

Single-stream: *Closing the loop*



by Susan Kinsella

A roundtable discussion of single-stream recycling between the collection, processing and manufacturing sectors brought new insights amid discussions about recycling as a whole system.

Why are single-stream collection and processing recycling programs so attractive to some and so problematic to others? Clearly the popularity of single-stream programs is rapidly changing the nature of recycling in North America but, at the same time, single-stream might be more accurately perceived as but one response to a series of challenges and opportunities.

The public is not aware of the sea changes happening in their community recycling programs, including single-stream collection and processing, landfill diversion to the exclusion of other recycling goals, and reliance on exports, but even many within the industry are unaware of the details. Surprisingly, little long-term thinking has accompanied these changes, in part perhaps because recycling is a very present-oriented activity:

- ◆ Materials are discarded every day and collected within very short timeframes.
- ◆ Processors generally need to clear out their facilities every day to be ready for the next day's materials.
- ◆ Manufacturers need recovered material on hand to continually feed their equipment.

Beyond these daily activities, recycling is also a system that needs long-term planning and

consideration in order to keep its immediate functions effectively operating. Recycling is a collaborative system: manufacturers need the material that collectors collect and processors process, and collectors and processors need manufacturers who buy their materials. As such, recycling needs to be reviewed as an interdependent system to determine whether the changes occurring in North America will result in a healthy, long-term recycling system.

Recognizing the need to raise awareness about these issues, Conservatree initiated the Single-Stream Roundtable in Sacramento, in May 2005, to bring together governments, collectors, processors and manufacturers from across California to discuss the impact of single-stream recycling. Since single-stream service has become the recycling program of choice for the majority of California communities (see "From two streams to one: The evolution of single-stream collection," *Resource Recycling*, December 2005), the Golden

State is a good microcosm for observation and discussions about application, implementation, implications and the potential for improvements.

To some, diversion is king

For the most part, collectors and local governments operating single-stream programs are pleased with the results. They appreciate that it:

- ◆ Brings in more recyclables
- ◆ Increases diversion rates
- ◆ Reduces worker compensation costs
- ◆ Reduces the number of trucks on the road
- ◆ Often allows additional materials to be added to the collection system.

According to Lynn France, conservation coordinator for the City of Chula Vista, California, a state mandate for 50-percent diversion changed the recycling landscape from a demand-side market (where shortages raise prices to increase collection) to a supply-side

Susan Kinsella is Executive Director at Conservatree (San Francisco). Nationally known as an expert on environmental paper and environmentally preferable product procurement issues, she is currently collaborating on writing a Single Stream Best Practices Manual. She can be reached at susan@conservatree.org.

market (where materials are collected to keep them out of landfills, not in response to a market demand). The continuous volume and lack of reference to price signals lowered prices, undermined processors' concern for quality end-products and facilitated many communities' move to single-stream.

Chula Vista converted its source-separation curbside recycling collection program to single-stream with automated collection in 2002. The new single-stream program continued collecting the same commodities – paper, bottles, cans and plastics, with yard waste collected separately – but now required participants to load all their recyclables into one 32-, 64- or 96-gallon cart rather than an 18-gallon bin, paper bags and a trash container. The city also implemented a variable-rate structure that provided an incentive for participants to divert more materials that had previously been going into the trash.

France says recycling volumes have increased by 100 percent (see Figure 1). Interestingly, the increase occurred during an improving economy and did not reduce trash volumes. The program now has an average seven-percent residue rate compared to its previous two-percent rate.

San Jose – long recognized for its high-quality, multi-sort recycling program – also produced positive results following a challenging start-up. After a difficult first year, including a nearly five-fold increase in its residue rate, averaging 30 percent, and a decrease in diversion, the city has seen single-family recycling tonnages increase by 25 percent and diversion by 11.5 percent over the prior source-separated system. San Jose's residential diversion rate is now at an all-time high of 49.5 percent.

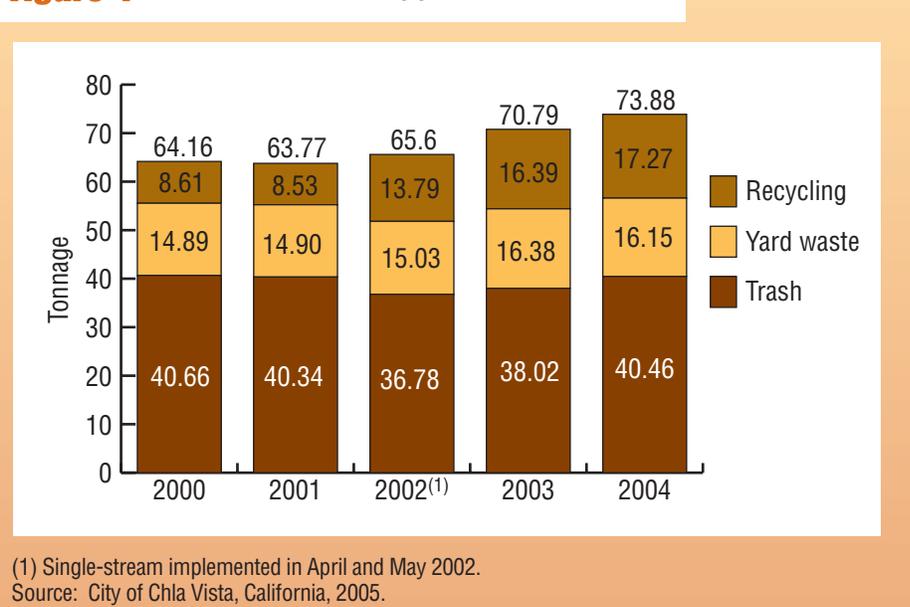
As previously mentioned, San Jose encountered significant challenges en route to its high diversion rate and learned some valuable lessons. It learned, for example, that pay-as-you-throw systems can encourage residents to put extra garbage in recycling carts to avoid higher garbage fees. Additionally, large, 96-gallon recycling carts provide contamination opportunities as drivers cannot see the materials as they are picked-up.

