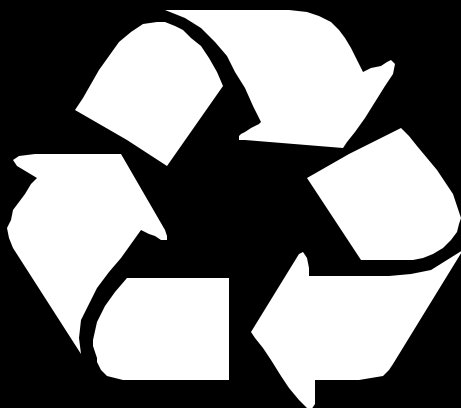


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A Citizen's Primer

Recycling and Dual-Collection in Philadelphia



Prepared for



**Citizens for
Pennsylvania's Future**

and the
Mid-Atlantic Consortium of Recycling and Economic
Development Officials (MACREDO)

in cooperation with
Clean Water Fund and Clean Air Council

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Table of Contents

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DEFINITIONS AND TERMS USED IN THIS REPORT

PREFACE

EXECUTIVE SUMMARY	1
SECTION I—Introduction	5
SECTION II—Recycling: Entering a Second Generation	7
Introduction	7
Automating municipal trash collection	7
Dual collection of trash and recyclables	8
Adding materials to be collected for recycling	9
Instituting curbside collection of yard waste	9
Using more sophisticated material recovery facilities	9
Adopting pay-as-you-throw	11
SECTION III—Philadelphia’s New Solid Waste Management Initiative	13
Current waste management operations	13
Commissioner Johnson’s proposal for integrated waste management	13
Launching the pilot: the same-day, same-way campaign.....	14
SECTION IV—Comparative Experiences of Other Municipalities.....	17
Why did municipalities choose to modernize?	18
What education and outreach efforts were employed?	18
What materials were collected?	19
What collection containers were used?.....	20
What vehicles were chosen, and why?.....	21
What impact did automation and dual collection have on collection routes?.....	22
What worker or union issues arose, and how were they resolved?	24
How does dual collection affect processing and materials marketability?	24
How do Philadelphia’s planning and pilot program preparations compare to the national experience?.....	26
SECTION V—Does Dual Collection Work?	27

APPENDICES

Appendix One: Profiles of selected municipalities 29
Appendix Two: Outreach and education 31
Appendix Three: Use of collection containers..... 33
Appendix Four: Recycling collection vehicles 36
Appendix Five: Union issues 39
Appendix Six: Material processing and marketing issues..... 41
Appendix Seven: Additional Questions Assessing Philadelphia’s Pilot..... 42
REFERENCES..... 44

LIST OF TABLES

Table 1---Communities in Mid-Atlantic States Using Unit-Based Pricing.....9
Table 2---PAYT Communities Profiled in This Report10
Table 3---Materials Collected by Municipalities Profiled in This Report19
Table 4---Collection Containers Used by Communities Profiled in This Report20
Table 5---Collection Vehicles Used by Communities Profiled in This Report21
Table 6---Automation at Work23
Table 7---Statistical Profile -Selected Municipalities and Philadelphia30

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Citizens for Pennsylvania's Future (PennFuture) is a statewide public interest membership organization. PennFuture works to create a just future where nature, communities and the economy thrive. The organization enforces environmental laws and advocates for the transformation of public policy, public opinion and the marketplace to restore and protect the environment and safeguard public health.

PennFuture advances effective solutions for the problems of pollution, sprawl and global warming; mobilizes citizens; crafts compelling communications; and provides excellent legal services and policy analysis.

PennFuture's offices are located in Philadelphia, Harrisburg and Pittsburgh. Additional information can be found at <http://www.pennfuture.org>.



The Mid-Atlantic Consortium of Recycling and Economic Development Officials (MACREDO) is an organization of recycling and economic development interests of the states of Delaware, Maryland, Pennsylvania, Virginia, West

Virginia, and the District of Columbia. The organization's mission is to identify, promote, and implement projects and programs that enhance recycling and economic development opportunities on a regional basis. Founded in 1993, primary funding support has been provided by the U.S. Environmental Protection Agency (EPA), Region III. For more information, please refer to MACREDO's website at <http://www.libertynet.org/macredo>.

Clean Water Fund

Clean Water Fund (CWF), based in Washington, DC, is a national nonprofit research and educational organization, with locally staffed environmental and health protection programs serving communities in over 20 states.

CWF's mission is to develop strong grassroots environmental leadership and to bring together diverse constituencies to work cooperatively for changes that improve their lives, focused on health, consumer, environmental and community problems. Clean Water Fund's Pennsylvania staff can be found in Philadelphia, Allentown and Pittsburgh. For more information see: <http://www.cleanwaterfund.org/>.



Clean Air Council

Clean Air Council is a member-supported, non-profit environmental organization dedicated to protecting everyone's right to breathe clean air. The Council works through public education, community advocacy, and government oversight to

ensure enforcement of environmental laws. The Clean Air Council's offices are located in Philadelphia, Harrisburg and Pittsburgh, Pennsylvania and Wilmington, Delaware. More information is available at the organization's website at <http://www.cleanair.org>.



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Definitions and Terms Used in This Report

Communities may define the terms for waste and recycling in various ways. In fact, the language used by the communities interviewed for this report was at times changed for the sake of clarity and consistency. For instance, co-collection and dual-collection are used interchangeably in literature to describe vehicles and collection systems. For purposes of this report, these terms describe two different collection methods. The following definitions apply only to this report, and are not meant to represent industry-wide definitions.

Automation	Use of mechanized vehicles for the collection of recyclable materials, trash, and/or yard waste. A system can be fully automated or semi-automated.
Bulk or Bulky Waste	Furniture, large household appliances and other such waste that will not fit in a trash container.
Co-collection	Collection of trash and recyclables in the same container and truck compartment, as in the co-collection of recyclable material in blue-bags with trash.
Collection efficiency strategy	A practice or policy in the management of waste and recycling collection which results in reduced costs and increased productivity.
Contamination	Non-recyclable material that is set out and collected with recyclable material. Contamination residue refers to that percentage of non-recyclable material separated during processing.
Commingled Containers	Describes the collection, transportation and processing of bottles, cans and jars made of different materials (e.g., glass, metal, plastic).
Commingled Recyclables	Describes the collection, transportation or processing of all designated recyclable materials (i.e., various forms of paper and commingled containers) as a single mix.
Composting	Transformation of organic material (plant matter) through decomposition into a soil-like material called compost. Invertebrates (insects and earthworms) and microorganisms (bacteria and fungi) bring about this decomposition. Composting is a natural form of recycling, which continually occurs in nature.
Diversion rate	The percentage of the total waste stream represented by the recyclable materials plus the waste separated for composting.
Dual collection	Collection of recyclable materials, trash, and/or yard waste in separate compartments on the same truck.
Dual-stream	Referring to separation of recyclable materials into two categories for purposes of collection and processing: “commingled containers,” including glass, plastic, and metal, and “paper,” including newspaper, discarded mail, corrugated, and other such fibers as designated.
Fully automated	Using a mechanized vehicle for the collection of trash, recyclables, or yard waste, with a hydraulic or mechanical arm designed to grasp and empty carts to appropriate hoppers in the truck body.
Green waste	Organic yard and garden waste, including leaves and garden debris, tree trimmings, branches, as designated for collection in a given jurisdiction. Also called “yard waste.”

Materials recovery facilities (MRFs)	Processing operations that receive truckloads of collected mixed recyclables and then use a combination of manual and mechanized systems to sort and process these materials so as to meet the specifications set by the marketplace for each.
Organic material	Any form of organic, bio-degradable material (excluding plastic in any form) including paper, leaves and garden debris, tree trimmings, branches, food waste, as designated for collection in a given jurisdiction.
Municipal solid waste	Common garbage or trash generated by industries, businesses, institutions, and homes.
Pay as you throw	Referring to a system under which residents pay for municipal waste management and disposal services by weight or volume collected, not by a fixed fee. Also referred to as unit-based pricing.
Participation rate	The percentage of the population participating in a recycling program.
Recyclable materials	Materials separated from trash based on their market value in manufacturing new products.
Recycling rate	The percentage of recyclable materials recovered from the total volume of waste.
Semi-automated	Referring to a system using a mechanized vehicle for the collection of trash, recyclables, or yard waste, requiring specially designed carts to be wheeled to the collection vehicle, where hydraulic or mechanical “cart flippers” lift them and empty the contents.
Single-stream	Referring to collection and processing of all recyclable materials in a single mix.
Solid waste	Non-liquid, non-soluble materials ranging from municipal garbage to industrial wastes that contain complex and sometimes hazardous substances. Solid wastes also include sewage sludge, agricultural refuse, demolition wastes, and mining residues. Technically, solid waste also refers to liquids and gases in containers.
Trash	Material considered worthless or offensive that is thrown away. Generally defined as dry waste material, but in common usage the term is a synonym for garbage, rubbish, or refuse.
Yard waste	Organic yard and garden waste, including leaves and garden debris, tree trimmings, branches, as designated for collection in a given jurisdiction. Also called “green waste.”

PREFACE

Introduction and Purpose

PennFuture and the Mid-Atlantic Consortium of Recycling and Economic Development Officials (MACREDO) produced this report in cooperation with the Clean Water Fund and Clean Air Council, with funding from the William Penn Foundation.

The purpose of the report is to provide concerned citizens in Philadelphia with a primer on the dual-collection pilots sponsored by the Philadelphia Streets Department. The primer describes the City's plans for an integrated waste/recycling collection system, and it documents examples from around the country, as well as potential benefits for Philadelphia. It can also serve as a resource for municipalities throughout the Mid-Atlantic region that are looking for ways to make their recycling and waste management programs more efficient.

