to human health and the environment, relevant to toxic releases specific end-market facilities.<sup>173</sup>
- **EPA Enforcement Cases:** Public lists of civil and clean-up enforcement cases.<sup>174</sup>
- **CalRecycle Solid Waste Information System:** Information on solid waste facilities located within California, including regulatory status and history of enforcement actions.<sup>175</sup>

International end markets may have more limited availability of databases and may rely more heavily on import/export permits, government-to-government verification channels, or MOUs with foreign environmental agencies. The Basel Convention addresses transboundary movements of waste and certain materials collected for recycling (e.g., plastic waste addressed in the amendment adopted in 2019),<sup>176</sup> requiring written Prior Informed Consent (PIC) by the importing country before the exporting country (and any transit countries) ships certain wastes. Therefore, PIC creates a verifiable set of documentation demonstrating information such as nature, quantity, origin, destination, intended recovery operation of the materials, and proof of facility authorization to

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<sup>171</sup> US EPA. "Facility Registry Service." *Www.epa.gov*, [www.epa.gov/frs](http://www.epa.gov/frs).

<sup>172</sup> US EPA. "Enforcement and Compliance History Online." *Echo.epa.gov*, [echo.epa.gov/](http://echo.epa.gov/).

<sup>173</sup> US EPA. "TRI Explorer: Waste Quantity Reports." *Epa.gov*, [enviro.epa.gov/triexplorer/tri\\_quantity.chemical](http://enviro.epa.gov/triexplorer/tri_quantity.chemical).

<sup>174</sup> US EPA. "Civil and Cleanup Enforcement Cases and Settlements." *Www.epa.gov*, [www.epa.gov/enforcement/civil-and-cleanup-enforcement-cases-and-settlements](http://www.epa.gov/enforcement/civil-and-cleanup-enforcement-cases-and-settlements).

<sup>175</sup> CalRecycle. "SWIS Facility/Site Search." *Cal/Recycle*, [www2.calrecycle.ca.gov/SolidWaste/Site/Search](http://www2.calrecycle.ca.gov/SolidWaste/Site/Search).

<sup>176</sup> Basel Convention. "Plastic Waste Amendments." *Www.basel.int*, [www.basel.int/Countries/StatusofRatifications/PlasticWasteamendments/tabid/8377/Default.aspx](http://www.basel.int/Countries/StatusofRatifications/PlasticWasteamendments/tabid/8377/Default.aspx).

receive the specific materials. A desk review could involve verification of the PIC documents.

Desk reviews provide certain benefits compared to traditional onsite audits, including lower costs and quicker screening times which enhance scalability. Minimization of travel to end-market locations also means reduced costs. Desk reviews have considerable limitations in that they rely on self-reporting and updated information in databases where they exist. Additionally, desk reviews do not confirm operational compliance with regulations, which is a significant limitation when considering whether end markets continue to operate responsibly.

#### 2.4.6.1.1.2 On-Site Audits

An on-site audit is a systemic, in-person evaluation conducted at an end-market facility to verify that it complies with the identified legal compliance requirements. Audits may be conducted by federal or state regulators, international regulatory authorities, or third-party auditors.

While on-site audits allow for document and records review similar to desk reviews, they allow for physical inspection of the facility. Therefore, in addition to obtaining the required permits and licenses, onsite audits may more easily assess other legal requirements such as ongoing operational requirements. While onsite, auditors can directly observe the following activities for legal compliance:

- Waste receipt, sorting, processing, storage, and shipment.
- Handling of hazardous or regulated materials.
- Pollution control measures (air, water, soil protection).

Requirements of the Act may warrant additional auditing beyond legal compliance. Sorting, processing, and shipping may be an area of focus as end-market conversion rates are a critical element to the value chain and overall recycling rates.

Comparative to desk reviews, on-site audits provide a higher level of confidence in compliance. In-person observations and interviews with personnel may help detect misrepresentations, anomalies, or illegalities. A Harvard Business School Study audited almost 35,000 compliance audits conducted in-person or remotely across global sites from 2019 to 2021 focusing on compliance with some of the most utilized management systems, including the ISO 14001 Environmental Management Systems. The study found that remote or desk audits found 25% less violations on average than in-person audits, suggesting that some violations may only be observable in person.<sup>177</sup>

While efficacy may be improved through on-site audits, there are trade-offs namely efficiency and capacity. On-site audits are more resource-intensive than desk reviews,

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<sup>177</sup> Fitzgerald, Jay. "Some Jobs Can Be Done Well Remotely. Inspecting Isn't One of Them." *Harvard Business School*, 25 Feb. 2025, [www.library.hbs.edu/working-knowledge/some-jobs-can-be-done-well-remotely-inspecting-isnt-one-of-them?](http://www.library.hbs.edu/working-knowledge/some-jobs-can-be-done-well-remotely-inspecting-isnt-one-of-them?) Accessed 16 Dec. 2025.

and this may be compounded depending on who is conducting the audit and where the end-market facilities are located.

