# COLLECTION OPTIONS FOR MIXED AND SOURCE SEPARATED ORGANICS

*Two and three bin solid waste collection and disposal costs at four Minnesota composting facilities are compared.*

*Robert L. Spencer*

COLLECTION SYSTEMS for source separated food scraps, nonrecyclable paper and other compostable materials are at the early development stage. Considering the debate over mixed waste versus source separated MSW composting and the significant proportion of total waste management costs which stem from collection, there is a need for data comparing collection costs of the two approaches. But such information will obviously have to wait until more than two full-scale programs are operating in North America. As of Fall, 1992, only Fillmore County and Swift County, Minnesota have full-scale three bin (container) organics collection programs. For the purpose of this article, a two bin collection system consists of separating recyclables from MSW at the source, while three bin separation adds a third container for organics.

It is generally assumed that the addition of a third container will add substantially to collection costs. On the other side of the equation is the assumption that capital and operational costs of a composting facility will be lower if it is designed to handle source separated organics rather than the mixed waste stream. Proponents of source separation maintain that such systems produce higher quality compost and recyclables. Mixed waste collection and composting systems are also accused of reducing the incentive for recycling by making disposal too convenient, and for composting potentially recyclable paper.

Conversely, mixed waste advocates argue that asking people to make more than two sorts (commingled recyclables and garbage) will reduce participation rates, and increase collection costs. Also, capital costs will not be reduced significantly because mechanical separation systems are still needed to produce good quality compost and recyclables.

The findings of this study do not support the theory that a three bin source separated organics collection program is necessarily more costly to an average household than a two bin mixed MSW collection system. The research also revealed that collection costs are driven by a variety of factors and that additional work needs to be done to quantify these costs more accurately.

Although collection and disposal costs are identified in this evaluation, the "true" costs of collection and disposal are shrouded in a maze of state and county grants and subsidies. The picture of total costs is further clouded by a lack of readily available cost breakdowns at each facility for the various components of the total waste management system, which includes landfills, transfer stations, staff salaries, consultant services, and waste hauling. Consequently, the costs which are presented are less than the true total costs for solid waste management and disposal. Nevertheless, the fact that all four of the composting systems are in the same state levels the playing field to some extent. In this light, the reported findings are a useful starting point for comparison of two and three bin collection systems in operation at MSW composting facilities.

The overall lack of information from North America reflects that only a handful of communities have conducted pilot programs to collect source separated organics (other than yard debris) from residential and commercial generators, and most of those did not track collection costs. The major exception is Mississauga, Ontario, where 4,000 homes are participating in an organics collection program in which costs are being compiled.

## SIMILAR COMMUNITIES

In order to compare the average cost of collection and disposal in Fillmore and Swift counties with the costs for a two bin composting system, Minnesota's East Central and Prairieland composting facilities were selected. As shown in Table 1, the Fillmore and Swift facilities have significantly small-

**Table 1. Village of Lawrence Compost Quality (mg/kg)**

| Parameter | Average Concentration | NYS Standard |
|---|---|---|
| Cadmium | 2.8 | 10 |
| Chromium | 16.2 | 1000 |
| Copper | 183.9 | 1000 |
| Mercury | 6.7 | 10 |
| Nickel | 14.2 | 200 |
| Lead | 139.8 | 250 |
| Zinc | 624.8 | 2500 |

**Table 2. Village of Cedarhurt Compost Nutrients (mg/kg)**

| Parameter | Concentration |
|---|---|
| TKN | 15,021 |
| Ammonia | 634 |
| Phosphorous | 920 |
| Potassium | 1,687 |
| pH | 6.2 |
| Total Volatile Solids | 59% |

serves as a scrubbing unit similar to a biofilter.

After the 51-day composting and curing cycle, the compost — which meets the New York State Class I designation — is screened by a local contractor and mostly utilized on the Village's golf course. Lawrence was able to initiate this program for a total capital cost of less that $100,000. The facility continues to produce quality compost with no odor incidents, despite close proximity to nearby residences.

### VILLAGE OF CEDARHURST

Cedarhurst (6,500) lies adjacent to Lawrence. It too owns and operates a wastewater treatment facility (10 MGD) that achieves secondary treatment standards. Like Lawrence, sludge previously was processed in an anaerobic digester prior to dewatering on open sand drying beds. With the same landfill closing, the Village also opted for composting, and the aerated static pile method was selected due to the success of the Lawrence project. Compost pile and site improvements were completed in less than 60 days for under $50,000 in capital costs, and the facility commenced operations in December, 1989.