Background

The impetus for this report was an October 27, 2000 presentation by the recently appointed Philadelphia Streets Department Commissioner, William Johnson. This was his first meeting with the City's Recycling Advisory Committee (RAC) and the Solid Waste Advisory Committee (SWAC). Stating his intention to make major changes in the Streets Department's policy and practice in solid waste management, Commissioner Johnson spoke of his experiences in California, where recycling is an important function of waste management. He set forth a bold vision for modernizing the department and outlined methods that would, among other benefits, "produce double-digit recycling rates" for Philadelphia.

The members of RAC and SWAC responded to the Commissioner's presentation with excitement tempered by skepticism. What exactly is the Commissioner proposing? Where else has it worked, and what are the implications for recycling in our city? Furthermore, how would so bold a plan overcome deep-seated institutional resistance to change? The Commissioner's qualifications were not in question. As a former division president with Waste Management of Alameda County, he had implemented similar changes for the City of Oakland. cursory research indicated that the methods he was proposing had achieved waste reductions ranging from 23 to 43 percent in urban jurisdictions, stabilizing or reducing waste management costs.

The Commissioner's presentation signaled an opportunity to attain some long-sought goals of Philadelphia's environmental organizations and to support the City in implementing a substantial recycling effort. A team comprised of three Philadelphia based environmental organizations---Clean Water Action, the Clean Air Council, and PennFuture---was formed to provide technical assistance, outreach, and education for members of RAC and SWAC, the City Council, and key community and civic leaders.

News of these plans was also shared with the members of MACREDO, a regional recycling market development group with state agency representation from Delaware, Maryland, Pennsylvania, Virginia, West Virginia, and the District of Columbia. Philadelphia's experience would be valuable to everyone. The diversity and size of the pilots reflected many aspects of recycling in municipalities all over the region. MACREDO members asked many of the same questions posed by Philadelphia's RAC and SWAC. They also wondered if dual collection would benefit rural areas, and if this approach would support or undermine state recycling policies and practices.

Given its constituencies, shared interest, and expertise, MACREDO was asked to join PennFuture's consulting team in producing this report.

Report Organization

PennFuture staff and consultants researched and prepared this report between June and August 2001. They performed a literature study identifying key documents, articles, programs, and individuals related to automated systems and dual collection, receiving and reviewing materials from across the country. They also conducted a survey to gain firsthand information from select municipalities whose experience was judged the most relevant to Philadelphia.

The primer is divided into five sections plus attachments and references.

- Section one provides the context for the report.
- Section two summarizes the documented collection efficiency strategies that comprise the state of the art in integrated waste collection.
- Section three describes the strategy and plans presented by the City of Philadelphia.
- Section four identifies seven municipalities selected for comparative review in response to questions concerning dual-collection and automation collection efficiency strategies being considered for Philadelphia. Public officials in Philadelphia and the Mid-Atlantic region, as well as Philadelphia's Recycling Alliance, RAC, and SWAC offered most of the questions. Others were derived from the documentation.
- Section five makes recommendations for those monitoring the progress of Philadelphia's dual-collection pilots or considering implementing collection efficiencies in their jurisdiction.

EXECUTIVE SUMMARY

Introduction

Recycling has become an American institution. From a few hundred programs in the 1970s, it has grown to encompass more than 9,000 municipal recycling programs and every state in the nation, with 139 million Americans participating. In the United States, more people recycle than vote.

Despite the popularity of recycling, the cost of providing recycling services is of increasing concern to public officials in Philadelphia and across the Mid-Atlantic States. Philadelphia officials have consistently resisted expanding program efforts, citing a concern for increased costs. Responding to the deep financial crisis of Washington, D.C., public officials there canceled the recycling program in 1995, reinstating it in 1998 after sustained public pressure. Despite similar objections, in the past year, both Baltimore, Maryland, and Charleston, West Virginia, answered the need to balance city budgets by reducing recycling services. Even where programs are successful, questions are being raised as to the practicality of reaching beyond the current 20 to 35 percent recycling goals set by State legislators. Across the region, from Virginia and West Virginia north to Pennsylvania, municipalities face the same challenge: How do they increase waste diversion, or, in some cases, justify continuation of recycling services in an era of shrinking public resources?

Fortunately, this issue has been addressed with considerable success over the past five years. Case studies prepared by organizations as diverse as the Institute for Local Self-Reliance (ILSR) and the Solid Waste Association of North America (SWANA) have independently confirmed the dramatic impacts of new residential waste collection strategies on cost-effectiveness, waste diversion, and the quality of service delivery. Using advanced technology and good business sense, these strategies are doing more with less, leading to a paradigm shift in collection methods, and taking advantage of a host of new practices and equipment. Programs employing these strategies are reporting combined waste reduction and diversion rates approaching 50 percent, while stabilizing costs, reducing worker injuries, and increasing customer services.

Furthermore, the success stories reach beyond suburban communities to include large, diverse cities, among them Los Angeles, San Francisco, and Oakland, California, as well as Milwaukee, Wisconsin. In these cases particularly, there is a surprising absence of union opposition, and the programs are flourishing without mandates or enforcement. These programs, developed primarily in the southern and western United States as models, offer valuable lessons for eastern municipalities interested in adopting proven technologies and practices.

Philadelphia to Test Semi-Automated Trash Collection and Recycling on the Same Truck

Between August and October 2001, the Streets Department of the City of Philadelphia, launched a six-month pilot program targeting 7,000 households, the first major test of these strategies in an East Coast city. The recently appointed Philadelphia Streets Department Commissioner, William Johnson, is leading this effort. As a former division president with Waste Management of Alameda County, he had implemented similar changes for the City of Oakland, California.

Currently, Philadelphia collects recyclables the day before trash in the most of the city, and trash is collected manually in any manner of container. Each resident sets out trash bags or other trash containers, bundled yard waste, or bulky waste at curbside. The Commissioner proposes to “modernize” this system. The pilot will test semi-automated, dual collection of trash and recyclables, providing weekly collection services on the same day, at the same time, in separate compartments of a single truck. Selected residents will receive wheeled 32- or 64-gallon carts for semi-automated collection of waste materials. The collection trucks are equipped with hydraulic lifting systems, which allow workers to roll carts and line them up with flippers that mechanically lift and empty them. Each resident is being asked to limit their weekly generation to fit the cart. Recyclables will be collected manually, in separate 7-gallon buckets and 19-gallon bins, and in other marked containers provided by residents. Plastic containers and old

corrugated containers will be accepted for recycling. Yard waste will be collected separately, several times a month. Bulky waste will also be collected on a scheduled basis.

If successful, the pilot is expected to offer greater convenience to residents, increase the number of items to be recycled, and consequently increase the level of recycling and waste diversion. Limiting trash to a single, covered cart will reduce litter, and uniform trash and recycling set-outs will improve the appearance of neighborhoods. This is a bold plan for Philadelphia, and elected officials as well as environmental and community advocates have greeted it with excitement tempered by skepticism. Where else has it worked, and what are the implications for recycling in our city? Furthermore, how can so bold a plan overcome deep-seated institutional resistance to change? The news of Philadelphia's plans has also captured the interest of recycling officials from all over the Mid-Atlantic States. Philadelphia's experience would be valuable to everyone: The diversity and size of the pilots reflect many aspects of recycling in municipalities all over the region.

The primary goal of the full report is to serve as a primer to assist independent groups and individuals in understanding and assessing Philadelphia's dual-collection pilot over the next year. The report has three objectives. First, it provides technical information in layman's terms, documenting the advances in recycling and waste collection around the country. Second, it describes the City's plans as presented in documents and interviews and as gathered by observation. Third, it addresses questions raised by Philadelphia officials and environmental advocates, in addition to concerns of State agency representatives throughout the Mid-Atlantic region, and offers recommendations for evaluating the results of Philadelphia's pilot.

The full report provides considerable detail; a summary of its findings and recommendations is provided below.

Does Dual Collection Work? Will It Work in Philadelphia?

Dual collection employing semi-automation or full automation works to reduce costs and increase collection efficiency, under specific conditions. The collection compartments on recycling trucks must be properly sized to match collection volumes. Tipping facilities for recyclables and trash must be within ten miles of each other. Streets must be large enough to accommodate the added length of collection vehicles or the reach of mechanized features. Routing, crew size, and public participation must also be considered. Ultimately, public works and municipal elected officials must be willing to plan for and endure some setbacks while developing approaches that work. The communities profiled had high implementation costs, but system operating costs were 20 to 40 percent lower than with the previous trash and recycling systems.

There is no such thing as a standard municipal recycling program. Replicating dual collection and other collection efficiency strategies requires consideration of local circumstances. All municipalities are unique, with differences in size, housing types, configuration of streets, geography, demographics, and waste composition. Municipalities considering major changes in their waste and recycling programs should scrutinize their options and develop plans that take their own special circumstances into account.

Determining how dual collection would work in Philadelphia is the goal of Philadelphia's pilot. The plans for testing dual collection in Philadelphia are consistent with collection efficiency strategies comprising "the state of the art" in solid waste management and recycling, and the initial planning for the pilot incorporates approaches similar to those used by the municipalities cited in this report.

Like Philadelphia, those jurisdictions were motivated to automate trash collection because of the need to reduce costs, increase collection efficiency, and increase waste diversion. Each city was unique, but all engaged in similar planning processes, setting goals, adding materials to be collected, and launching

pilots to test new methods, collection trucks, and containers. Ultimately each municipality called on residents to handle waste very differently than they had in the past.

If dual collection and automation are implemented in Philadelphia, its residents can expect the same magnitude of change.