## 2.4.6.2 Transparency

End markets' willingness to undergo audits and maintain records — such as permits, chain of custody documentation, material recycling activities, complaints, and enforcement actions — is critical to ensuring that they operate responsibly. Assessing an entity's willingness to be audited is largely about evaluating attitude, cooperation, transparency, and behavior before and during early audit interactions. Four primary ways of evaluating willingness include evaluation of:

- Pre-audit engagement and responsiveness.
- Audit access.
- History of prior audits or certifications.
- Management commitment.

### 2.4.6.2.1 Pre-audit engagement and responsiveness

Understanding an end market's willingness to be audited or maintain records begins in the pre-audit engagement phase. Evaluation of how promptly and completely the facility responds to audit requests, questionnaires, and scheduling communications may indicate their willingness to participate in the process. Timely replies, willingness to schedule planning meetings, and completeness of answers can all indicate whether the end market is supportive and willing to be audited. Additionally, timely, cooperative engagement suggests openness and lower compliance risk. According to the UK's tax and customs authority, HM Revenue and Customs, continued compliance with a cooperative framework is seen as an indicator of lower-risk behavior.<sup>178</sup> Conversely, chronic delays, ignoring requests, repeated rescheduling, or non-answers may indicate unwillingness to be audited or comply.

### 2.4.6.2.2 Audit access

The scope of access granted to auditors by end markets is also a key indicator of an end market's willingness to be audited and maintain records. Openness to providing documents, systems access, staff interviews, and site visits (if applicable) are all indicators of willingness to undergo independent scrutiny and verification. In addition to indicating willingness, these indicators are identified by leading international organizations as critical to ensuring accurate conclusions. ISA 500 audit evidence states that auditors must obtain sufficient, appropriate evidence to draw reasonable conclusions on which to base their opinion; a lack of transparency would make this impossible. Furthermore, the Institute of Internal Auditors describes gathering

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<sup>178</sup> HM Revenue & Customs. "HMRC's Framework for Co-Operative Compliance." *GOV.UK*, 15 Mar. 2024, [www.gov.uk/guidance/hmracs-framework-for-co-operative-compliance?](https://www.gov.uk/guidance/hmracs-framework-for-co-operative-compliance?) Accessed 16 Dec. 2025.

information through audit interviews as an essential part of audit engagement planning and execution, because interviews shape auditors' understanding of the area under audit.<sup>179</sup>

#### **2.4.6.2.3 History of prior audits or certifications**

In lieu of engaging directly with end markets to determine willingness to be audited or maintain records, prior audit and data records could be reviewed. Completion of prior regulatory inspections, third-party audits, and certifications (e.g., ISO 14001 standard for environmental management systems) may indicate a willingness to undergo audits and maintain required records. However, completion of an audit alone may not indicate a willingness to participate. A documented audit history with completed corrective actions may more accurately indicate proactive compliance and willingness to be audited. An article in *Auditing & Accounting* indicates "Management response is a critical component of the audit process, where management acknowledges the audit findings, provides feedback, and outlines corrective actions to address identified issues. A well-crafted management response demonstrates the organization's commitment to accountability, continuous improvement, and effective risk management."<sup>180</sup>

#### **2.4.6.3 Environmental, Public Health, and Worker Safety**

Understanding the impacts of end markets requires systematic assessment across environmental emissions and discharges, public health outcomes, and worker safety practices. Recycling operations provide clear environmental benefits by diverting waste from landfills and reducing raw material extraction, but they also create risks that must be routinely evaluated and mitigated. Consistent with the previous sections, assessment methods can range from desk reviews to third-party database checks to onsite audits. The methods considered and the standards required will vary based on the location of the end market. Since the methods remain consistent, this section focuses on different mechanisms to consider when evaluating environmental impacts, public health outcomes, and workers safety considerations.

##### **2.4.6.3.1 Effects on the Environment**

Development of new environmental impact standards and evaluation is cumbersome and there may be limited regulatory capability to implement a new standard. Instead, it is likely more feasible to utilize existing standards and perform desktop reviews or in-person audits of results.

As previously mentioned, a cursory review of compliance with environmental permits such as air emissions, wastewater discharge, stormwater, and waste handling is an

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<sup>179</sup> "Audit Interviews." *Theiia.org*, 2025, [www.theiia.org/en/products/learning-solutions/on-demand/audit-interviews/](http://www.theiia.org/en/products/learning-solutions/on-demand/audit-interviews/). Accessed 16 Dec. 2025.

