

## MATERIALS PROCESSING

Results of a recent study comparing collection methods suggest the true cost of single-stream recycling lies in subsequent materials processing.



by the  
staff of  
Eureka  
Recycling



# DOWNSTREAM OF SINGLE-STREAM

**S**ingle-stream recycling collection — in which all residential recyclables, including cans, glass, plastic and paper, are combined and collected together — is rapidly drawing the attention of community recycling program managers. Supporters of single-stream service argue this collection method is easier for residents and allows haulers to use standard garbage trucks, leading to higher diversion rates and improved efficiency. Opponents of single-stream, on the other hand, point out drawbacks in the processing and marketing of materials. Program managers considering the implementation of a single-stream system need information about how the collection method affects the entire recycling process in order to make the best decisions.

A May 2002 study by Eureka Recycling, a nonprofit organization that manages the recycling program for St. Paul, Minnesota, takes a closer look at collection methods, evaluating them with regard to overall environmental impact, cost, convenience and resident satisfaction. The report, *A Comparative Analysis of Applied Recycling Collection*

*Methods*, outlines the 14-month study's conclusions about the results of five different collection methods. The collection methods examined in the study differ from each other in frequency of pickup, container size and sort method. Specifically, the study compares the current biweekly source-separated collection in bins with biweekly two-stream collection in carts, bi-weekly two-stream collection in bins, weekly two-stream collection in bins plus organics, and biweekly single-stream collection in carts.

The study recommends that the city move from its current source-separated collection (in which residents sort materials at the curb into separate categories, except for plastic bottles, for biweekly collection) to a two-stream recycling system in which materials are collected in bins on a weekly basis, with the gradual implementation of weekly collection of organics in carts. Although the results of the study are specific to St. Paul, some conclu-

sions may be valid in other communities. In the following analysis of the study results, Eureka Recycling reveals some surprising insights about the assumptions that have been made about various collection methods — particularly single-stream — and their effects on quality and quantity of the materials collected.

### **It's not the sort, it's the capacity**

A common argument in favor of single-stream collection is that resident participation will rise once the necessity of sorting is eliminated. Eureka Recycling's study tested this assumption and discovered that residents in St. Paul did not respond as expected to a simpler sort method. Container capacity, not less sorting, was the significant factor in determining the amount of materials set out at the curb.

Two-stream collection in 18-gallon bins picked up on a weekly basis offered residents more storage capacity than any other system

Eureka Recycling (St. Paul, Minnesota) is a nonprofit organization that specializes in recycling and waste reduction services, programs, education and advocacy. Its staff can be reached at (651) 222-7678 or [info@eurekarecycling.org](mailto:info@eurekarecycling.org).

— a total of 72 gallons over a two-week period. Two-stream biweekly collection in 35-gallon carts was similar, offering a total of 70 gallons of space. In comparison, the single-stream segment of the study provided each household with one 64-gallon cart, in which all recyclables were combined for biweekly collection. Two-stream biweekly collection in bins and source-separated biweekly collection in bins offered 36 gallons of capacity.

The greatest gains in material collected came in the two-stream systems in which capacity was the greatest: a 32.8 percent increase for biweekly carts and a 26.1 percent increase for weekly bins. The single-stream system, which has been touted as the simplest and thus most likely to increase collection, came in third at 20.8 percent (see Table 1).

### Increased residuals headed for landfills

Material quality, as well as quantity, is a concern for recycling program managers and materials recovery facility (MRF) operators alike. A high residual rate after processing can cancel out the benefits of increased collection of materials. Drawing on its national survey of 36 programs, Governmental Advisory Associates (Westport, Connecticut) estimates the average residual rate among single-stream programs to be 16.6 percent (see “Single-Stream Ahead” in the August 2002 issue of *Resource Recycling*).

The 16.6 percent single-stream residual rate is a significant departure from other collection systems. St. Paul’s existing source-separated collection method maintains a residual rate that does not exceed 1.6 percent, while GAA’s national survey of 215 two-stream facilities indicates an average residual rate of 6.4 percent. In the Eureka Recycling study, the net overall recovery of materials in single-stream (i.e., the amount of materials reaching end markets), at 72.8 percent, was lower than every other tested method (see Table 2).