Lessons from the Municipalities Profiled in This Report

- Municipalities chose to modernize in order to increase public participation; improve collection efficiency; reduce the cost of service, as well as worker injuries, street litter, and scavenging; and meet waste diversion targets.
- Continuing education and outreach are critical. Each city implemented extensive education and outreach programs along with distribution of containers for trash and recycling
- “Pay-as-you-throw” (PAYT) policies are an effective incentive for residents to generate less trash and increase recycling. Dual-stream collection programs with PAYT achieved high recycling rates without enforcement when the policy was uniformly practiced citywide. Large containers and single-stream collection may encourage residents to avoid extra fees by “hiding” trash in containers dedicated to recycling. If private haulers are not held to the PAYT policy practiced by the municipality, residents will opt for the less expensive, more convenient option, recycling less and generating more trash.
- Materials added for collection included mixed paper, corrugated cardboard, and yard waste. The addition of yard waste and other organic materials was critical to reaching diversion rates above 35 percent.
- Selection of collection containers required testing to “fit” the container to the needs of the municipality. Containers must be large enough to hold available materials between collection but should not be obtrusive in the home or unwieldy in set-out or collection. They also must be compatible with the collection vehicle.
- Collection bins and carts are a significant capital investment at \$4 each for bins and \$35 to \$52 each for carts, with one to three containers purchased for each household. Operating budgets must also provide for replacement of lost containers and ongoing cart repair.
- Specialized collection vehicles have been developed for manual, semi-automated, and fully automated collection of trash and recyclables, with separate compartments to accommodate dual-stream recycling systems. These vehicles cost \$120,000 to \$192,000. Municipal collection programs initially retrofitted existing vehicles, later purchasing new vehicles as part of their regular fleet replacement schedule. Many program administrators recommend that municipalities purchase new trucks in order to avoid higher maintenance costs.
- Collection systems are evolving toward trucks operated by a single worker and longer collection routes, with household collection rates increasing by 80 to 300 percent per scheduled crew hour.
- Workers have generally benefited from automation, with reductions in lifting-related injuries and improved working conditions. Unions have not opposed automation. Generally skeptical at first, they have been reassured by policies promising no automation-related layoffs. Cost reductions have been achieved by shifting workers to yard waste collection, by worker attrition, and by freezing new hires.
- Where recyclables are dual collected with trash or collected commingled, contamination is increasing to levels of 20 percent or more. This issue is being studied by representatives of several California cities and MRF operators under the direction of the California Integrated Solid Waste Management Board (CISWMB).
- MRFs are evolving toward single-stream systems, receiving commingled recyclables. This sets a trend that includes evolution to a single container, and a vehicle of the same model as that used to collect trash. This method shows great promise provided the contamination problem can be overcome.

Recommendations for Review of Philadelphia's Dual-Collection Pilot

1. Support the Philadelphia Streets Department's continuing use of pilots to learn about the feasibility of dual collection and other collection efficiency strategies. Pilots may raise new issues. Expect and encourage promising approaches to be readdressed in future pilots. Encourage implementation of results.
2. Participate in the pilot and encourage community participation, and provide constructive feedback to the Streets Department. Encourage more substantial involvement of Philadelphia's Recycling Advisory Committee (RAC) and the Solid Waste Advisory Committee (SWAC) before and during pilots.
3. Review the results of the pilot program, with specific consideration of the following questions:
 - Will it work in every neighborhood and on every street? If not, what should the City do in those areas where it will not work?
 - Should the City provide alternative-sized containers or alternative collection options for residents with special needs or constraints?Consider, as appropriate, the additional questions as offered in Appendix seven. Work with the Streets Department to develop a timeline to adequately review the pilot and provide feedback for further development of the program.
4. For purposes of future pilots and program development, the following should be considered:
 - Test larger set-out containers for recycling, and the use of semi-automation and the split cart for dual-stream recycling, as in Milwaukee. Focus these efforts in high-participation areas.
 - Develop and test methods to increase collection in areas with traditionally low participation: low-income areas with a transient population, a large number of non-English-speaking people, and high illiteracy.
 - Consider contract provisions limiting the acceptable levels of contamination residues in recovered materials. Los Angeles' contract provisions limit contamination residues to 10 percent or less.
 - Be wary of the single-stream MRF and commingled collection. The City's consideration of this technology and its materials processing contracts should be based on resolution of the contamination issues that have arisen in other jurisdictions.
 - Consider public ownership and private operation of MRFs to protect the City's considerable investment in trucks, containers, and education of the citizenry.
5. Due consideration should be given to the following principles:
 - All changes in the City's program should consider recyclable materials markets first, supporting the ultimate use of collected materials for the manufacture of new products.
 - It is the municipality's responsibility to deliver high volumes of uncontaminated recyclables to the MRFs. Limits for contamination should be set, compliance should be monitored, and problems should be addressed vigorously through education, enforcement, and fine-tuning of collection methods.
 - Ensure by contract or ownership that MRFs have adequate capacity to handle the types and quantity of materials delivered and that those materials are processed consistently with market specifications.

SECTION ONE: INTRODUCTION

Recycling has become an American institution. From a few hundred programs in the 1970s, it has grown to encompass more than 9,000 municipal recycling programs and every state in the nation, with 139 million Americans participating. In the United States, more people recycle than vote.

Despite the popularity of recycling, the cost of providing recycling services is of increasing concern to public officials across the Mid-Atlantic States. Responding to the deep financial crisis of Washington, D.C., public officials there canceled the recycling program in 1995, reinstating it in 1998 after sustained public pressure. Despite similar objections, in the past year, both Baltimore, Maryland, and Charleston, West Virginia, answered the need to balance City budgets by reducing recycling services. Even where programs are successful, questions are being raised as to the practicality of reaching beyond the current 20 to 35 percent recycling goals set by state legislators. Across the region, from Virginia and West Virginia north to Pennsylvania, municipalities face the same challenge: How do they increase waste diversion, or, in some cases, justify continuation of recycling services in an era of shrinking public resources?

Fortunately, this issue has been addressed with considerable success over the past five years. Case studies prepared by organizations as diverse as the Institute for Local Self-Reliance (ILSR) and the Solid Waste Association of North America (SWANA) have independently identified residential waste collection strategies that have dramatic impacts on cost-effectiveness, waste diversion, and the quality of service delivery. Using advanced technology and good business sense, these strategies are doing more with less, leading to a paradigm shift in collection methods, and taking advantage of new practices and equipment. Programs employing these strategies are reporting combined waste reduction and diversion rates approaching 50 percent, while stabilizing costs, reducing worker injuries, and increasing customer services.

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The Streets Department of the City of Philadelphia has launched a pilot program targeting 7,000 households, the first major test of these strategies in an East Coast city. As the City with the nation's first urban mandatory recycling legislation (in 1987), Philadelphia was once a leader in this field---but its residential recycling rate has never exceeded 8 percent. Now the circumstances are right for Philadelphia to resume a leadership role:

- Modernizing the City's waste collection practices is consistent with Mayor John F. Street's Neighborhood Transformation Initiative.
- William Johnson is the first Streets Commissioner in fifteen years with significant experience in solid waste management. Formerly a division president for Waste Management of Alameda County, California, he brings first-hand experience in the early development of new waste management strategies. He has mobilized his staff and is pursuing a course consistent with the most successful programs in the country.
- Long at odds with the City administration, environmental and recycling advocates are cautiously optimistic and poised to support the pilots as a test of the new strategies.

The primary objective of this report is to serve as a primer to assist independent groups and individuals in understanding and assessing Philadelphia's dual-collection pilot over the next year. This report has three objectives. First, it provides technical information in layman's terms, documenting the advances in recycling and waste collection around the country. Second, it describes the City's plans as presented in documents and obtained from interviews and by observation. Third, it addresses questions raised by Philadelphia officials and environmental advocates and concerns of state agency representatives throughout the Mid-Atlantic region.

This report is not intended as an analysis, nor is it a how-to manual. Its purpose is to provide the information needed for substantive involvement by the public, policymakers, and advocates, whose participation and support will be essential for the program's success. It is also a guide to assist officials in other municipalities in their own research and planning processes.

SECTION TWO: RECYCLING--ENTERING A SECOND GENERATION

Introduction

Across the country, public and private waste collection managers are experimenting with techniques to reduce costs and increase productivity in providing waste collection and recycling services. Improvements in collection efficiency are a major way to accomplish this goal. According to a case study of six municipal governments conducted by SWANA, collection of solid waste and recyclables consumes 39 to 62 percent of total system costs, an average of 50 percent overall. Communities of all sizes, terrains, and climates have cut costs and improved service using collection efficiency strategies.¹

A review of these collection efficiency strategies suggests that a new state of the art is emerging, a truly integrated waste collection system in which cost-effective waste collection cannot be achieved without significant waste diversion from recycling and composting. A literature review identified the following as collection efficiency strategies with a record of success:

- **automating municipal trash collection;**
- **dual collection** of trash, recyclables, and /or organics in separate compartments on the same truck;
- **adding materials to be collected for recycling**, particularly mixed paper, plastics, and corrugated boxes;
- **instituting curbside collection of yard waste**, and in some jurisdictions, yard waste together with food discards and soiled paper;
- **using more sophisticated materials recovery facilities (MRFs)**, which are capable of processing commingled recyclables and producing fewer residues; and
- **adopting Pay As You Throw (PAYT)**, also known as unit pricing or variable-rate pricing, which provides incentives to residents to recycle more and waste less by charging for the collection of waste based on the amount they throw away.

Automating Municipal Trash Collection

Nationally, manual collection of trash has been the norm and mainstay of waste management for decades. Automation represents the “modernization” of the waste management industry. Increasingly, municipalities with the most successful recycling programs are automated. Benefits of automation include the following:

- Reduction of labor requirements and improvements in worker safety. Automation can minimize or completely reduce operator fatigue and manual lifting. This in turn reduces worker's compensation claims and decreases worker turnover, enhancing job longevity.
- Ability to service an average of 80 to 250 percent more set-outs per scheduled collection crew hour.
- Reduction in the number of vehicles needed to serve a given collection territory.
- Reduction in litter and unsightly set-outs.

Waste collection managers have a choice of fully automated or semi-automated collection systems. Each system employs trucks with hydraulic or mechanical lifting systems, requiring residents to use special wheeled carts ranging in size from 32 to 110 gallons. Fully automated systems are handled without the

¹ United States Environmental Protection Agency, *Collection Efficiency: Strategies for Success*, December 1999, p. 5.

driver leaving the cab. Semi-automated systems require workers to manually line up containers and activate lifting mechanisms, returning carts after emptying.