<sup>180</sup> Accountancy. "Management Response: Addressing Audit Findings and Driving Organizational Improvement – Auditing Accounting." *Auditingaccounting.com*, 18 Jan. 2025, [auditingaccounting.com/management-response-addressing-audit-findings-and-driving-organizational-improvement](http://auditingaccounting.com/management-response-addressing-audit-findings-and-driving-organizational-improvement). Accessed 16 Dec. 2025.

efficient starting point for evaluation. For example, a domestic plastics end market facility's wastewater discharge reports could be reviewed to confirm pollutant levels remain within permitted limits, and stormwater controls are inspected to prevent pellet loss into nearby waterways. This review lends itself to both desk reviews and on-site audits.

A secondary approach to monitoring could be to use environmental aspect and impact scoring tools that align with the ISO 14001 standard for environmental management systems. "The purpose of this International Standard is to provide organizations with a framework to protect the environment and respond to changing environmental conditions in balance with socio-economic needs."<sup>181</sup> The five primary components of ISO 14001 include developing an environmental policy, planning, implementation, checking, and management review. Again, using existing impact scoring tools and standards aligns well with both desk reviews and in-person audits.

An additional, albeit more labor-intensive approach, would be on-site environmental inspections. On-site inspections could range from a walk-through of operational areas to active onsite monitoring. In a walk-through, inspectors could observe outdoor storage areas to assess whether runoff controls prevent plastic fragments or metals from entering soil or surface waters. On-site monitoring would require even further resources and could include:

- Air monitoring for dust, VOCs, and particulate matter.
- Water sampling of process water, stormwater, and groundwater.
- Soil sampling in high-risk areas.
- Waste assessments to determine materials diverted versus those sent for disposal.
- The level of inspection, whether a desk review or in-person inspection, will be heavily influenced by the definition of responsible end markets and the location of these end markets.

#### **2.4.6.3.2 Public Health**

Assessing public health effects from end markets extends beyond measuring environmental emissions, it integrates community exposure and health risk assessment methods. Similar to assessing impacts on the environment, health risk assessments may be evaluated using existing frameworks such as a Health Impact Assessment (HIA). According to the World Health Organization, "Health impact assessment is a practical approach used to systematically judge the potential health effects of a policy, strategy, plan, program, or project on a population, particularly on vulnerable or

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<sup>181</sup> *Iso.org*, 2025, [www.iso.org/obp/ui/#iso:std:iso:14001:ed-3:v1:en:~:text=The%20purpose%20of%20this%20International](http://www.iso.org/obp/ui/#iso:std:iso:14001:ed-3:v1:en:~:text=The%20purpose%20of%20this%20International). Accessed 16 Dec. 2025.

disadvantaged groups.”<sup>182</sup> The primary elements of HIAs include baseline health data, community demographics, exposure modeling, and stakeholder input. HIAs have been applied to waste management systems and can be adapted for end markets to weigh risks and benefits across scenarios.

#### 2.4.6.3.3 Worker Health & Safety and Corporate Violations

Similar to other aspects of evaluating end markets, worker health and safety may be easier to monitor domestically through existing databases and desktop reviews. Readily available domestic databases include:

- **Occupational Safety and Health Administration (OSHA) Database:** Records of inspections, violations, and enforcement actions related to worker health and safety standards.<sup>183</sup>
- **Good Jobs First Violation Tracker:** Database aggregating information on environmental, health, and safety violations, as well as financial offenses, record-keeping, and licensing issues.<sup>184</sup>
- **State-Level Databases (e.g., California):**
  - **Department of Industrial Relations:** Public data on labor law violations.<sup>185</sup>
  - **Secretary of State Business Search:** Enables verification of corporate status and access to business entity documents.<sup>186</sup>

International markets may require additional resources as data may not be readily available based on the end market location. Effective monitoring of worker safety could include many elements and can start with identification of an occupational health and safety management plan. Internationally, the ISO 45001 standard could be utilized to evaluate whether the end market has a functioning management system. However, identification of a management system is likely insufficient to document ongoing compliance. Utilization of on-site verification or worker-centered incident data may be more robust mechanisms for monitoring worker safety. In lieu of ISO 45001, there also are other internationally recognized standards such as the International Finance

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<sup>182</sup> World Health Organization. “Health Impact Assessment.” *Www.who.int*, 2022, [www.who.int/health-topics/health-impact-assessment#tab=tab\\_1](http://www.who.int/health-topics/health-impact-assessment#tab=tab_1).

<sup>183</sup> US Department of Labor. “Occupational Safety and Health Administration Establishment Search.” *OSHA.gov*, [www.osha.gov/ords/imis/establishment.html](http://www.osha.gov/ords/imis/establishment.html).

<sup>184</sup> Good Jobs First. “Violation Tracker.” *Www.goodjobsfirst.org*, [violationtracker.goodjobsfirst.org/](http://violationtracker.goodjobsfirst.org/).

