Recycling Composition Studies Raise the Bar on Residential Waste Programs

Waste characterization data turns into information that helps plan how to reduce waste and contamination, set up recycling programs, and conserve money and resources. The process helps communities refine programs to achieve more valuable efficiencies and positively affect our environment.



Composition studies support more efficient municipal and state recycling programs. Photo courtesy of Miami-Dade County.

CHINA'S 2018 BAN ON IMPORTED RECYCLABLE materials rang clear as a wakeup call: communities must pay close attention to what materials residents put in their blue bins to confirm material processors desire them and that they are free of contaminants that could impact the desired materials. Recycling composition studies are proving to be powerful tools in reaching this objective. But these granular, customized analyses provide benefits beyond identifying and helping curb contamination—especially as jurisdictions set ambitious diversion and recycling targets.

Waste and recycling composition data can present a realistic picture of disposal and recovery outcomes. This insight can inform actionable strategies to improve collection programs' efficiency and economics. "These studies are instrumental in identifying new diversion opportunities. They can help identify key zero-waste programs and policy opportunities; understand the feasibility of alternative disposal technologies; and when done at regular intervals, they can be used to measure progress towards waste reduction and recycling goals so communities can see what is working and where they can do even better," says Brent Dieleman, a project manager in SCS Engineers' Sustainable Materials Management practice and a TRUE advisor (certified in Zero Waste practices).

Miami-Dade County, FL Works Hard to Understand Collection

With 2,763,366 residents, Miami-Dade County works hard to stay on top of curbside contamination and introduce cost-effective efficiencies. The County's Department of Solid Waste Management routinely performs recyclable material composition studies to understand the performance of its residential collection program and how it has changed over time. The study results help inform messaging to residents about how to recycle properly and provide guidance to maximize the recovery of materials accepted as part of its program. The data has also proved useful in negotiating the County's multi-year material processing contract and helping meet greenhouse gas reduction goals that are sustainable. Miami-Dade County recently completed a study of source-separated recyclable materials from single-family and multi-family homes (four-units and smaller) designed to accomplish several goals:

1. Identify and quantify non-contract materials contaminating the recycling streams
2. Understand what materials the processing contractor ordinarily accepts but have become contaminated in the collection process
3. Recognize materials not accepted as part of the current recycling program that could potentially become integrated

"We gathered data specific to three county zones to be able to tailor strategies to improve collections in each zone and to customize recycling messages based on behaviors in each community," says

Dr. Ravi Kadambala, Division Director at the Miami-Dade County Department of Solid Waste Management.

The latest recycling composition study for Miami-Dade County in 2023 showed that the recycling contamination rate was lower by 9 percent compared to the previous study in 2020. This showed the effectiveness of the latest marketing campaign. It also allowed the county to renegotiate lower recycling processing fees with the contractor. The revised recycling processing fee was lower by 11.5 dollars per ton of recyclables, thus lowering the recycling cost by a few million dollars over the life of the contract.

With the analysis complete, Dr. Kadambala and his team now know they can further reduce contamination through three behavior changes:

1. Getting residents to empty and clean dirty packaging before placing it in the recycling bin
2. Having residents place materials loosely rather than in bags
3. Having them place only accepted recyclables in the bin

"That's a huge difference we can achieve just by educating residents to take three fairly simple actions. Ultimately, we can lower the recycling cost while capturing and capitalizing on more materials," he says.

Dr. Kadambala and Dieleman see more opportunities for operational efficiencies. "We are finding a fair amount of plastics #1-7 non-bottles in the recycling stream (such as yogurt containers and clam shells for produce), so it's in our interest to see if our processor can recycle these materials," says Dr. Kadambala.

The scope of material composition studies has grown as material packaging evolves and as jurisdictions expand programs to include organics and other source-separated materials.

For instance, today's comprehensive analyses explore streams and opportunities beyond recovery at the curbside, including a deep dive into the effectiveness of processing technologies at materials recovery facilities (MRFs).

"We want to understand how efficiently these facilities recover what they are designed to capture to inform operational improvements. Further, material studies serve as a tool to structure contracts that benefit both the MRF and the community, enabling them to work together to maximize the recovery of valuable commodities," Dieleman says.