Fully automated systems can be operated with a crew of one, and offer dramatic reductions in labor costs and worker safety; however, they are more expensive to purchase and maintain. They require placement of containers in accessible areas, and operations are hindered by on-street parking, low-hanging wires, and narrow, one-way, or dead-end streets. Any out-of-cart set-outs are problematic, as they require the operator to leave the cab and contend with a hopper whose height makes manual use impractical.

Semi-automation allows the flexibility to address geographical constraints such as tight streets, on-street parking, and one-way streets. Manual collections for out-of-cart and overflow materials are readily accommodated. Semi-automation for trash alone does not always decrease collection time compared with manual loading; the time may even increase depending on how long it takes to retrieve and return carts, or if the "lifter" unit is insufficient to handle the weight of the carts or is misadjusted. The effect of adding recycling collection, and its function as a manual operation, should also be considered.

Dual Collection of Trash and Recyclables

Dual collection refers to the collection of trash or yard waste and recyclable materials at the same time on the same truck. Several configurations are available for dual-collection systems, using a variety of two or three bins, compartmentalized truck bodies, and specialized wheeled carts ranging from 32 to 110 gallons. The compartments of each truck can be dumped individually, and some have the ability to compact collected materials

Several types of vehicles may be used. Fully automated trucks employ a hydraulic or mechanical arm designed to grasp and empty carts into appropriate hoppers in the truck body. Semi-automated systems require specially designed carts to be wheeled to the collection vehicle, where hydraulic or mechanical "cart flippers" lift and empty the contents. There are three popular configurations for semi-automated vehicles:

Rear loading, with two or three separate compartments for designated collection of trash or yard waste, commingled containers, and mixed paper. This kind of vehicle is automated for trash collection and can accommodate either manual or automated collection of recyclable materials.



Side loading, with street-level bins that hoist and empty to hoppers, and with a rear compartment for trash

Front loading, with split compartments (Oakland used modified dumpsters) bolted to the lift arms. Each compartment is equipped with "cart flippers." Once the bolted containers are full, the contents empty to a compartmentalized





body. This is called a “one-pass” system and employs collection vehicles that are normally used to retrieve waste from commercial dumpsters.

Split-cart systems use compartmentalized wheeled carts with dividers to store combinations of recyclables, trash, and yard waste in a single container. Automated vehicles are designed to empty containers so that the contents flow into different compartments.

Adding Materials to be Collected for Recycling

Targeting more materials for collection will increase the volume of materials collected in a recycling program. A survey of 600 programs across the United States indicated that more than 20 percent had added materials in the previous two years, adding 2 to 5 percentage points to recovery rates.² These materials included: mixed paper, a variety of plastics, old corrugated containers, paper, glass, and metal cans.

Addition of materials must be coordinated with collection and processing systems, from set-out requirements to collection bins, vehicles, and processing capacities. Since increasing the volume collected increases collection costs, it is best to add materials when other changes that may offset costs are implemented.

Instituting Curbside Collection of Yard Waste

All materials recovery programs exceeding 40 percent did so by supplementing recycling with the collection and composting of yard waste. According to reports issued by the U.S. Environmental Protection Agency (EPA), 18 communities with waste reduction rates exceeding 40 percent recorded an average 27 percent collection rate for yard waste and other organic materials.³ Communities in the South and Southwest with long or year-round growing seasons have found it cost-effective to offer curbside collection weekly. Programs in other parts of the country offer the service on a seasonal basis.

Using More Sophisticated Materials Recovery Facilities

More sophisticated MRFs can process and market greater volumes of recyclable materials. MRFs are facilities that receive truckloads of collected mixed recyclables and then use a combination of manual and mechanized systems to sort and process these materials so as to meet the specifications set by the marketplace for each. MRFs play a critical role in preparing materials for the market place, and are a dynamic influence on the design of recycling systems. The materials targeted for collection, set-out preparations, and collection truck options are all linked to MRF design and capabilities. Generally speaking, the more sophisticated the MRF, the more convenient and less complex recycling will be, with fewer separations at the curb for the resident, and fewer compartments on the collection vehicle.

What is the importance and relationship of markets, processing, and MRFs? Putting it simply, where there are no markets, recycling does not happen. “Processing” describes the preparation of mixed materials to render them acceptable for the market. This means that “paper” must be separated into various grades (newspaper, corrugated, sorted office papers, etc.) and compressed into bales; plastic, too, must be separated into grades and sometimes colors (these grades are distinguished by numbers between 1 and 7, circled with chasing arrows, stamped on most plastic containers), and baled or otherwise contained for

² Gary Liss, Lisa A. Skumatz, et al., “Curbside Recycling, the Next Generation: A Model for Local Government Recycling and Waste Reduction,” unpublished. November 2000, p. 2

³ U.S. EPA, “Cutting the Waste Stream in Half,” July 1999, p. 14.

shipment for further processing; glass must be separated by color and crushed; and metal containers must be separated and baled or otherwise stored separated as aluminum and tin-plated steel.

Organic material, some times called yard or green waste, comprises grass, leaves, branches, and food waste. It goes to a distinct location to be processed mechanically and biologically into a product called "compost." Compost is valuable as a natural fertilizer for gardens and agricultural applications.

Processing operations for recyclable materials do not always require mechanization. Rural areas and small communities have established systems requiring residents to make multiple separations, or separating on the collection vehicle or at the transfer area. Collected materials are deposited in open storage bays, roll-offs, or trailers until the aggregated volume justifies the cost of transportation to markets. MRFs are the mechanized version of processing operations. MRFs operate best when they serve a number of smaller communities in a region or a large urban area where there is a consistent flow of mixed recyclable materials. Well-managed MRFs stabilize recycling programs by producing the quantity and quality of materials capable of attracting long-term contracts with material markets.

Collection programs and MRFs. Three predominant MRF processing systems are currently in use in the United States: single-stream, dual- or two-stream, and blue-bag systems. The single- and dual-stream processing facilities are served by dual collection and, consequently, will be further examined in this report. Blue-bag systems are described here for comparative purposes only.

Dual-stream MRFs are the original and most common type. They serve both manual and automated collection programs where materials are collected and separated into two categories—commingled containers (mixed glass, plastic, and metal) and paper, which can be either newspaper alone or newspaper and a variety of mixed-paper grades including junk mail, paperboard products, office papers, or old corrugated containers. Collected containers and paper are received and tipped at separate processing lines at the MRF. Materials are then fed to separate conveyor belts, where they are manually and mechanically separated, crushed, and baled or otherwise packaged to meet market specifications.

Single-stream MRFs represent the latest in MRF technology. Recyclables are collected commingled (paper and containers mixed) in standard or automated compactors. At the MRF, the load is tipped to a mechanical sorting unit that separates the single flow into paper and container streams feeding into sort lines of the kind found in dual-stream MRFs. Reported benefits to recycling programs using single-stream MRFs include the following:

- ease of resident participation, pick-up by collection crews, and MRF operation by facility personnel;
- increased diversion, as residents are likely to participate more actively;
- no need for special trucks, as materials for single-stream processing can be transported in standard, multipurpose vehicles, including front-end loaders, rear-end loaders, or one-pass vehicles; and
- more stops per hour, since collection can be made in a single trip, allowing more homes to be served in comparison to two-stream systems.⁴

Blue-bag MRFs are markedly different from the single- or dual-stream system in that they use no special containers or collection system. Residents purchase special blue bags, which they fill with designated recyclables and place- in a single container with regular trash. Trash and recyclables are then co-collected in an automated or standard trash compactor. Loaded trucks are tipped at a processing facility, where blue bags are manually separated from trash across conveyor belts. Each bag is then opened, and

⁴ P. E. Nathiel Egosi and Andrew Weinberg, "New Technology Overview: Single-Stream Processing," *Resource Recycling*, May 1998, p. 45.

the contents are sorted further to meet market specifications for each material. The City of Chicago has the most elaborate system of this type. An excellent on-line, graphic explanation of this system is available at the City of Chicago Recycling Program website (<http://www.ci.chi.il.us/env/BlueBag/WhatHappens.html>).

Adopting Pay As You Throw

Traditionally, residents pay for waste collection through property taxes or a fixed fee, regardless of how much—or how little—trash they generate. PAYT breaks with tradition by treating trash services just like electricity, gas, and other utilities. Households pay a variable rate depending on the amount of service they use.

Most communities with PAYT programs charge residents a fee for each bag or can of waste they generate. In a small number of communities, residents are billed based on the weight of their trash. Either way, these programs are simple and fair. The less individuals throw away, the less they pay.

How does it work? PAYT works best in municipalities that have defined their costs on a unit basis, most typically per household or premises. Fee structures are defined as either fully variable, multi-tiered, or additional base tax. With fully variable pricing, households pay for each can or bag set out. These programs typically incorporate fixed costs into the variable rate by basing the unit fee on estimated average costs. With a multi-tiered system, the estimated fixed costs of collection and a basic level of service are financed by a flat fee or through taxes. Residents pay variable fees for incremental service levels above the base level. Like the multi-tiered system, the additional-base-tax system involves a flat fee to cover estimated fixed costs of collection. However, residents do not receive a base level of service; a variable rate covers all trash containers set out.

Where has it worked? In 1989, 400 such programs were in place; today more than 4,000 communities in the United States have adopted PAYT.⁵ Solid waste managers report that PAYT has reduced municipal solid waste costs, increased recycling, and decreased waste generation. Under PAYT, residents are continuously reminded to reduce waste, since they pay for trash removal services by the bag, can, cart, pound, or cubic yard, depending on how the program is structured. This creates a direct economic incentive to recycle more and to generate less waste. The payoff from this economic incentive is significant. A recent Duke University study found that average waste reductions in PAYT communities range from 14 to 27 percent. To date, PAYT is the only approach that has been documented to result in measurable residential waste reduction without regulatory mandates or enforcement programs.⁶

Table 1. Communities in Mid-Atlantic States Using Unit-Based Pricing

State	Fully Variable	Multi-tiered	Additional Base Tax	No Information	Total No. of Unit Pricing Communities
Delaware	12	0	0	0	12
Maryland	1	1	1	1	4
Pennsylvania	75	30	22	4	131
Virginia	1	0	3	3	7
West Virginia	0	0	0	3	3

SOURCE: U.S. EPA, August 2000.