<sup>185</sup> Department of Industrial Relations. “Judgement Search.” *Ca.gov*, [cadir.my.site.com/s](http://cadir.my.site.com/s).

<sup>186</sup> California Secretary of State. “Business Search.” *Ca.gov*, [bizfileonline.sos.ca.gov/search/business](http://bizfileonline.sos.ca.gov/search/business).

Corporation's environmental, health, and safety guidelines for waste management facilities.

#### 2.4.6.4 Conversion Efficiency

Assessment of conversion efficiency of covered materials specifically poses a significant challenge. Because end markets receive materials in bales that include both covered and noncovered materials, assessing the recovery of covered materials may be difficult. End market conversion rates are often calculated using mass balance analysis comparing total inbound material weight to outbound products, residues, and losses over a defined period of time. Similar to the inbound bale limitations, this analysis would not provide enough granularity to determine end-market conversion rates for covered materials separately from other materials accepted at the end market.

A more granular approach to determining conversion is to use yield or recovery rate calculations, which calculate the percentage of specific input materials converted into saleable recycled output. In order for this approach to provide sufficient granularity and data, it could require that covered materials are:

- Processed separately to establish the conversion rate separately from noncovered materials.
- Paired with composition studies of inbound materials, materials recovered, and residue. AI could potentially be used to assist with this approach.
- These approaches may introduce operational inefficiencies or disruptions; therefore, it may be beneficial to establish a specified cadence for yield calculations or a certification program that verifies conversion rates on a periodic basis. There are a wide variety of certification programs for noncovered materials that could be adapted to fit the needs of establishing the conversion rate. For example, the city of Los Angeles and the Central Contra Costa Solid Waste Management Authority have certification programs for construction and demolition recyclers. Although these facilities are largely not accepting covered materials, the program framework and administration practices could be leveraged with more specific updates to sampling protocols.

# Abbreviations and Acronyms

Abbreviation	Description
AAMC	Association of American Medical Colleges
AB	Assembly Bill
AB 341	Mandatory Commercial Recycling (Assembly Bill 341)
AB 1826	Mandatory Commercial Organics Recycling (Assembly Bill 1826)
AI	Artificial Intelligence
APR	Association of Plastic Recyclers
BMPs	Best Management Practices
CARB	California Air Resources Board
CBO	Community-Based Organization
CBSM	Community-Based Social Marketing
CDC	The U.S. Center for Disease Control
CDFA	California Department of Food and Agriculture
CEQA	California Environmental Quality Act
CMC	Covered Material Category
CPEM	Collection, Processing, and End Markets
CRV	California Redemption Value
DEQ	Oregon Department of Environmental Quality
DTSC	Department of Toxic Substances Control
EJ	Environmental Justice
EPR	Extended Producer Responsibility
GHGs	Greenhouse Gases
HF&H	HF&H Consultants, LLC
ISRI	Institute of Scrap Recycling Industries
JPA	Joint Powers Association
LDPE	Low-Density Polyethylene
MRF	Material Recovery Facility
MRSC	Municipal Research and Services Center
MWP	Mixed Waste Processing
NOP	National Organics Program
NO <sub>x</sub>	Nitrogen Oxides
OCC	Old Corrugated Cardboard

<b>Abbreviation</b>	<b>Description</b>
OPF	Organics Processing Facility
PCR	Post-Consumer Recycled
PE&O	Public Education and Outreach
PET	Polyethylene Terephthalate
PHEC	Public Health, Environment, and Community
PM	Particulate Matter
PP	Polypropylene
PPE	Personal Protective Equipment
PRC	Public Resources Code (California Statute)
PRE	Plastics Recyclers Europe
PS	Polystyrene
PVC	Polyvinyl Chloride
ReMA	Recycled Materials Association
ROG	Reactive Organic Gases
SB	Senate Bill
SB 54	Senate Bill 54 (Allen, 2022)
SB 613	Senate Bill 613 (Seyarto, 2023)
SB 1383	Senate Bill 1383 (Lara, 2016)
SWFP	Solid Waste Facility Permits
TPH	Tons Per Hour
USDA	U.S. Department of Agriculture