The Village's wastewater treatment facility produces approximately one dry ton of sludge per day, which is composted on a batch basis approximately three to four times per year. There is sufficient space available in the primary digester, secondary digester, and holding tank to allow for storage of stabilized sludge in between composting cycles. Sludge dewatering is provided by a contractor with a mobile belt-filter press.

The outdoor operation achieved temperatures above 131 degrees F (55° C) within five days after start-up. To date, not one odor complaint has been received despite the operation being located less than 150 feet from the Village's public high school. Compost quality is similar to Lawrence for metal concentrations, and it also has been designated Class I by the New York State Department of Environmental Conservation. Finished product is utilized in local public works projects as well as marketed to a large scale topsoil manufacturer. ■

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er capacities at 11 and 40 tons per day (tpd), respectively, compared to 250 tpd at the East Central facility and 100 tpd at Prairieland. Reflecting the smaller capacity, the capital costs of the Fillmore and Swift plants are $1.5 and $1.8 million compared to $11.2 million for East Central and $8.6 million for Prairieland.

Because these four, rural MSW compost facilities are located in the same state, a measure of comparability was afforded to the research despite the numerous variables associated with each facility and its waste collection. Some of the commonalities among the four regional composting facilities and their collection systems include: public ownership, state subsidies of capital costs, annual state recycling subsidies, state composting and recycling regulations, and state motor vehicle regulations.

To compare the demographic characteristics of the four regions, Table 2 presents 1990 census data on average family income, poverty level, educational level, population and population density for the nine counties. This information shows that the service areas for the four composting facilities are fairly similar in that these are rural counties with small cities and towns, with most under 1,000 persons.

The largest community (pop, 11,500), is Fairmont in the East Central composting facility service area. The average 1990 population of the nine counties served by the four composting plants is about 19,400 persons, ranging from 10,700 in Swift County up to 30,500 in Chisago County. Population densities show considerable range with an average of 41 persons per square mile for the five East Central counties, 29 persons per square mile for the two Prairieland counties, and 24 and 14 persons per square mile for Fillmore and Swift counties. The median annual family income is $30,200 for the five counties served by the East Central composting plant, $28,700 for Prairieland's two counties, $27,100 for Fillmore County, and $24,400 for Swift County. The poverty level in all the counties ranges from 12 to 15 percent, with 68 to 74 percent of residents completing high school.

Although these are rural communities, the density of development in the cities and towns is typical of many suburban areas throughout North America, with a mix of commercial and residential development. Most of the population in these small Minnesota communities is served by curbside collection of garbage and recyclables, with outlying residents relying on either curbside collection or dropoff centers. It is estimated that 40 percent of the population in Fillmore County is without waste collection service, 34 percent of Swift County, 31 percent of Faribault County, 20 percent of Chisago County, and 47 percent of Pine County.

The demographic information is presented to allow readers to compare their own regions' characteristics with these Minnesota counties. It also shows that the demographic profiles of Fillmore and Swift counties (the three bin collection programs) are similar to the East Central and Prairieland counties (the two bin collection programs).

## SYSTEM DESCRIPTION

For each of the four facilities, Table 1 presents the start-up date, design capacity, average amount of waste received, tip fee, capital cost, and amount of subsidy. All four facilities are publicly owned; three are publicly operated, with only the East Central facility privately operated.

Both the Fillmore and Swift county facilities rely on generators to separate the waste stream into three sorts: recyclables, compostables, and landfill items. A list of designated compostable and nonprocessible items is presented in Table 3 (Fillmore County) and Table 4 (Swift County). Even though the Fillmore County list shows that bond paper, corrugated cardboard, and computer paper are directed to the compostable stream, these materials are hand sorted to be recycled as fiber rather than recycled as compost.