⁵ Lisa Skumatz, Erin Truitt, and John Green, "The State of Variable Rates: Economic Signals Move into the Mainstream," *Resource Recycling*, August 1997.

⁶ Janice Canterbury, "How to Succeed With Pay-As-You-Throw," *BioCycle*, December 1998.

What about communities without a fee system? Communities that currently pay for waste collection out of general taxes (for example, property taxes) typically face an initial lack of support for variable-rate fees because they have never paid directly for trash services before. Waste management is a hidden expense; thus, no matter how far waste collection costs drop, unit pricing is viewed as an added cost. But given a monthly bill, or an added charge for trash in excess of average volume, trash collection costs become real to everyone. Under these circumstances, instituting a unit pricing program provides equity to every resident, and the public can actually experience the decrease in the cost of waste collection.

Regardless of the circumstances, instituting PAYT in any community requires careful consideration and planning. The environmental, economic, and equity costs to residents of the current waste management approach must be documented and clearly articulated. The benefits of waste reduction, increased recycling, and reduced costs also need to be understood by the public and policy makers. Concerns about illegal dumping and the impact on low-income residents must be resolved. Many of these issues have been addressed, and the U.S. EPA offers considerable support in the form of information, workshops, and expertise.

Furthermore, with 4,000 communities practicing PAYT, there is considerable experience to draw upon. As Tables 1 and 2 illustrate, there are 157 programs in the Mid-Atlantic area, and 3 urban municipalities with PAYT are profiled in this report, including Los Angeles—the second-largest municipality in the country.

Table 2. PAYT Communities Profiled in This Report

Community	Population	Households	Program Type	Start Date	Container Type
Los Angeles, CA	3,485,398	1,219,770	Multi-tiered	1996	Can
Loveland, CO	52,000	18,382	Multi-tiered	1993	Bag & cart
Oakland, CA	372,242	144,766	Fully variable	1985	Can
San Francisco, CA	723,959	305,984	Fully variable	1980's	Can

SOURCE: U.S. EPA, August 2000.

SECTION THREE: PHILADELPHIA'S NEW SOLID WASTE MANAGEMENT INITIATIVE

Current Waste Management Operations



Philadelphia's current system offers waste and recycling collection to all residents of single-family housing (premises with six units or fewer). Materials are picked up by unionized crews from the Sanitation Unit of the Streets Department. Waste collection is provided citywide on a weekly basis, and recycling collection is provided to most residents every other week, the day before trash collection. As the result of an earlier pilot, one section of the city receives recycling and trash collection weekly, on the same day. Separate trucks are used to collect trash and recyclables. Each truck is operated by a crew of three: one driver and two lifters.

Trash can be set-out in any container, sturdy box or tied plastic bag, the morning of the assigned collection day. Residents are limited to six containers of trash, weighing no more than forty pounds each. Eight- and nineteen-gallon containers have been provided to each resident for recycling. Recycled materials are collected in two streams: commingled containers (glass and metal containers, including empty aerosol cans and empty, dry paint cans) and paper (newspaper and mixed papers). Bulky waste (furniture, mattresses, electronics, white goods, and tires) is collected on a scheduled basis, to be set out on trash day. Leaves and Christmas trees are collected seasonally. Waste and recycling collection is provided to 537,900 residents. All recyclables collected amount to less than 8 percent of the total waste.

Philadelphia's Current Trash Collection System



A Common Set-Out



Manual Collection of Trash



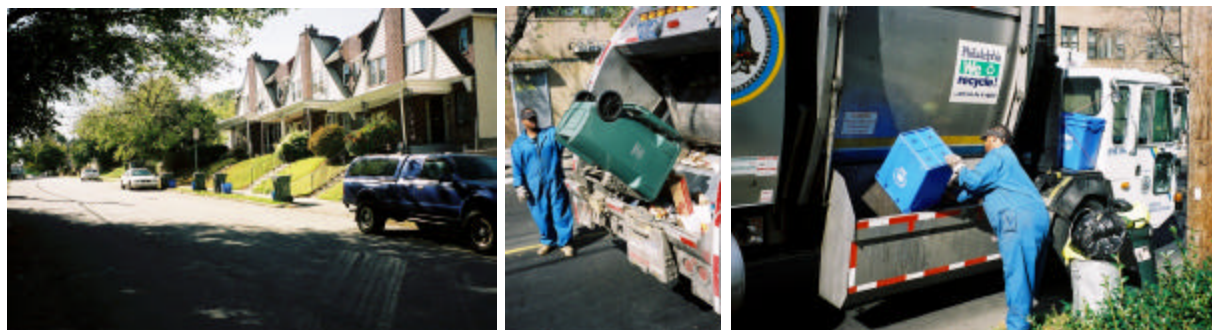
Separate Recycling Truck

Commissioner Johnson's Proposal for Integrated Waste Management

Philadelphia Streets Commissioner William Johnson is proposing to institute an integrated waste management system in which each household or building receives a base level of services including waste collection and bulk waste removal. System administrators will determine the average cost of this service for each household or building. Currently, there is not a standard cost per resident for trash removal services; the true cost is hidden within property and wage taxes. In practice, despite regulatory limitations, residents dispose of waste in any volume they choose. Prudent residents with minimal volumes of waste subsidize more wasteful neighbors. Establishing a baseline of waste management services is a tool to ensure equity in providing services while managing costs. Meeting this objective calls for operational changes designed to achieve the greatest efficiency without compromising service.

A possible solution would include dual collection of trash and recyclables on the same day, at the same time, on a single truck. The pilot calls for all residents to receive wheeled 32- or 64-gallon carts for semi-automated collection of waste materials. Semi-automated trucks are equipped with hydraulic lifting

systems, which allow workers to roll and line up carts to flippers that are mounted on the trucks. The flippers mechanically lift and empty the containers. The pilot requires the use of special dual-collection vehicles with compartmentalized bodies designed to receive and compact at least three streams of materials: trash, commingled containers, and paper. Plastic containers and old corrugated containers will be added to the mix. Yard waste will be collected separately, several times a month. Bulky waste will also be collected on a scheduled basis.



Philadelphia's Dual Collection Set-out

This approach achieves several objectives. First, it is a response to public pressure and findings from surveys and focus groups conducted for the Streets Department, calling for weekly recycling on the same day as trash and for the addition of plastics and old corrugated containers. Second, the wheeled, automated carts are designed to contain a week's worth of trash generated by the average family, provided the recyclables are removed. The containers are animal resistant, control litter, and provide a uniform appearance consistent with Mayor John Street's Neighborhood Transformation Initiative to "eradicate blight" and "improve the appearance of Philadelphia streetscape."⁷ The public will be challenged to produce only as much trash as will fit in the container provided for trash. This can be accomplished if the recyclable fraction is separated for collection. Third, collecting recyclables and trash in one truck reduces labor costs. Semi-automation has reportedly reduced worker injuries and increased productivity. Displaced labor is reassigned to yard waste collection. The diversion of yard waste from the waste stream and the increased convenience of same-day collection support the departmental goal of at least doubling the recycling rate in three years.

Dual collection is expected to produce improvements in efficiency and savings in disposal costs, with minimal operational costs. The cost of new equipment may be absorbed by planned fleet replacements. Plans call for moving the whole city to a weekly recycling system in five to seven years. This timetable is consistent with the truck replacement schedule, providing the time to customize the trucks and containers and to complete implementation in each area of the city, giving consideration to the size and configuration of streets, housing, and other physical and social characteristics. Education and enforcement will be equally specific, aggressive, wide reaching, and ongoing. Successful implementation of these improvements requires new protocols developed through multiple pilot programs.

Launching the Pilot: The Same-Day, Same-Way Campaign

On July 28, 2001, the Streets Department presented the details of its "Same-Day, Same-Way Campaign." The pilot, planned by the Streets Department's Sanitation Division, is being conducted in parts of three sanitation collection routes in the northwest and northeast sections of the city. The selected routes are organized in 13 contiguous segments, each representing a day's work for a collection crew. The neighborhoods were selected based on an in-depth assessment according to the following criteria:

⁷ "Neighborhood Transformation Initiative" brochure, available at the City of Philadelphia website (http://www.phila.gov/mayor/jfs/mayorsnti/about_nti.html).

- weekly collection currently in place (requiring less effort to educate residents),
- ability to accommodate the dual-collection vehicle (longer than current trucks),
- mix of housing types (single-family, duplexes, rowhouses),
- high and low recycling levels,
- high and low litter levels, and
- obstacles (rear and front collection, steps, and in-home storage-of-the-cart issues).

Education, Outreach, and Enforcement Plans

The outreach program was developed with the following priorities:

- to make sure residents understand the program and what they are being asked to do,
- to secure a commitment from residents to participate, and
- to form a partnership to address the issues of the pilot and make them work.