# Glossary of Terms

Term	Description
Alternative Collection	A program that collects materials that may be covered materials and is not curbside collection (e.g., mail-back, third-party drop-off, retail take-back, buy-back, home-pickup).
Back-Haul	Generating and transporting solid waste, materials collected for recycling, or materials collected for organics recycling to a destination owned and operated by the generator using the generator's own employees and equipment.
Beverage Container Recycling Program	CalRecycle administers the California Beverage Container Recycling & Litter Reduction Program ( <a href="#">BCRP</a> ) in which consumers pay a refundable deposit every time they purchase an included beverage and then receive – California Refund Value (CRV) – when they return the empty container to a certified recycling center, registered dealer cooperative, or participating retail location. Californians may instead choose to forfeit their deposit by donating beverage containers to certified community service programs, or giving them to a registered curbside or certified drop-off or collection program for recycling.
Bin	A collection container with a capacity of 1 to 8 cubic yards (200 to 1,600 gallons) and a hinged lid. Bins may or may not have wheels. Typical bin volumes may vary by local jurisdiction.
Cart	A plastic collection container with a hinged lid and wheels with varying capacities ranging, typically, from 10 to 100 gallons. Typical cart volumes may vary by local jurisdiction.
Census Tract	Small, relatively permanent statistical subdivisions of a county or statistically equivalent entity. The primary purpose of census tracts is to provide a stable set of geographic units for the presentation of statistical data. Census tracts generally have a population size between 1,200 and 8,000 people, with an optimum size of 4,000 people. A census tract usually covers a contiguous area; however, the spatial size of census tracts varies widely depending on the density of settlement.
Collect, Collected, or Collection	The act of removing discarded materials from the place of generation within a region and delivering such materials to a facility for processing or disposal.

Term	Description
Collection Program	Refers to curbside single-family, multi-family, and commercial, as well as noncurbside options, such as residential and commercial drop-off, take-back, public space collection, and other options for the collection of covered materials. Depending on the collection program, single family, multifamily, and commercial sources may be mixed (e.g., a single recycling service provider route may pick up curbside materials collected for recycling from both commercial and multifamily locations). The definitions of single family, multifamily, and commercial may also differ among collection programs.
Commercial	Of, from, or pertaining to nonresidential premises where business activity is conducted, including but not limited to retail sales, services, wholesale operations, institutions, manufacturing and industrial operations, and including hotels, motels, and other similar premises, and any and all facilities operated by governmental entities, but excluding businesses conducted upon premises that are permitted under applicable zoning regulations and are not the primary use of the property.
Community-Based Organization (CBO)	Refers to a public or private nonprofit organization of demonstrated effectiveness that: <ol style="list-style-type: none"> <li>1. Has deployed projects and/or outreach efforts within the region of one or more impacted priority populations in the state.</li> <li>2. Has an official mission and vision statements that expressly identify serving priority populations (e.g., disadvantaged communities, low-income communities, and/or communities in rural areas).</li> <li>3. Currently employs staff member(s) who specialize in and are dedicated to diversity, equity, or inclusion, or is a 501(c)(3) non-profit.</li> </ol>
Compactor	A mechanical apparatus that compresses materials to reduce their volume.
Composting	The controlled biological decomposition of organic solid wastes that are source-separated from the municipal solid waste stream, or which are separated at a processing facility.
Collection Container	A receptacle for temporary storage of solid waste, materials collected for recycling, or materials collected for organics recycling. Collection containers include but are not limited to bins, carts, compactors, and roll off boxes.

Term	Description
Contamination	<p>Contamination includes material that is not intended to be recycled but ends up in the recycling stream. Contamination may include materials intentionally included in a product that are removed throughout the recycling process as well as materials that incidentally or accidentally end up in the recycling stream or end up in the incorrect recycling stream. Contamination may also include materials that are deleterious to facilities or consumers. Contamination may refer to various situations and materials:</p> <ul style="list-style-type: none"> <li>• A material that a collection program does not accept.</li> <li>• A material that a receiving processing facility or end market does not accept or is not designed, permitted, or authorized to recycle.</li> <li>• A material that a receiving processing facility or end market accepts but is destined for disposal.</li> </ul>
CMC Conversion Rate (%)	The percent of covered material that is accepted by end markets and effectively converted into a recycled product to be used in lieu of virgin material. It is inclusive of both the end market acceptance and end market recovery.
Covered Material	<p>The Act applies to “covered material,” which PRC section 42041(e) defines as:</p> <p>Single-use packaging [PRC section 42041(e)(1)(A)] that is routinely recycled, disposed of, or discarded after its contents have been used or unpackaged, and typically not refilled or otherwise reused by the producer.</p> <p>Plastic single-use food service ware [PRC section 42041(e)(1)(B)], including but not limited to plastic coated paper or plastic-coated paperboard, paper or paperboard with plastic intentionally added during the manufacturing process, and multilayer flexible material.</p>
Covered Material Category (CMC)	A category that includes covered material of a similar type and form, as determined by the department [PRC section 42041(f)]. This report uses the CMCs that CalRecycle published on July 1, 2024. The list and other supplementary material can be found at <a href="https://calrecycle.ca.gov/packaging/packaging-epr/cmclist/">https://calrecycle.ca.gov/packaging/packaging-epr/cmclist/</a> .
Covered Material Category Group (CMC End Market Group)	A group that includes Covered Material Categories, as determined by the contractor for the purposes of this contract. See the Current State of End Markets Report for further details on groupings.
Covered Material Category Collection Group (CMC Collection Group)	A group that includes related CMCs, as determined by the contractor for the purposes of this contract. See the Current State of Collection Report for further details on groupings.