ReGen Monterey Uses Characterization Data Strategically Across Multiple Cities

ReGen Monterey is the waste management district serving the Monterey region's cities of Carmel-by-the-Sea, Del Rey Oaks, Marina, Monterey, Pacific Grove, Sand City, Seaside, and the unincorporated areas of Big Sur, Carmel Highlands, Carmel Valley, Castroville, Corral de Tierra, Laguna Seca, Moss Landing, Pebble Beach, San Benancio, and Toro Park in the Bay Area of California. ReGen's recycling facility serves approximately 170,000 people. ReGen Monterey contracted with SCS Engineers to conduct single-stream recycling characterization studies annually from 2018 through 2021.

"We wanted to have a scientific method, performed consistently over an extended timeframe, to understand the magnitude and composition of contamination in our single-stream recycling operation. We used the data to set customer charges based on contamination levels," says Felipe Melchor, General Manager of ReGen Monterey.

In addition to processing fees, the agency implemented a $65/ton fee for contamination above 10 percent in July 2019. While contamination remained high during the pandemic shutdowns, it dropped substantially in 2021. Other factors, including increased commodity prices, proved enough to eliminate the processing fee in June 2022.

ReGen Monterey also launched an educational campaign and tweaked earlier messaging to target materials the study identified as problematic, including a surprisingly high volume of leather and textiles as well as plastic film.

The community outreach and education campaign had a simple headline: "Recyclable?" accompanied by a graphic of an arrow pointing to an image with clear-cut verbiage: either "Yep" or Nope." This tailored campaign was even further customized at the pandemic's height to direct masks, sanitizer bottles, and other items now inundating the stream to the right place.

As part of its strategy, ReGen Monterey also installed a $3M MRF upgrade, complete with optical sorters and an OCC (Old Corrugated Cardboard) screen to document missed California Redemption Value (CRV) containers on the residual line and possibly tweak upstream processes to boost recovery.

"The study helped us prove justification for this expensive upgrade. Being able to document our case was critical as we had to propose the investment to the ReGen Monterey Board of Directors and let them know why we are targeting these materials," Melchor says.

"We want to build on the knowledge we have gained, so in 2023, we commissioned another study to learn the feasibility of diverting additional materials that the community currently throws in the trash through recycling or composting. We are awaiting results to fully capitalize on these valuable commodities while keeping our costs down and ultimately passing savings to ratepayers," Melchor says.

Statewide and National Benefits in Wisconsin

While local jurisdictions like Monterey and Miami-Dade have reaped multiple benefits, recycling composition and waste characterization studies support statewide and national efforts, too. The Wisconsin Department of Natural Resources (DNR) has completed several analyses to gauge how various state initiatives are working

to improve waste management operations and to justify policies and programs.

The agency's most recent study—conducted in 2021—cast a wide net, capturing collection points representing 72 percent of Wisconsin's MSW stream and covering all state regions. A primary project result was learning about organic waste going to landfills. Wisconsin is now focusing on work to halve per-capita food waste disposed of in landfills by 2030. "It's easier to make a strong policy case for our waste diversion programs when we have data. Using those numbers also helps to model greenhouse gas emissions generated in landfills," says Kate Strom Hiorns, Wisconsin Department of Natural Resources Recycling and Solid Waste Section Manager.

The latest study uncovered an uptick in landfilled organics, the largest percentage of the stream at about 30 percent, with edible food discards accounting for 14.5 percent. With this understanding, Wisconsin DNR opted to use an EPA grant to understand existing food waste prevention and reduction efforts and opportunities for reducing waste food and increasing the recovery of food scraps in an effort to reduce environmental impacts associated with food loss and waste while improving food security. The grant-funded work will focus on gaining knowledge about existing organics and food scrap collection and processing infrastructure to identify where and how to improve and where expansions are needed.

Wisconsin DNR oversees an electronics recycling program, E-Cycle Wisconsin, and consecutive characterization studies served well in guiding messaging to increase residents' awareness of statewide collection sites and to assess how the program was doing. The 2021 study found 16,729 tons fewer televisions landfilled than in 2009, providing a sound case for legislation later implemented that created a grant to establish new collection sites. "Through these analyses, we can show programs like this can and do truly make a difference," Strom Hiorns says. "We want to do these studies more regularly to look at changes over time and for the knowledge to continually strengthen and improve outcomes of Wisconsin's waste management operations."

Waste Characterization Returns

Waste characterization data turns into information that helps plan how to reduce waste and contamination, set up recycling programs, and conserve money and resources. Essentially, these benefits will reduce greenhouse gas emissions and help communities work toward achieving climate change goals. The periodic process helps communities refine programs to achieve more valuable efficiencies and positively affect our environment. **|WA**

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