The outreach program began before the pilot and will continue over the six-month period. Outreach, education, and enforcement activities include the following:

- Briefings were held with City Council members in whose districts the pilot routes were located. Michael Nutter (District 4), Donna Miller (District 8), Marian Tasco (District 9), Richard Mariano (District 7), and Brian O'Neill (District 10), representing the targeted routes in the northwestern and northeastern neighborhoods, were contacted first and briefed on the pilot and its objectives. At the request of Council members, three community meetings were held in Councilmanic Districts 7, 8, and 9 to brief targeted residents.
- A special briefing was presented to RAC, SWAC, and other community leaders on July 28, 2001.
- A mailing went out to each resident, informing them of what was to occur and why, and when to expect the delivery of the cart.
- Uniformed SWEEP officers performed selective door-to-door canvassing as follow-up to the mailings, particularly in the northeast, where the greatest change will occur. (The northeast was previously receiving recycling collection every other week, the day before trash collection.)
- Reminder handouts for bulk clean-up days and yard waste collection were delivered door to door.
- SWEEP officers are also examining trash and recycling set-outs for compliance. Whenever possible, they speak one-on-one with residents or leave written warnings.
- At the outset, the city will collect all trash, including that in excess of the container. Enforcement of regulations prohibiting non-containerized trash will follow.

Materials Collected and Collection Containers

Recycled materials collected in all collection areas include glass and metal food and beverage containers, empty aerosol containers and paint cans, newspaper, and mixed papers. Corrugated cardboard and plastic PET (#1) and HDPE (#2) containers have been added to the collection mix, and yard waste collection will be offered on Saturdays. Residents in all but one of the one-day collection areas will receive a 64-gallon cart equipped for semi-automated collection. Carts from three different vendors will be tested. Residents who do not receive carts will continue using their own containers. Residents will continue to use the eight-gallon bucket or nineteen-gallon bins currently provided by the city. More containers are available upon request, or residents can use their own containers with labels provided by the City.

The City will also provide two collection days—and only two—over the six-month pilot for collection of bulk waste. Saturday collection will be provided for yard waste: leaf, tree, brush, and shrub prunings. Each resident will be given a supply of ten large, heavy paper bags.

Collection Vehicles

The Sanitation Division is evaluating two vehicles in the pilot. The first dual collection vehicle has one side-loading hopper that empties to 12 cubic yard recycling compartment, and a 17 cubic yard, rear loading compactor compartment for trash. The second vehicle being tested is a slit, three-compartment

rear loader for commingled containers, paper and trash. A total of five trucks will be used to conduct the pilot.

Worker Training and Union Issues

Up to three days of training programs have been conducted for twenty Sanitation Division staff members, including supervisors, crew chiefs, SWEEP officers, clerical workers, and customer service representatives---everyone who would come into contact with the public. Everyone was briefed on what questions and reactions to expect and on how to handle objections and answer questions.

The union has also been included in the loop, and was part of an early road trip to see a side-loader in operation. According to Van Cooper, President of AFSCME Local 427, the union has “no objections to the use of technology” and is “open to testing” dual collection. He sees problems with dual-collection and believes it will “ultimately be unworkable in Philadelphia.” Among his comments:

- Operationally, the (side-loaded) truck will not be suitable for use citywide due to the size of streets and access problems. Mr. Cooper also questions the durability of dual-collection trucks and their ability to hold up under use in the city environment.
- The side-loader presents safety issues, since it can only be loaded on one side. Workers must retrieve containers and periodically cross the street in front of the truck.
- Although the union was informed of the City's interest in dual collection, Mr. Cooper was not privy to details of program implementation.

Materials Processing and Marketing

Two of the three pilot routes are serviced at a facility in the Northwest part of the City (Area 6) and the third, in the Northeast (Area 4). Trash and recyclables are transported by dual-collection vehicles to Area 6 and transferred to roll-off containers for delivery to BFI facilities; Area 4 to MRFs and a transfer station operated by Waste Management. All targeted materials are processed and sold to markets for use in new products.

Reporting and Evaluation

The pilot will be conducted over a period of six months from the start-up date. Start-up dates are staggered based on the availability of the collection vehicle. Reports on the progress of the pilot will be produced monthly. A baseline was established at the outset of the program, which will be evaluated based on the following criteria:

- customer satisfaction,
- recycling set-outs,
- recycling diversion rates,
- yard waste participation,
- response to enforcement, and
- costs.

Expected benefits include the following:

- reduced litter,
- improved community appearance with uniform trash and recycling set-outs,
- increased collection frequency (weekly recycling collection in areas now receiving service every other week),
- addition of corrugated cardboard, plastic containers, and yard waste to materials targeted for recovery,
- increased recycling rates and waste diversion, and
- improved bulk waste collection service.

SECTION FOUR: COMPARATIVE EXPERIENCE OF OTHER MUNICIPALITIES

The second section of this report reviewed the technology, public policy, and efficiency practices that are being employed to modernize trash collection and recycling in America. The third section set forth Philadelphia's plans to test some of these practices: automation, dual-collection, targeting additional materials for recycling, and yard waste collection. Underlying all of these efforts is the objective of identifying a standard level of waste management services provided to each resident or premises served by the City. This would provide an equitable means of gauging costs and would make it possible to levy charges for removal of waste that exceeds the standard: a form of PAYT.

This section explores the comparative experience of six municipalities that have implemented many of the practices that Philadelphia is about to test. In section five, this experience is used as a benchmark for later assessment of Philadelphia's pilot and a means to consider similar practices in other municipalities. The municipalities selected for comparison and the reasons they were chosen are as follows:

Los Angeles, California. Los Angeles has considered, tested, or implemented all of the collection efficiency practices described in Section two. It is also the second largest city in the United States. It currently diverts 39 percent of its waste through recycling and composting, the highest level of diversion among America's cities with a population of more than a million. In terms of size, demographic and geographic diversity, and sheer complexity, Los Angeles' experience offers the most relevant information for Philadelphia.

Loveland, Colorado. Loveland implemented one of the first and most heralded dual-collection programs in the United States, which it has recently decided to abandon. (See Appendix 4, Recycling Collection Vehicles, for details)

Milwaukee, Wisconsin. Milwaukee was the first urban municipality to implement semi-automated collection of recyclables using split containers. It is also the only documented municipality to effectively address the issues of recycling in low-income areas.

Oakland, California. Oakland had an early urban dual-collection program, implemented by Waste Management of Alameda County under the direction of Philadelphia's current Streets Commissioner, William Johnson.

San Francisco, California. San Francisco is a large urban municipality that has also tested or implemented all of the collection efficiency practices described in Section two. Its experiences are the most extensively documented among the selected municipalities.

Visalia, California. Visalia conceived, developed, and implemented the split-container collection system, allowing for simultaneous, semi-automated collection of trash and recyclables in the same container.

Each of these cities is profiled in Appendix 1, and they are compared below based on questions offered by representatives of the RAC, SWAC, Philadelphia elected and appointed officials, U.S. EPA, and state officials from the Mid-Atlantic region. The questions are as follows:

- Why did municipalities choose to modernize?
- What education and outreach efforts were employed?
- What materials were collected?
- What collection containers were used?
- What vehicles were chosen, and why?
- What impact did automation and dual collection have on collection routes?
- What worker or union issues arose, and how were they resolved?
- How does dual collection affect processing and materials marketability?
- How does Philadelphia's planning and pilot program preparations compare to the national experience?

Why Did Municipalities Choose to Modernize?

The primary reason municipalities modernized was to reduce the cost of waste collection services and improve collection efficiency. A common element of all the municipalities studied was the automation of trash collection, most frequently pursued to reduce worker injuries and control worker's compensation costs. Increasing recycling and decreasing the cost of recycling were also cited as reasons. Automation of yard waste collection sometimes accompanied that of trash, while automated recycling collection usually followed trash collection automation and was implemented only when there were high participation rates for recycling. PAYT fees are used in some municipalities that impose regular fees for waste disposal.

- Los Angeles implemented fully automated collection to "increase public participation, improve collection efficiencies, reduce driver injuries and deter scavenging."⁸
- San Francisco's hauler, Sunset Scavenger, implemented a fully automated system "focused on reducing street litter and associated costs while striving to increase efficiency in collection of all materials."⁹
- Oakland's semi-automated "One Pass" system was implemented "to reduce worker's compensation claims and reduce the cost of service."¹⁰
- Visalia, California, added automated collection of recyclables to its pre-existing automated trash collection in order to meet waste reduction targets set in state law.
- Loveland, Colorado, employed PAYT and dual collection of trash and recyclables in "response to rising worker's compensation insurance rates due to the lifting of overloaded containers of yard wastes and other materials and the need to replace an aging fleet."¹¹

All of these municipalities report meeting or exceeding their objectives.

Oakland and Loveland are among the profiled communities in which manual collection of recyclables matches automated collection of trash. In Milwaukee some residents use bins while the rest are serviced by automated collection. San Francisco and Los Angeles started with manual bin collection of recyclables and have since moved to automated collection of all materials.

The downside of automation is its high initial capitalization and its ongoing system maintenance costs, for vehicles, containers, and customer service.

What Education and Outreach Efforts Were Employed?

Successful automation of trash collection not only demands education and outreach on how to handle trash; it requires every citizen to recycle as much as possible in order to reduce the volume of trash to fit in the trash collection cart. Accordingly, education and outreach programs for automated trash collection focused on recycling when teaching people how to prepare trash for collection. Generally speaking, municipalities that have automated systems used proven education and promotion methods practiced in traditional recycling programs: brochures or packets of information mailed or delivered to each resident; door hangers; community presentations; free bins, carts, bags, or tags to get started. Pilot projects and some smaller municipalities followed up with phone calls or door-to-door visits. Larger municipalities used billboards and transit posters; information was also sometimes sent with utility bills, or advertisements were placed in local newspapers. Mass media, mostly radio and occasionally television, were sometimes used.

⁸ Shirley Plews, "L.A. Recycles: The Next Generation," *Waste Age*, July 1997.

⁹ "San Francisco Takes Residential Organics Collection Full-Scale," *BioCycle*, February 2000, p. 54.

¹⁰ "One Pass Takes Off in Oakland," *BioCycle*, July 1996, p. 51.

¹¹ U.S. EPA, "Cutting the Waste Stream in Half," June 1999, p. 105.