Term	Description
Covered Material Category Processing Group (CMC Processing Group)	A group that includes CMCs, as determined by the contractor for the purposes of this contract. See the Current State of Processing Report for further details on groupings.
CRV Materials	See definition for Beverage Container Recycling Program.
Curbside Collection (or Curbside)	A program that includes the collection of material, including but not limited to, covered materials, by a local jurisdiction or recycling (including composting) service provider under contract with a local jurisdiction (PRC section 42041(g)).
Customer	The person whom a local jurisdiction or their recycling service provider(s) submits its billing invoice to and collects payment from for collection services provided to a premises. The customer may be the occupant, owner, or manager of the premises.
Discarded Materials	Materials placed by a generator in a receptacle to be collected and managed by a local jurisdiction or a recycling service provider as part of the local jurisdiction's curbside collection programs.
Disposal (of Covered Materials)	<p>Material landfilled, used for alternative daily cover (Title 27, California Code of Regulations (CCR), section 20690), used for alternative intermediate cover (Title 27, CCR, section 20700), combusted, incinerated, used for energy generation, or used for fuel production, except for anaerobic digestion of source-separated organic materials.</p> <p>Material that does not enter the managed disposal system or is lost from the recycling and waste management system through open burning, illegal dumping, or other forms of leakage.</p>
Disposed Of	Material sent to any activity meeting the definition of disposal, such as landfill or incineration.

Term	Description
End Market	<p>For material sent to a composting or in-vessel digestion facility for the creation of compost, digestate, or biogas, the end market is that facility.</p> <p>For other material, the end market is the entity that converts the material into feedstock to be used in lieu of virgin material to produce new or reconstituted products. Example end markets include:</p> <ul style="list-style-type: none"> <li>• Glass: A beneficiation plant that produces cullet.</li> <li>• Metal: An entity that smelts metal to produce ingots, sheets, or coils.</li> <li>• Paper: A beneficiation plant that repulps material into a pulp product.</li> <li>• Wood: An entity that chips and grinds wood material.</li> <li>• Plastic: An entity that creates plastic pellet.</li> </ul>
Exclusive	Refers to a type of agreement or service arrangement between a local jurisdiction and a recycling service provider for solid waste handling services in which the recycling service provider has the sole or exclusive right to collect designated material(s) within the local jurisdiction or designated part(s) of a local jurisdiction.
Food Waste	A subset of organic waste including: food scraps (discarded food that will decompose and/or putrefy including: [i] all kitchen and table food; [ii] animal or vegetable waste that is generated during or results from the storage, preparation, cooking or handling of food stuffs; [iii] fruit waste, grain waste, dairy waste, meat, and fish waste; and [iv] vegetable trimmings, houseplant trimmings, and other organic waste common to the occupancy of residential dwellings and some commercial kitchen operations).
Franchise Service	A type of agreement or service arrangement in which a recycling service provider may conduct collection services in a local jurisdiction, as memorialized in a franchise agreement between the local jurisdiction and recycling service provider. Franchise service may be exclusive or nonexclusive.
Kraft Paper	Stiff, sturdy paper derived from wood pulp, usually brown but can be white or colored.
Landfill Stream	Solid waste that is accepted by a local jurisdiction for collection, transfer (if applicable), and transport to a disposal facility. The exact list of solid waste accepted for collection in the landfill stream varies by local jurisdiction and is therefore not specifically listed herein. This does not include disaster debris or designated waste sent to landfill.

Term	Description
Leakage	Refers to the loss of materials from various stages of the recycling and waste management process, such as during collection, transportation, sorting, or processing. Leakage results in these materials failing to reach the intended collection, processing, end market, or disposal facilities.
Local Jurisdiction	A city, county, city and county, regional agency formed pursuant to Chapter 5 (commencing with section 6500) of Division 7 of Title 1 of the Government Code or Article 3 (commencing with section 40970) of Chapter 1 of Part 2, or special district that provides solid waste collection services (PRC 42041(m)).
Materials Collected for Organics Recycling	Organic waste that is accepted by a local jurisdiction for collection, transfer (if applicable), and transport to a facility(ies) for composting, anaerobic digestion, or other organic waste processing permitted under applicable law. The exact list of materials collected for organics recycling will vary by local jurisdiction and is therefore not specifically listed herein.
Materials Collected for Recycling	Materials accepted by a local jurisdiction for collection, transfer (if applicable), and transport to a facility(ies) for recycling, in accordance with applicable law. The exact list of recyclable materials accepted for collection will vary by local jurisdiction and is therefore not specifically listed herein. For the purposes of this report, materials collected for recycling do not include organic waste intended for composting or in-vessel digestion.
Material Recovery Facility (MRF)	A permitted solid waste facility that sorts or separates mixed waste, solid waste, or materials collected for recycling for the purpose of recycling or composting.
Mixed Waste	Solid waste that includes landfill stream material and may additionally be combined with materials collected for recycling and/or materials collected for organics recycling. The exact list of mixed waste accepted for collection will vary by local jurisdiction and is therefore not specifically listed herein.
Mixed Waste Processing (MWP)	A permitted solid waste facility that sorts or separates mixed waste for the purpose of recycling or composting.
Multifamily	Of, from, or pertaining to residential premises with five or more dwelling units. Multifamily premises do not include hotels, motels, or other transient occupancy facilities, which are considered commercial businesses.
Natural/Clear	Referring to glass or plastic, without coloring.