Most critically, San Jose learned that contract incentives can make single-stream programs more effective, but only when subcontractors' terms also reflect those incentives and the city maintains control of the materials stream. Because collection efficiencies and higher diversion rates trade off for higher contamination, single-stream programs also require a greater focus on outreach programs and more work at the material recovery facility (MRF) to effectively sort materials.

All that glitters isn't gold

For others, especially many recycled-product

Figure 1 Chula Vista volumes by year



manufacturers, single-stream programs are more problematic. The most commonly cited troubles are:

- ◆ Poor quality feedstocks
- ◆ Reduced energy efficiencies
- ◆ Increased internal costs
- ◆ Lost access to recyclables
- ◆ Landfilling of significant percentages of feedstock materials.

California and West Coast recycled-product manufacturers value the volume promised by single-stream collection and processing programs, but they say the quality issues they are experiencing may limit their ability to maintain and expand markets for recycled-content products.

Many from local community recycling programs attending the Roundtable were astonished to learn that significant percentages of the recyclables they counted as diverted end up landfilled – not recycled – at manufacturing plants because they are so poorly sorted. Since more than 75 percent of curbside collection is paper fiber, paper mills are hardest-hit, with plastics, glass and metals all ending up in their recovered fiber bales.

Les Joel, deink plant superintendent for Blue Heron Paper Co. (Oregon City, Oregon), has seen the mill make a number of equipment and process improvements to account for the trend towards single-stream recycling, but the impact is still daunting.

From 1999 to 2005, the mill increased the recovered paper it used from 154,000 tons to 182,000 tons per year, an increase of 18 percent; however, the amount of contaminants in this material doubled to over six percent, resulting in over 11,000 tons going to landfill in 2004 at a cost of over \$500,000 (see Table 1). The most maddening aspect, accord-

ing to Joel, is that the contamination problem is not consolidated, like the proverbial engine block in the bales. Rather, he likened it to "death by 1,000 cuts," with costs increasing at so many points in the process that the mill has a difficult time quantifying it.

Contaminants such as glass, for example, require expensive screen baskets to be replaced twice as often, nearly doubling annual replacement costs. Meanwhile, the glass, metals and plastics introduced into the paper-making system by poor MRF sorting wear out pipes and pumps more quickly.

Jay Simmons, the deink process engineer at the NORPAC deinked newsprint mill in Longview, Washington, has seen his mill implement one of the most intensive raw materials sampling and testing programs in North America. NORPAC, which consumes over 250,000 tons of #8 old newspapers (ONP) per year, takes random samples of approximately 300 pounds to sort for outthrows – fiber-based contaminants (e.g., the wrong type of fiber delivered to the mill, such as old corrugated containers at a newsprint mill) – and prohibitives – non-fiber contaminants such as plastics, glass and metals.

As more suppliers have shifted to co-min-gled collection and processing systems, the overall quality of NORPAC's ONP has declined significantly. Outthrows that had been no higher than one-half of one percent have increased to nearly six percent while prohibitives have gone from zero to 1.3 percent. And these numbers vary by supplier, indicated Simmons. The outthrows in one supplier's bales jumped to over 21 percent and prohibitives added another 3.4 percent, which means the mill landfilled nearly one-fourth of the recyclable materials purchased to make new products.

For NORPAC, the move to co-mingled processing has led to a four-fold increase in maintenance costs and an 800-percent increase in yield loss at the pulper from inappropriate fiber and prohibitives that must be landfilled. This is coupled with an eight-fold increase in additional fiber that must be purchased to replace the rejects at an annual cost approaching \$2 million.

Dick Johnston, general manager at Smurfit Stone Container's paperboard mill in Santa Clara, California, explained that what might seem like a small amount of contaminants and non-recyclable materials in one bale is magnified to an untenable amount by the several hundred tons of materials a paper mill takes in each day to make its products. Which contaminants are most problematic also varies by the type of mill. While glass is a serious problem for newsprint mills, plastics are more a problem at paperboard mills.