At Fillmore County, the bags of compostables and landfill items are opened and manually sorted to remove recyclables which were not sorted out at the point of generation. Sorters also remove inorganic items from the compostable materials prior to shredding of the material. Recyclables are

**Table 1. Minnesota Compost Facility Characteristics**

| Facility | Design cap. (tpd)* | Avg. (tpd)* | Tip fee ($/ton) | Capital Cost (mil.) | State Subsidy | Start Date | P&G Grant |
|---|---|---|---|---|---|---|---|
| Fillmore | 11 | 11 | $40 | $1.5 | $586,682** | 1987 | $186,722 |
| Swift | 40 | 16 | $80 | $1.8 | $820,067 | 1990 | $109,067 |
| E. Central | 250 | 150 | $77 | $11.2 | $2 million | 1991 | $0 |
| Prairieland | 100 | 52 | $50 | $8.6 | $2 million | 1991 | $0 |

*Tons per day
**Includes a loan of $48,240

**Table 2. 1990 Demographic Characteristics of Four Minnesota Compost Facility Service Areas**

| Facility County | Pop. | Pop. Density per Sq. mile | Finish High School (%) | Median Family Income | Families in Poverty (%) |
|---|---|---|---|---|---|
| East Central | | | | | |
| Chisago | 30,521 | 73.1 | 80.1 | $35,229 | 7.8 |
| Isanti | 25,921 | 59.0 | 78.2 | $35,154 | 8.7 |
| Kanabec | 12,802 | 24.4 | 69.9 | $27,445 | 15.4 |
| Mille Lacs | 18,670 | 32.5 | 70.1 | $27,170 | 13.9 |
| Pine | 21,264 | 15.1 | 69.2 | $26,131 | 15.0 |
| Average | 26,088 | 40.8 | 73.5 | $30,226 | 12.2 |
| Prairieland | | | | | |
| Faribault | 16,937 | 23.7 | 74.4 | $27,606 | 12.0 |
| Martin | 22.914 | 32.3 | 75.2 | $29,856 | 11.9 |
| Fillmore | 20,777 | 24.1 | 70.2 | $27,151 | 14.8 |
| Swift | 10,724 | 14.4 | 68.2 | $24,434 | 14.1 |

**Table 3. Designated Compostables and Landfill Material in Fillmore County, Minnesota.**

**Compostables:**
- Books
- Bond paper
- Corrugated cardboard
- Catalogs
- Cereal boxes
- Computer paper
- Cooking grease (in paper containers)
- Disposable diapers
- Food packaging paper
- Food scraps
- Glossy paper
- Magazines
- Paper bags
- Paper milk containers
- Pet waste
- Pop and beer cartons
- Scrap paper

**Landfill Material:**
- Aerosol Cans
- Air, Oil, Furnace Filters
- Ashes
- Automobile Parts
- Batteries (household)
- Building Materials
- Canning Lids
- Coat Hangers
- Clothing, Boots
- Cooking Oil (in plastic jug)
- Dishes
- Egg Cartons (styrofoam)
- Fiberglass
- Frozen Juice/Bread container (with metal ends)
- Radios
- Garden, hydraulic hose
- Glass (broken or window)
- Plastics (nonrecycled categories)
- Light Bulbs
- Metal Toys
- Paint Pails
- Plumbing Fixtures
- Sawdust, sheet rock
- Styrofoam
- Twine
- Wire and banding

**Table 4. Designated Compostables and "Nonprocessibles" in Swift County, Minnesota**

**Compostables**
(Placed in untied clear bag or adequate container such as a box or garbage can)
- Paper Waste:
  - Newspaper (wet or soiled)
  - Used tissues, napkins and paper plates
  - Shiny paper ads and inserts
  - Envelopes with windows
  - Junk mail
  - Used waxed paper
  - Magazines
  - Paper filters
  - Carbon paper
  - Construction paper
  - Phone books
  - Text books (remove hard covers)

manually sorted and processed for markets at the facility.

Residents of Swift County are instructed to place compostables loose in "an adequate container such as a box or can." Clear plastic bags are accepted if they are untied and placed in a container "to allow the contents to be easily removed for composting." Swift County asks residents to not tie the bags of compostables to facilitate manual emptying of bags at the facility in order to keep the plastic bags out of the shredder and the compost. Other than this bag sorting step and a magnet for ferrous recovery, Swift County does not sort compostables or landfill items. The contents of the compostables only bags are fed through the shredder. Commingled recyclables are collected by the county and manually sorted at the facility.

At the East Central composting plant, a combination of mechanical and hand sorting is employed to remove recyclables from the mixed waste. At Prairieland, the only recyclable material sorted from the waste stream is ferrous metal pulled off by a magnet. Although both regions have recycling programs, neither facility processes collected recyclables.

Recycling is mandatory in both Fillmore and Swift counties for residents and businesses, and haulers are required to collect recyclables. A mixture of voluntary and mandatory recycling is found in the seven counties served by the East Central and Prairieland compost facilities.