Automation also places a high priority on customer service. In addition to missed collections, it is important to respond quickly to the needs of those who cannot fit their trash in the cart, to handle bulky collections, to replace stolen or broken carts, and to address the needs of infirm and older residents unable to maneuver the cart. Pilot programs used to test and develop operational proficiency are also important in developing education and outreach programs. Several municipalities conducted periodic surveys to determine how well the programs were working and what changes should be made.

San Francisco and Los Angeles used the pilot project as a way to fine-tune their outreach programs. The City of Oakland started its program without a pilot six years ago, and today points to problems in reaching certain segments of the public and some negative public perceptions that might have been addressed in a pilot.

In interviews, officials from Oakland, San Francisco, Los Angeles, and Visalia all stressed the importance of being honest as problems arise and responsive to people’s needs.

Specific details for the municipalities profiled are listed in Appendix 2, Outreach and Education.

What Materials Were Collected?

Table 3 below shows the materials collected by the profiled programs. Three considerations determined which materials were collected after automation: (1) materials collected prior to automation, (2) materials representing a significant volume of the waste stream which could be collected and marketed or composted, and (3) materials that the public demanded to have collected.

Table 3. Materials Collected by Municipalities Profiled in This Report

Program	Paper			Containers			Organics (compostables)	
	News paper	Mixed	Corrugated	Glass containers	Metal containers	Plastic containers	Yard waste	Food waste
Los Angeles, CA	-	-	-	-	-	-	-	
Loveland, CO	-	-		-	-	-	-	
Milwaukee, WI	-	-	-	-	-	-	-	
Oakland, CA	-	-	-	-	-	-	-	
San Francisco, CA	-	-	-	-	-	-	-	-
Visalia, CA	-	-	-	-	-	-	-	

Other materials collected at curbside include the following:

- Visalia: milk and juice cartons, plastic bags
- Loveland: aluminum foil and food pans
- Oakland: aluminum foil and food pans, milk and juice cartons, used oil

The four materials most commonly added to increase diversion were yard waste, mixed paper, plastics, and corrugated cardboard.¹² As noted earlier, yard waste collection for composting is essential for high waste diversion rates.

San Francisco discovered that, despite high participation rates, its residential waste diversion rate had peaked at 20 percent. A waste composition study indicated that 30 percent of total waste was food waste. In order to meet the state-recycling mandate of 40 percent, the City launched a series of pilots collecting food and yard waste. This effort succeeded; the current waste diversion rate is 49 percent.

¹² Gary Liss, Lisa A. Skumatz, et al., “Curbside Recycling, the Next Generation: A Model for Local Government Recycling and Waste Reduction,” unpublished. November 2000, p. 4

The selected municipalities successfully marketed recovered materials, with one exception. Loveland ships amber glass to Coors Bottling in Denver, while green and flint are used as alternative daily cover at the County landfill, located next to the MRF.

What Collection Containers Were Used?

Collection containers are at once an educational tool and an operational device. In the home and on the street they are a reminder and ever-visible advertisement to the resident, and a very important part of the education and outreach program. Operationally, collection containers must be large enough to store targeted materials generated by each resident between scheduled collections, but not obtrusive in the home or unwieldy in set-out and collection.

Three types of containers were common to the programs profiled in this report:

Five- and seven-gallon buckets, and fourteen- to twenty-gallon bins are common to the traditional curbside and dual-collection programs. Such programs are in place in Loveland, part of Milwaukee, and Oakland. Loveland and Oakland provided two bins of different colors, one for commingled containers (i.e., glass, plastic, and metal) and one for newspaper and other forms of paper (i.e., junk mail, paperboard, office paper, etc.) targeted for collection. Milwaukee’s current program and San Francisco and Los Angeles’ earlier programs provided bins for containers, asking residents to use brown shopping bags or twine to secure paper.

Carts designed for automated collection (fully or semi-automated), in sizes ranging from 32 to 110 gallons, used in San Francisco and Los Angeles, for commingled recyclables, yard waste, and trash. Three color coded containers were provided to each resident in both of these cities, one for each material collected.

Split carts in 64- or 110-gallon sizes, used in Milwaukee and Visalia. A “split” cart is a cart with two compartments, designed to be used in an automated system with a truck that allows material to flow into separate compartments. In Milwaukee, a 95-gallon split cart with a single lid was used for once-monthly recycling collection; paper products were placed in the left compartment and containers in the right. In Visalia, a two-lid, 110-gallon cart was provided. Commingled recyclables were deposited on the green-lid side and trash on the brown-lid side. Split carts were also tested in Los Angeles and San Francisco.

Details on the use of bins and carts in the communities profiled can be found in Appendix 3, Use of Collection Containers. Table 4 below summarizes the containers used by each of these communities.

Table 4. Collection Containers Used by Communities Profiled in This Report

Municipality	Collection system	Recycling	Yard waste	Trash
Loveland	Dual collection of trash and recyclables in semi-automated vehicles; separate truck for yard waste (phased out 2001)	12-gal. blue bins/old newspaper 1-gal. green/containers	60-gal. green cart	96/64-gal. & bags
Milwaukee	Semi automated dual-collection split cart system	95-gal. split container & 20-gal. bins-mixed containers w/ paper in bag	Not offered	95-gal. green cart
Oakland	Dual-collection vehicle	18-gal. blue bins/paper; 18-gal. yellow bins/containers;	64-gal. green cart	64-gal. brown cart
San Francisco	Fully automated vehicles	32-gal. blue cart/commingled	32-gal. green cart	32-gal. black cart
Visalia	Semi-automated dual-collection splitcart system	One 55-gal. half of 110-gal. split container	90- & 100-gal. carts	One 55-gal. half of 110-gal. split container

Choosing Collection Vehicles

The development of specialized recycling collection equipment is a relatively recent phenomenon, and many of the automated and dual-collection vehicles developed in the 1990s are still being perfected. The shift from manual to automated collection represents a major change, both in collection practices and in maintenance procedures. While the benefits of automated collection have been heralded, failures have resulted from poorly engineered or manufactured equipment and poor maintenance. It is important to acknowledge that when early programs succeeded, they did so because of the commitment of elected officials, the determination of public works officials, experienced maintenance crews, and close working relationships with skilled vendors.

All new trash compactors, regardless of who produces them, go through a “breaking-in” period in which malfunctions, breakdowns, and parts replacement are the norm. Custom-designed vehicles and trucks that employ hydraulics and unique configurations will produce unique repair needs that must be addressed by municipalities in cooperation with manufacturers. New equipment has a life of five to ten years, and most fleet vehicles are scheduled for retirement after a certain number of miles or years. Equipment is leased or purchased with budget set-asides that are also tied to miles or amortization schedules to provide “replacement costs.” While older trucks may be kept in use beyond the time allotted in budget set-asides, a well-managed fleet rarely depends on these vehicles to serve as its primary rolling stock. Given the cost of new equipment, it appears to make good fiscal sense to retrofit older existing chassis with new bodies until parameters for the new operations are established. This is frequently done.

Some of those interviewed cautioned against retrofitting, and throughout the literature and interviews it was strongly recommended that communities purchase the best trucks possible in order to minimize the number of breakdowns and the maintenance costs. Because of maintenance issues, a number of “back-up” trucks should be included in the plan.

What Vehicles Were Chosen, and Why?

Public works officials and their fleet managers selected vehicles that they judged would be the most efficient in making collections in their municipalities. Operationally, labor needs, geography, loading, and dumping must also be considered. Performance expectations are greater the larger and more diverse the municipality. Because many of the vehicle configurations had little or no prior history of use, each program was part of the learning curve for others to follow.

Table 5. Collection Vehicles Used by Communities Profiled in This Report

Municipality	Vehicles/bodies	Cost per truck	Crew size	Number of residents served
Los Angeles	Fully automated Amrep trucks with Peterbilt or Volvo chassis and semi-automated trucks with McNeilus or Heil bodies with Peterbilt chassis for hard-to-collect areas	\$125,000 to 160,000	1	800/day
Loveland	Crane Carrier chassis, E-Z Pack Apollo 10 CY rear-load trash body, and an 18 CY May Western Curbside Collector side-load recycling body	\$120,000	1	925/day
Milwaukee	GNH Manufacturing with Crane Carrier chassis	\$135,000	1	NA
Oakland	Kahn Manufacturing	NA	1	450/day
San Francisco	Dual-compartment compacting body by Labrie and Volvo chassis	\$192,000	1	NA
Visalia	Heil 7000 packers (modified side-loading automated)	\$164,500	1	900/day

Among the municipalities selected for this study, every configuration of automated, semi-automated, and dual-collection vehicle described in Section two of this report was used. Oakland alone used the one-pass, front-loading truck. Between Los Angeles and San Francisco all other styles were tested, together with multiple sizes of regular and split carts, in the collection of trash, single- and dual-stream recyclables, yard waste, and food waste. Milwaukee requires selected trucks to be capable and equipped to plow snow.

Dual-Collection Vehicles

Loveland and Oakland were involved in the design of their dual-collection vehicles. Oxnard, California, and Durham, North Carolina, are not profiled in this report, but their experiences provide important information. Visalia and Los Angeles retrofitted new bodies to existing chassis at substantial savings over new equipment. Their experiences, detailed in Appendix 4, offer contrasting perspectives on the use of dual-collection vehicles.

Split-Dual-Collection Vehicles and Containers

Visalia was the designer of the split container and accompanying collection vehicle and the first municipality to use them. Oxnard modeled its efforts after those of Visalia. Milwaukee was the first major U.S. city to use the system strictly for recycled materials. Split containers were also tested in Los Angeles and San Francisco for trash, recyclables, and yard waste.

Details on the municipalities profiled, including those with negative experiences, are given in Appendix 4, Recycling Collection Vehicles.

What Impact Did Automation and Dual Collection Have on Collection Routes?