Term	Description
Nonexclusive	A type of agreement or service arrangement between a local jurisdiction and a recycling service provider for solid waste handling services in which the recycling service provider does not have the exclusive right to collect materials within the local jurisdiction or a designated part of a local jurisdiction.
Organic Waste	Solid wastes containing material originated from living organisms and their metabolic waste products, including but not limited to food, green material, landscape and pruning waste, organic textiles and carpets, lumber, wood, paper products, printing and writing paper, manure, biosolids, digestate, and sludges. Not all organic waste is collected in collection containers for organics recycling.
Packaging	<p>PRC section 42041(s): means any separable and distinct material component used for the containment, protection, handling, delivery, or presentation of goods by the producer for the user or consumer, ranging from raw materials to processed goods.</p> <p>“Packaging” includes, but is not limited to, all of the following:</p> <p>(1) Sales packaging or primary packaging intended to provide the user or consumer the individual serving or unit of the product and most closely containing the product, food, or beverage.</p> <p>(2) Grouped packaging or secondary packaging intended to bundle, sell in bulk, brand, or display the product.</p> <p>(3) Transport packaging or tertiary packaging intended to protect the product during transport.</p> <p>(4) Packaging components and ancillary elements integrated into packaging, including ancillary elements directly hung onto or attached to a product and that perform a packaging function, except both of the following:</p> <p>(A) An element of the packaging or food service ware with a de minimis weight or volume, which is not an independent plastic component, as determined by the department.</p> <p>(B) A component or element that is an integral part of the product, if all components or elements of the product are intended to be consumed or disposed of together.</p>
Paper	A material made from cellulose pulp derived mainly from wood, for the creation of consumer products.
Paperboard	A thicker paper material used for the production of packaging containers, such as folding cartons, paper cups, and coated boards.

Term	Description
Permitted Service	A type of agreement or service arrangement in which a recycling service provider may conduct specified collection services in a local jurisdiction, provided that the recycling service provider has received a permit from the local jurisdiction.
Person	An individual, firm, limited liability company, association, partnership, public or private corporation, or any other legal entity.
Plastic	PRC section 42041(t): means a synthetic or semisynthetic material chemically synthesized by the polymerization of organic substances.... “Plastic” includes, without limitation, polyethylene terephthalate (PET), high-density polyethylene (HDPE), polyvinyl chloride (PVC), low-density polyethylene (LDPE), polypropylene (PP), polystyrene (PS), polylactic acid (PLA), and aliphatic biopolyesters, such as polyhydroxyalkanoate (PHA) and polyhydroxybutyrate (PHB). “Plastic” does not include natural rubber or naturally occurring polymers such as proteins or starches.
Plastic Component	PRC section 42041(u): Plastic component means any single piece of covered material made partially or entirely of plastic. A plastic component may constitute the entirety of the covered material or a separate or separable piece of the covered material.
Plastic Covered Material	Plastic covered material includes any item of covered material with a plastic component.
Priority Populations	Disadvantaged communities, low-income communities, communities in rural areas, and Tribes.
Processing	To sort, segregate, break or flake, and clean material to prepare it to meet the specification for sale to a responsible end market (PRC section 42041(v)).
Processing Facility	Any facility that engages in the statutory definition of processing (PRC section 42041(v)).