## CREATIVE COLLECTION

Collection programs for the four composting facilities are varied. In Fillmore County, for example, haulers collect three streams of materials in a variety of ways. Some communities have their materials collected on different days, which means that the hauler makes two trips to each house each week. Compostables are collected weekly, and on another day of the week either recyclables or landfill items are collected biweekly. The monthly charge for waste collection includes curbside collection of commingled recyclables.

In Fillmore County, Richard Sanitation serves the town of Mabel's 350 homes with a packer truck to collect compostable materials in white bags. On the same day, a one ton truck collects the landfill items in blue colored bags. When the small truck is full, the bags are transferred to a rolloff container, and later loaded onto the rear of the packer truck with the compostables. This adds an extra weighing step at the composting facility since the truck is weighed when it arrives. Then the landfill bags are dumped, the truck is weighed a second time, the compostables are dumped, and the empty truck is weighed. This allows for charging the differential tip fee of $40/ton for compostables, and $70/ton for landfill materials. For loads of unsorted waste the county charges $125/ton in order to discourage delivery of mixed loads.

Goodsell Sanitation Systems serves 888 homes in Spring Valley, Fillmore County's largest community at 2,216 persons. They collect all three materials on the same day. A packer truck collects the bags of compostable items, and a recycling truck towing a custom made trailer dumpster collects recyclables and landfill item. To distinguish between the two different bags, Goodsell utilizes a "ballot bag" on which homeowners mark the appropriate box next to the word "compost" or "landfill." The commingled recyclables go into the recycling truck and the landfill bags into the trailer dumpster. Once the trailer dumpster is full, it is dropped off at a central location where another packer truck picks up the contents of the trailer dumpster. Sometimes the packer truck meets the recycling truck with trailer dumpster on the street to transfer the landfill items. Once all the material is collected the two packer trucks and the recycling truck drive to the composting facility. Goodsell estimates that compostable materials make up 50 percent of the material collected, with recyclables and landfill items at 25 percent each.

The town of Lanesboro in Fillmore County provides municipal collection of compostables on Fridays, with landfill bags collected on the first and third Thursday, and recyclables collected on the second and fourth Tuesday of each month. The same packer truck is used for compostables and landfill items, and a pick-up truck with trailer is used to collect recyclables.

The major difference between collection systems in Fillmore and Swift Counties is that Swift County collects commingled recyclables in the towns and cities through a contract with a private company rather than using county employees. Beyond the boundaries of the cities, County haulers use a trailer behind the garbage truck to collect recyclables from commercial accounts and rural residences.

In Swift County, bags of compostables and bags of landfill materials are collected simultaneously by the same packer truck. Trucks are weighed at the composting facility and charged $80/ton. After dumping on the tipping floor, the two types of bags are manually sorted. There is no differential tip fee at Swift County for the landfill and compostable materials, although the County charges $120/ton for an unsorted load.

Swift County started out using two different colored bags to distinguish between the two types of materials, but switched to clear bags in order to have more control over the separation system. It is now the responsibility of the hauler to visually check the contents of each bag to see if they are properly sorted. If the hauler notices a bag with a mix of compostables and landfill items, they put a tag on the bag identifying the reason the bag was not collected. According to Steve Mattheisen of Mattheisen Disposal, the inspection has made the hauler the "policeman" for the county. He estimates that the inspection and tagging requirement add as much as two hours to the time it takes to col-

lect from a route with 600 stops.

Another down-side for his business since the two bag system started in May, 1991 notes Mattheisen, is the loss of rural accounts. He estimates that almost half of his 200 farm accounts have ceased waste collection because they do not want to have two separate dumpsters for compostables and landfill materials, and instead are opting to burn or bury most of their waste.

Collection systems for the East Central and Prairieland facilities are similar to programs used for landfills and incinerators in that one vehicle collects the can or bag of mixed waste. Recyclables also are collected curbside or dropped off at transfer stations in the seven counties served by these two compost facilities.

## COLLECTION COSTS

In 1991, there were more than 30 public or private MSW haulers operating in the nine counties served by these four composting facilities. Based on a telephone survey of 22 haulers or communities, information was obtained about typical collection costs per household in each of the nine counties.

The average cost per household in the two counties served by the Prairieland composting facility is $10 to $12 per month. For residents in the service area of the East Central compost plant the costs of collection are between $18 and $22 per month.