Several reasons can be offered as to why single-stream collection leads to a higher residual rate. First, residents include more nonrecyclable materials in single-stream carts. Study results indicate that 4.4 percent of the materials collected in the single-stream method were not recyclable, compared to less than 1.9 percent in any other method tested. Second, because materials are mixed together, more materials are contaminated and more sorting is required to separate the materials before they can go to market. The additional sorting is particularly damaging to glass, which is broken to the point that it cannot be sorted easily by color.

Currently, Waste Management’s district office in Blaine, Minnesota reports that, in its experience, single-stream collection sees residual rates of 3 to 5 percent. However, at this time, the Minneapolis MRF where WM

**Table 1** Increase in materials and participation by storage capacity and collection method

Collection method	Capacity (in gallons)	Increase in materials, in percent	Increase in participation, in percent
Two-stream carts biweekly	70	32.8	7
Two-stream bins weekly	72	26.1	7
Single-stream carts biweekly	64	20.8	5
Two-stream bins biweekly	36	7.3	4
Source-separated biweekly	36	6.2	4

Source: *A Comparative Analysis of Applied Recycling Collection Methods in St. Paul*, Eureka Recycling, 2002.

is basing this experience handles less than 11 percent single-stream material as a percentage of all materials coming through its facility. As a result, it is difficult to ascertain whether this 3 to 5 percent residual rate is a result of the 20,000 plus tons per year of source-separated materials from St. Paul’s program that also are handled at that MRF — tonnage that arrives at the MRF with fewer nonrecyclables and requires no sorting.

### Broken glass

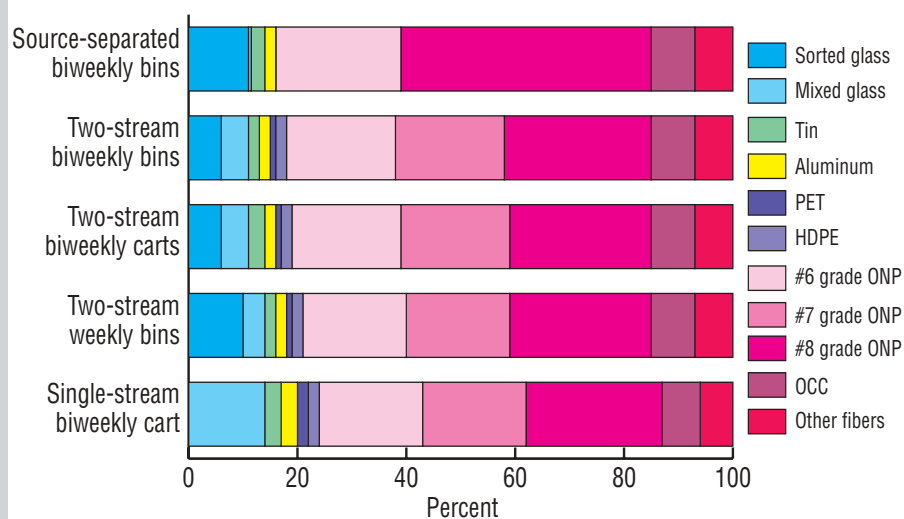
One major consideration for both MRFs and subsequent buyers of recyclables is the residual glass found among recovered materials. This study, in conjunction with the GAA survey, found that glass breakage increased as the curbside sorting requirements decreased. In source-separated collection, 95 percent of the total glass collected was sorted by color and could be recycled back into bottles. In two-stream collection, 59 percent was sorted. In single-stream, none of the glass could be sorted by color.

According to WM, “single-stream collection produces less breakage in collection and tipping than two-stream, but breaks glass in processing because of the additional handling and screening in the systems.” Broken glass cannot be sorted by hand, and new technology designed to sort glass by color is expensive. Mixed color glass is not suitable for marketing to most traditional glass bottle recycling markets, and 99 percent of St. Paul residents surveyed do not consider use of glass in landfill operations (a typical alternative market, along with sandblasting and paving) to be recycling. Therefore, with a lack of suitable markets, mixed color glass is considered a residual in St. Paul’s program. This significantly increases the single-stream collection method’s materials processing residual rate in this study to 27.2 percent.

### Processing: The costly side of single-stream

The cost of single-stream collection is low. However, the cost benefits of single-stream

**Figure 1** How the proportion of recyclables differs by collection method



ONP Old newspapers.  
OCC Old corrugated containers.  
Source: *A Comparative Analysis of Applied Recycling Collection Methods in St. Paul*, Eureka Recycling, 2002.