Diversion versus recycling

Not only are plastics, glass and metal cans serious problems at paper mills, they also are contaminants at other types of manufacturing facilities. Plastics manufacturers are receiving glass while glass manufacturers are receiving unsorted glass mixed with paper fibers and non-cullet contaminants. But the biggest concern for plastics and glass manufacturers is all the recyclables lost to their own recycled-product manufacturing because they were delivered instead to paper mills.

"If you're not using the material diverted, you didn't divert," said Dennis Sabourin, executive director of NAPCOR (Sonoma, California). Paper mills say that 39 million pounds of plastics were sent to their mills in one year because of poor sorting. Though the generating communities counted that tonnage in their diversion rate, it actually just took a longer route to the landfill.

Sabourin agreed that single-stream recycling, if done properly, will work, but it requires proper techniques and capital expenditures. MRF equipment is expensive, ranging from \$1 to \$6 million per plant, but can increase processing production to up to 40 tons per hour. Screening and optical equipment have been improving auto-separation of materials and making sorting easier for line workers.

With PET plastics, solving single-stream's problems is economically compelling. While the value of one metric ton of newsprint is between \$100 and \$125, the value of the same weight of PET is \$530 to \$570. And in California, where containers earn a container redemption value plus processing payments, one metric ton of PET is worth \$2,066.

Tom Mabie, West Coast counsel for the Glass Packaging Institute (Alexandria, Virginia), also insisted, "Diversion is not the same as recycling." Over-emphasis on diversion

Table 1 Blue Heron reject volumes to landfill

	1999	2000	2001	2002	2003	2004
Paper used (in 1,000 tons)	154	165	172	192	194	182
Tons sent to landfill	5,200	7,600	10,500	12,900	10,700	11,100
Contamination rate	3.3%	4.6%	6.2%	6.8%	5.5%	6.1%
Landfill costs	\$260,000	\$382,000	\$530,000	\$650,000	\$535,000	\$555,000

Source: Blue Heron Paper Company, 2005.

has resulted in some local communities not paying attention to the implications of choosing low cost programs.

Glass bottles, which contain an average of 35-percent post-consumer cullet, have suffered. The leading contaminants for glass containers – organics, porcelain and vision glass – can lead to weaker bottles that are more likely to break. The significant increase in single-stream curbside collection is resulting in increased three-color mix (brown, green and clear) instead of color sorted, but this severely diminishes the technological ability to recycle it into new glass bottles. Most often, three-color goes to non-recyclable uses such as roadbeds, when it could have saved natural resources indefinitely if it had gone back into new glass. Higher collection truck compaction rates also increase the likelihood of a three-color mix and amplified contamination rates.

Ironically, just as glass manufacturers' customers, especially bottlers, are demanding increasingly higher quality containers – and more of them – the quality and quantity of recyclable glass cullet is going down. "You need tighter specifications when you're hitting higher recycling rates," says Mabie. "If we don't meet the specifications of our customers, we don't sell our product and then we don't buy your glass."

Taking a systemic approach

The challenges single-stream recycling presents are not isolated to individual sectors. From collection to processing to manufacturing, each sector faces issues that must be overcome for the system to work as a whole.

At the community level, increased public education is a critical factor for a program's success. When transitioning to single-stream collection, San Jose committed over \$2 million to outreach efforts and continues spending over \$350,000 per year in on-going education. A city also can improve material quality through contract management.

Peter Slote, recycling specialist with the City of Oakland, believes that single-stream's impact on product quality is less affected by contamination from non-program materials by residents than by cross-contamination of acceptable materials during processing, especially when materials flow into large, regional single-stream facilities handling materials

from multiple jurisdictions.

Tom Mabie suggests dealing with contamination at the collection and processing stage by ending compaction in collection vehicles and initiating a first, positive sort for glass at the MRF. Blue Heron has taken steps at the mill to deal with contamination by modernizing equipment, adding a drum pulper as well as more cleaners and screens. The mill also plans another \$3 million in upgrades to its contaminant removal process and is looking at ways of decreasing landfilling costs by using plastics and inappropriate fibers as a fuel source.

Government participants at all levels suggested getting millage loss reports from the manufacturers who receive their recovered materials, in order to evaluate their processors' effectiveness and calculate true diversion rates that take into account whether their materials were actually recycled. They also recognized the importance of including recycled-product manufacturers in feedback loops for designing and evaluating their programs.

Increased volumes are good, increased participation is good and material quality is a problem. With budgets getting tighter and waste streams growing, it seems clear that more communities see single-stream as worth the trade-offs, but how long will those trade-offs work if recycling is not addressed as a whole system? Recycling's inherent interdependency means that problems in one sector will eventually undermine gains in other sectors.

Most Roundtable participants agreed, though, that single-stream recycling can fulfill its promise if local communities' recycling programs require quality as well as quantity. As Pat DeRueda, president of Waste Management/Recycle America Alliance (Houston), the nation's largest collector and processor of municipal recyclables, put it, "We've just got to make sure that what's going into the bales is meeting the specs of the mills." Simple, right? **RR**

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