For the two source separation facilities, the cost is between $11 and $15 per month in Fillmore County, and about $13 per month in Swift County.

A comparison of the two facilities with the highest tipping fees (East Central at $77 per ton and Swift County at $80 per ton) shows that a household which sets out an average of three bags of material per week pays $21 per month in Swift County, slightly less than the $22 per month in the East Central region. For an average of two bags of garbage per week the cost is less for Swift County at $13 per month compared to $21 per month at East Central. Factoring in the county's cost for collection of recyclables in Swift County increases the cost by only $0.73 per household per month. This low cost results from a contract with a private company for $24,400 per year to collect recyclables from 2,800 households in the cities of the county.

The similar or lower cost of the three stream system in Swift County compared to East Central was not the case when comparing costs at the two facilities with the lowest tip fees. The Fillmore County tip fee is $40 per ton for compostables, and Prairieland is $50 per ton. In this case the collection and disposal costs are somewhat higher for Fillmore than for Prairieland, with $15 per month for two bags per week ($18 for three bags) at Fillmore, and $9 per month for two bags per week ($11 for three bags) at Prairieland.

However, when the monthly cost for an average household in Fillmore County is compared to the average costs in the East Central counties, Fillmore County is less costly for either two or three bins per week. Consequently, both Fillmore and Swift are less costly than East Central, but more costly than Prairieland.

No attempt was made to compare hauling costs based on differences in hauling distances to the compost facilities, recycling facilities, and landfills.

## SUBSIDIZED OPERATIONS

When comparing the collection and disposal costs at these facilities it is important to recognize that all four plants received state grants to subsidize the capital costs, as shown in Table 1. The percent of total capital costs which are provided by the state subsidies is greater for the two source separation facilities since they have smaller capital costs. This is due to the fact that Minnesota provides grants of 50 percent of capital costs of the facilities up to a maximum of $2 million. Therefore, for the East Central and Prairieland facilities with their much higher capital costs, the relative percentage of the subsidies is less than at Fillmore and Swift. Another subsidy for capital improvements at both Fillmore and Swift has been provided by Proctor and Gamble's composting program, as shown on Table 1. Therefore, the two source separation facilities have received a greater percentage of subsidies for total capital costs than the two mixed waste composting plants. However, quantifying the impact of each of the four composting plant's capital cost subsidies on collection and disposal costs for the average household will have to be the subject of future research.

On the basis of county population, the state also provides semi-annual "SCORE" grants to each county to support recycling activities. Included in the list of eligible activities for these funds is separation and processing of materials for recycling. For the nine counties included in this study, the amount received ranges from $55,000 per year for the least populated counties, up to $87,402 for Chisago County, which has the largest population. At the Swift County facility, the grant is considered part of the overall budget for solid waste management since the composting facility includes a processing line for recyclables. The combined subsidy for the recycling programs in the five counties served by the East Central composting facility is over $300,000, of which a portion goes to support the recycling education programs of the East Central Commission. As with the capital cost subsidies, the impact of these annual subsidies on total waste system costs at each composting facility is not known.

In addition to the state funding, Fillmore County assesses home owners and businesses a service fee of approximately $15 per year per household to subsidize the composting/recycling facility operation. Likewise, Swift County subsidizes its composting/recycling facility at $110,000 per year for payment of the bond. In addition, the

***Table 4. Designated Compostables and "Nonprocessibles" in Swift County, Minnesota*** *Continued*

**Compostables**
(Placed in untied clear bag or adequate container such as a box or garbage can)

- Paper Packaging:
  - Paper bags, milk cartons
  - Paperboard boxes
  - Cake mix boxes, cartons, etc (remove liners)
  - Frozen paper juice containers
  - Other paper wrappers and containers
- Food Waste:
  - Coffee grounds and tea bags
  - Fruit and vegetable peelings
  - Any leftover food scraps
  - Grease
  - Cooking oil
  - Egg shells, etc.
- Miscellaneous:
  - Disposable diapers
  - Yard wastes, grass clippings, leaves, weeds
  - Plant waste
  - Garden wastes, etc.