**Table 2** Comparison of tested collection methods

	Source-separated Biweekly	Two-stream Biweekly	Two-stream Biweekly	Two-stream Weekly	Two-stream plus organics Weekly	Single-stream Weekly
Schedule						
Containers	18-gallon bins	18-gallon bins	35-gallon carts	18-gallon bins	18-gallon bins, 35-gallon cart	64-gallon carts
Projected set-out rate, in percent (baseline: 46)	52	52	58	53	NA	59
Projected participation rate, in percent (baseline: 71)	75	75	78	78	NA	76
Gross increase in tons collected, in percent	6.2	7.3	32.8	26.1	91.6	20.8
Fiber portion, in percent (baseline: 85.2)	84.7	82.3	79.6	82.5	NA	76.5
Container portion, in percent (baseline: 14.8)	15.3	17.7	20.4	17.5	NA	23.5
Material loss during processing, in percent (1)	1.6	10.9	11.6	10.8	11.0	27.2
Net increase in tons collected, in percent	4.5	-4.5	17.5	12.5	70.5	-12.2
Collection costs per ton	\$60	\$50	\$65	\$59	\$80	\$51
Processing costs per ton (2)	\$35	\$50	\$50	\$50	\$50 recyclables, \$30 organics	\$60
Processing revenue per ton	\$50	\$43	\$44	\$43	\$43 recyclables, \$20 organics	\$33
Net costs per ton	\$45	\$57	\$71	\$66	\$88	\$78

(1) This residual rate includes mixed color glass as not being recycled.

(2) Based on differential costs of processing methods when applied to current price of service for source-separated processing. Information provided by Waste Management.

Source: *A Comparative Analysis of Applied Recycling Collection Methods in St. Paul*, Eureka Recycling, 2002.

collection disappear when systemwide costs are considered. In this study, the single-stream method, along with the biweekly two-stream bins scenario, resulted in the least expensive collection costs, but the increase in sorting and processing costs, and the decrease in revenues due to material loss, ultimately made single-stream the most expensive method. When comparing MRF processing costs of St. Paul's existing truck-sorted materials with those of facilities handling single-stream materials, the outlay nearly doubles, increasing costs \$25 to \$35 per ton. WM estimates that single-stream processing adds an additional \$10 to \$20 per ton "pre-processing" step to a two-stream system.

Single-stream materials will have inherently lower end-market values. In the study's appendix, RecycleWorlds Consulting (Madison, Wisconsin) notes that high-speed, high-throughput sorting is necessary in order to attain economic feasibility, which can lead to sorting that is less extensive and therefore less effective. When this happens, the end product tends to be of a lower quality and sells for a lower price (see Figure 1). Furthermore,

single-stream processing will see higher costs because MRFs must pay for the disposal of increased residuals, resulting in additional lost revenue.

For example, old newspaper (ONP) collected in a single-stream system tends to be worth less than that collected using other sort methods. In St. Paul, the source-separated collection method offers 33 percent of the lower #6 grade and 67 percent #8 grade. Based on interviews with different types of MRFs across the country, RecycleWorlds projects that single-stream collection would be expected to produce 30 percent #6 grade, 30 percent #7 grade and 40 percent #8 grade.

Having supplemented local data collected in St. Paul with information from other single-stream programs across the country, RecycleWorlds adds, "Mills also report skepticism that single-stream MRFs will be able to achieve a strong #8 [grade ONP] share, suggesting that the projected fractions for single-stream may overstate the portion that is ultimately sold as #8 [grade ONP]."

With a high residual rate, expensive proc-

essing and the lower quality in materials, single-stream collection presents concerns from both an environmental and a financial point of view. In the Eureka Recycling study, the cost advantages and efficiencies of single-stream collection disappear the more closely one looks at the later stages of the recycling process. The results of the Eureka Recycling study are one tool that recycling program managers can use in a balanced assessment of the best choices for their communities. There is no single answer or one-size-fits-all solution. Rather, it takes a recycling program tailored to meet each community's values and needs to accomplish its recycling goals. **RR**

The full report of *A Comparative Analysis of Applied Recycling Collection Methods* is available from Eureka Recycling's Web site at [www.eureka-recycling.org](http://www.eureka-recycling.org).

Reprinted with permission from Resource Recycling, P.O. Box 42270, Portland, OR 97242-0270; (503) 233-1305, (503) 233-1356 (fax); [www.resource-recycling.com](http://www.resource-recycling.com).