Term	Description
Producer	<p>A person who manufactures a product that uses covered material and who owns or is the licensee of the brand or trademark under which the product is used in a commercial enterprise, sold, offered for sale, or distributed in the state (PRC section 42041(w)(1)).</p> <p>If there is no person in the state who is the producer for purposes of paragraph (1), the producer of the covered material is the owner or, if the owner is not in the state, the exclusive licensee of a brand or trademark under which the covered product using the covered material is used in a commercial enterprise, sold, offered for sale, or distributed in the state. For purposes of this subdivision, a licensee is a person holding the exclusive right to use a trademark or brand in the state in connection with the manufacture, sale, or distribution of the product packaged in or made from the covered material (PRC section 42041(w)(2)).</p> <p>If there is no person in the state who is the producer for purposes of paragraph (1) or (2), the producer of the covered material is the person who sells, offers for sale, or distributes the product that uses the covered material in or into the state (PRC section 42041(w)(3)).</p> <p>“Producer” does not include a person who produces, harvests, and packages an agricultural commodity on the site where the agricultural commodity was grown or raised (PRC section 42041(w)(4)).</p> <p>For purposes of this chapter, the sale of covered materials shall be deemed to occur in the state if the covered materials are delivered to the purchaser in the state (PRC section 42041(w)(5)).</p>
Producer Responsibility Organization (PRO)	<p>An organization that is exempt from taxation under section 501(c)(3) of the federal Internal Revenue Code of 1986 and is formed for the purpose of implementing a plan to meet the requirements of this chapter (PRC section 42041(x)).</p>
Recycled Organic Product	<p>Digestate used for land application, biogas, and compost produced by a process that meets the definition of recycling.</p>

Term	Description
Recycling	PRC section 42041(aa) defines recycle or recycling as the process of collecting, sorting, cleansing, treating, and reconstituting materials that would otherwise ultimately be disposed of onto land or into water or the atmosphere, and returning them to, or maintaining them within, the economic mainstream in the form of recovered material for new, reused, or reconstituted products, including compost, that meet the quality standards necessary to be used in the marketplace. Recycling does not include combustion, incineration, energy generation, fuel production (except for the anaerobic digestion of source-separated organic materials), or other forms of disposal. For material to be considered recycled, it must be sent to a responsible end market (PRC section 42041(aa)(3)).
Recycled Organic Product	Digestate used for land application, biogas, and compost produced by a process that meets the definition of recycling.
Recycling Rate	Weight of material recycled / (weight of material recycled plus weight of material disposed of).
Recycling Service Provider (RSP)	A solid waste enterprise that provides solid waste handling services on behalf of a local jurisdiction (PRC section 42041(ac)).
Region or Regional	Mutually exclusive and collectively exhaustive geographic areas of the state as determined by CalRecycle's Agreement DRR24043 and Statewide Waste Characterization Study. There are five distinct regions: Bay Area, Coastal, Mountain, Southern, and Valley (regions). A map and further description of each unique region is included in the methodology section of this report.
Residential	Of, from, or pertaining to single-family dwellings and multi-family dwellings used for human shelter, irrespective of whether such dwelling units are rental units or are owner-occupied, excluding hotels, motels, or other similar premises.
Responsible End Market	A materials market in which the recycling and recovery of materials or the disposal of contaminants is conducted in a way that benefits the environment and minimizes risks to public health and worker health and safety (PRC section 42041(ad)).
Roll Off Box	An open top collection container with a capacity, typically, of 8 to 40 cubic yards that is serviced by a roll-off collection vehicle (Typical roll off box volumes may vary by local jurisdiction).
Secondary Packaging	Grouped packaging or secondary packaging intended to bundle, sell in bulk, brand, or display the product. (See the definition of packaging.)

Term	Description
Self-Hauler or Self Haul	A person who transports solid waste, organic waste, materials collected for recycling, or recovered material they have generated to another person. Self-hauler also includes a person who back hauls waste.
Single Family	Of, from, or pertaining to a residential premises with less than five units.
Single-Use Packaging	Packaging that is routinely recycled, disposed of, or discarded after its contents have been used or unpackaged, and typically not refilled or otherwise reused by the producer (See the definition of covered material).
Solid Waste	Means and refers to the definition of “solid waste” in PRC section 40191, as it may be amended or superseded from time to time.
Source Separated	The generator segregated the discarded materials into separate collection containers for collection by the recycling service provider, such that all solid waste was placed in a solid waste collection container, all materials collected for recycling were placed in a collection container for recycling, and all organic materials were placed in a collection container for organics recycling.
The Act	Refers to The Plastic Pollution Prevention and Packaging Producer Responsibility Act (The Act, Senate Bill 54, Allen, Chapter 75, Statutes of 2022).
Technical Assistance	A form of education and outreach conducted by a local jurisdiction, or their recycling service provider or designee, that typically involves direct contact with generators (e.g., on site visits, phone calls, or video calls) for purposes, such as general education, trainings, waste assessments, compliance support, service level adjustments, or other outreach.
Thermoform	A manufacturing process where a plastic sheet is heated to a pliable forming temperature, formed to a specific shape in a mold, and trimmed to create a usable product. The sheet, or ‘film’ when referring to thinner gauges and certain material types, is heated in an oven to a high enough temperature that permits it to be stretched into or onto a mold and cooled to a finished shape.
Yard Trimmings	A subset of organic waste including grass, lawn clippings, shrubs, plants, weeds, branches, and other forms of organic waste generated from landscapes, yards, or gardens.
White Paper	Generally, refers to white or cream-colored paper packaging recovered from offices, homes, schools, and other sources (e.g., white envelopes).

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