**Nonprocessibles**
(placed in tied, clear bag)

- Metal items:
  - Empty aerosol spray cans
  - Old toys
  - Foil-like paper
  - Cream cheese wrap
  - Old hangers
  - Wires
  - Nuts, bolts
- Clothing items:
  - Old clothes
  - Shoes
  - Nylons
  - Fabric scraps
  - Rags
- Small appliance items:
  - Radios
  - Hair dryers
  - Toasters
  - Small kitchen appliances, etc.
- Plastic items:
  - Plastic wrappers and film,
  - Plastic bags
  - Bread bags
  - Baggies
  - Candy wrappers
  - Chip bags
  - Plastic bottle caps
  - Some plastic food containers
  - Styrofoam food containers
  - Frozen food plastic bags
  - Plastic toys
- Other items:
  - Tape
  - Rubber bands
  - Wax products (candles)
  - Disposable razors
  - Flash lights
  - Small batteries
  - Feminine hygiene products/ Napkins
  - Gum
  - Toothpaste containers
  - Light bulbs
  - Prescription bottles
  - Dried up paint cans

County makes up any operating cost shortfall, which amounted to about $8,000 in 1991. Swift County estimates that without the county subsidies and the state SCORE funds, the tipping fee at the composting plant would be approximately $125 per ton.

Like the two source separated composting plants, both mixed MSW facilities depend on operational subsidies from the counties they serve. For the East Central facility, which completed its first year of operation in August 1992, all five counties contributed an extra $3.5 million to support the operations of the East Central Solid Waste Commission. Complicating this analysis is the fact that the subsidy is applied not only to the composting facility, but other aspects of the Commission's operation as well, such as transfer stations, two landfills, consultants, and staff salaries. To raise funds, one of the five counties imposed a $25 solid waste service fee per household per year, and two other counties are considering a solid waste service fee of $40 to $50 per approved parcel of land.

To help offset the fiscal impact of receiving only half of the tonnage expected at the East Central facility, the tip fee was increased from $67 to $77 per ton in the first year of operation. As of January, 1993, it will be $87 per ton.

The Prairieland composting facility also is subsidized by service fees charged in both counties in its service area. The fee is a sliding scale based on distance to the composting facility, but averages about $30 per household per year and $50 per business. Without the county subsidies, the tip fee would be between $66 and $70 per ton if the facility were operating at full capacity. However, since it is operating at about one half capacity, the tip fee would have to be substantially higher than $70 per ton if there were no county subsidies.

At this point, all four facilities have produced Minnesota Class I compost. However, the Swift and Fillmore facilities are making major capital improvements in their facilities which are designed to improve the quality of the compost product by removing inert material and providing better control over pathogen destruction temperatures. The Minnesota Pollution Control Agency may conduct such a comparison once the planned improvements are made to the Fillmore and Swift facilities and they are producing consistent quality compost.

### QUANTIFYING COSTS

The reasons for the differences in collection and disposal costs are complex and difficult to quantify. This research highlights the need for more efforts to quantify the collection costs for two and three bin systems in the United States. Surprisingly, it shows that the three bin collection approach is not necessarily more expensive. At Swift County, this is partly due to the fact that the county provides for separate collection of recyclables in the cities and towns instead of leaving that task to waste haulers. By cocollecting the compostable and landfill bags with the same vehicle, only one trip to each house is required each week, and therefore the cost of collection is not significantly increased.

To keep hauling costs competitive, some Fillmore County haulers have adapted their collection systems so that landfill destined materials are collected at the same time as the recyclables by pulling a trailer behind the recycling truck. In other communities, an alternating schedule is used such that compostable materials are picked up weekly, and recyclables and landfill items biweekly. In this case there are only two extra trips to each household each month, rather than four.

Other reasons that the costs are not significantly higher for the three stream approach include the competitive bidding for the hauling contracts. A number of haulers characterized the waste hauling business as "very competitive" so prices have not risen substantially with the new approaches.

The substantially less capital costs of the Fillmore and Swift facilities are due to the smaller capacity and the simplicity of the processing systems compared to the two larger operations. However, there are too many variables to draw conclusions about the collection/disposal costs based on size and complexity of these facilities.

A comparison based on facility costs is complicated by the fact that all of the facilities report they are not getting as much waste as they should due to diversion to less costly disposal facilities, on-site burial, or use of illegal burn barrels by rural residents. For East Central and Prairieland, diversion to other disposal facilities is causing substantial financial difficulties, and county subsidies are making up the shortfall.

Hopefully, this preliminary look at collection and disposal costs at these four composting facilities will set the stage for more detailed future evaluation, particularly a total systems approach which identifies the full impact of source separation and mixed waste collection, including fuel consumption, air pollution, landfill diversion, recycling rates, compost quality, and marketing success with the humus. ■

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