Automation and dual collection increase collection efficiency: more households can be serviced in a given time period than with manual collection. Semi-automated vehicles collect 15 to 100 percent more than manual collection vehicles. Automated systems have been documented to reach 200 to 300 percent more households (see Table 6 below) per crew hour. All systems have pluses and minuses and must balance the political, financial, and operational realities (e.g., containers, vehicles) of the collection system. Dual-collection systems with manual collection of bins require more time and serve fewer households per route than semi-automated split-container systems. Dual collection requires a thorough understanding of set-outs and sizes of truck compartments so that no single compartment is filled before all compartments are half filled. Semi- or fully automated systems collecting commingled recyclables offer the opportunity for the highest efficiency. Both split-container and commingled systems collect higher levels of total materials and generate more contamination. The specific experience of profiled communities includes the following:

Milwaukee. Milwaukee's recycling program was transformed from a citywide bin collection program to a program that serves 160,000 residents using 95-gallon split carts and semi-automated collection and serves 32,000 residents using manually collected 20-gallon bins. The transformation reduced the number of collection routes from 45 to 35.¹³

Los Angeles. In Los Angeles, a fleet of semi- and fully automated collection vehicles had a dramatic impact. Collections increased from 400 to 800 homes per route, at one truck per route; the recycling fleet was reduced from 264 to 134 trucks.¹⁴

Loveland. Under the previous trash-only system, the driver stayed in the truck while the helper manually loaded trash, servicing 450 households per day. With the dual-collection system, a crew of two serves 875 households per day, including recycling, bagged trash, and semi-automated trash cart service.¹⁵ Approximately 25 percent of the city now uses either a 64- or a 96-gallon trash cart.

Oakland. Oakland's One Pass system can service 400 to 500 households for recycling and trash or for trash and yard waste in an eight-hour day with a single driver. The previous system used a three-person crew for trash collection alone.¹⁶

¹³ Michael J. Englebert and Steven D. Brachman, "Divide and Conquer Curbside Collections," *WasteAge Online*, January 1997.

¹⁴ Shirley Plews, "LA Recycles: The Next Generation," *World Wastes Online*, July, 1997.

¹⁵ Molly Farrell, "Co-collection Remains an Experiment," *BioCycle*, August 1996, p. 38.

¹⁶ "One Pass Takes Off in Oakland," *BioCycle*, July 1996, p. 52.

San Francisco. The Fantastic Three program dual-collects recyclables and trash in compartmentalized trucks and yard waste in a separate vehicle, all semi-automated. While a reduction in the number of routes over that with the original recycling bin and manual trash collection system was reported, specific information was not available.

Visalia. Transformation of an automated trash collection system to an automated split-container allowed Visalia to maintain route productivity, collecting trash and recyclables in the same amount of time, with the same numbers of stops and vehicles deployed,¹⁷ as it had previously used for trash alone.

Local government	System type		Crew size		Percentage increase in households served per scheduled crew hour
	Before	After	Before	After	
Austin, Texas	Manual	Semi-automated	3	2	15
Rochester, New York	Manual	Semi-automated	2	1	100
Boca Raton, Florida	Manual	Semi-automated	3	1	86 (projected in feasibility study)
Escambia County, Florida	Manual	Fully automated	3	1	235
Indianapolis, Indiana	Manual	Fully automated	3	1	260
Little Rock, Arkansas	Manual	Fully automated	3	1	250
Pensacola, Florida	Manual	Fully automated	3	1	300
Glendale, California	Manual	Fully automated	2	1	309
Long Beach, California	Manual	Fully automated	2	1	300

SOURCE: U.S. EPA, *Collection Efficiency: Strategies for Success*, December 1999.

¹⁷ U.S.EPA, "Cutting the Waste Stream in Half," June 1999, p. 153.

What Worker or Union Issues Arose, and How Were They Resolved?

The change from manual to automated collection and the use of dual-collection vehicles has evoked very few objections from the labor unions. The primary concerns for labor have been worker safety and job retention. Automation reduces injuries associated with manual lifting and, by raising worker productivity, reduces the size and number of crews performing collection. In Milwaukee, the municipal labor union supported automation on the basis of safety and reduced costs, buffering the workers against privatization. In other municipalities the dramatic decline in the workforce needed was a cause for concern.

Los Angeles addressed this issue by adopting a policy of no layoffs due to automation. Workforce reduction was achieved by adding new services (mostly curbside yard waste collection), attrition, and freezing new hires. Los Angeles also benefited from programs involving workers in the decision-making process. Process action teams, or PATS, comprised of supervisors, managers, and workers, were formed and met regularly to plan efficiency improvements. The goal set by the Los Angeles Bureau of Solid Resources is to establish self-directed teams that will manage their own workloads and implement future efficiencies. One of the purposes of automation is to reduce the fatigue of manual labor and worker injuries, and in doing so to increase job longevity by reducing worker turnover.

Five of the municipalities surveyed--Los Angeles, Loveland, Milwaukee, San Francisco, and Oakland---have workforces represented by labor unions. San Francisco and Oakland use contracted services; Milwaukee, Loveland, and Los Angeles employ municipal crews.

Appendix 5, Union Issues, offers more detailed information on the three programs operated by municipal crews.

How Does Dual Collection Affect Processing and Materials Marketability?

Unless it alters what is required of residents and their participation, dual collection does not affect processing and materials marketability. Addition of materials, automation, or any other efficiency improvement should increase productivity. For dual collection to be advantageous, MRFs and transfer facilities must be no more than ten miles apart.¹⁸

Other issues regarding MRFs should be considered. The two market issues reported below--the use of glass as a landfill cover, and canceling a successful curbside collection program for corrugated cardboard--were systemic issues not linked to dual collection. Market issues are related to MRF design, facility ownership and control, and the evolving technology of materials collection and processing.

Technologically, the trend is to mechanize and simplify recycling systems, ultimately using one cart, one truck, and a single-stream MRF. As the programs have evolved, contamination--the increasing presence of nonrecyclable materials---has been a growing concern, related to both technology and residential set-outs.

The programs examined for this report illustrate these issues.

- Loveland had the most noted dual-collection system reported in the literature, delivering materials to a two-stream MRF adjacent to a landfill, both owned by the County and under contract to a private vendor. Several materials are problematic. While there are markets for amber (brown) glass, flint (clear) and green glass are used for landfill cover. In addition, the MRF is close to reaching its operating capacity, and as a result has stopped processing corrugated. This action forced Loveland to cancel its successful addition of corrugated to curbside collection of mixed paper.
- Milwaukee owns its dual-stream MRF, operated under contract, and collects recyclables in a single, split 95-gallon cart, serviced by a two-compartment truck.

¹⁸ American Plastics Council, Washington, DC, 1995

- San Francisco and Los Angeles use single-stream MRFs, and collect recyclable materials commingled in 95- or 35-gallon carts, in dedicated trucks. San Francisco's MRF is owned and operated privately by its contractor. Los Angeles is committed to eventually owning all six of its MRFs, currently under contract with several vendors. Contamination has become a serious problem, amounting to more than 20 percent of the total volume processed at the facilities.
- Visalia uses a fully automated, dual-collection vehicle and split containers for commingled recyclables and trash. Materials are delivered to a privately operated MRF and transfer station.

Contamination is the MRFs' biggest issue. Among all of the MRFs surveyed, contamination is a common concern. Less than 10 percent contamination is acceptable; levels consistently in excess of 20 percent signal serious problems in the collection system. Oakland's MRFs are operating at 2 to 5 percent contamination; Milwaukee's MRF experienced less than 4 percent contamination in 1996 and is currently at 8 percent. Visalia's is a so-called "dirty" MRF taking select commercial loads that are rich in recyclable paper and have high expected contamination levels, up to 28 percent.

Single-stream MRFs are reporting the most serious problems. Los Angeles and San Francisco recently began operation with less than 10 percent contamination; together with other single-stream operations in California, they have watched levels rise to more than 20 percent. The California Integrated Solid Waste Management Board (CISWMB) has joined with Los Angeles officials, representatives from San Francisco and San Diego, Los Angeles' six MRF operators, and other industry leaders to explore the problem and develop solutions.

There are two major sources of contamination: collection methods and set-out practices. In an effort to cut collection costs, recycling collection programs have gone from open-loaded to compaction vehicles. Compaction tends to crush glass to such a size that the material is not easily retrieved. This has led to an increase in residues and reduced glass recovery. Single-stream collection also contributes to paper contamination from container-borne food and liquids as well as glass-impacted paper.

Set-out practices are also a problem, particularly as programs evolve toward single-stream and commingled collection and use single and split containers for commingled materials and trash (i.e., Visalia). Apparently, residents are paying less attention to the distinctions between commingled recyclable materials and trash. This is particularly disturbing because programs that have traditionally had high participation (Los Angeles and San Francisco) and low contamination with dual-stream MRFs are now seeing high levels of contamination. The comment made by Visalia's recycling coordinator tells the story: "People are either recycling or contaminating." Each of these systems levies additional fees for waste disposal in excess of the capacity of the containers supplied. Residents who are not sure if certain items are recyclable unintentionally contaminate compartments or carts dedicated to commingled recyclables, while others intentionally choose not to participate. The size of the containers and semi-automation make on-site inspection impractical; thus, the problem cannot be easily checked at curbside.

Detailed information organized by municipality can be found in Appendix 6, Material Processing and Marketing Issues.

How Do Philadelphia's Planning and Pilot Program Preparations Compare to the National Experience?

The plans for testing dual collection in Philadelphia are consistent with collection efficiency strategies comprising "the state of the art" in solid waste management and recycling, and the initial planning for the pilot incorporates approaches similar to those in the cities discussed in this report.

Specifically:

- All the collection efficiency strategies outlined in Section two, except for PAYT, are being tested as a function of Philadelphia's pilot. PAYT is not under consideration at this time.
- The education and promotion measures being implemented for the pilot incorporate many of those used in Los Angeles and San Francisco. Uniformed SWEEP officers are being used both to educate and to enforce participation.
- While new types of materials have been added to those targeted for recycling collection, the system continues to rely on manual collection of buckets and bins. This strategy is similar to those now in place in Oakland and parts of Milwaukee. It was also tested in interim stages of the programs in Los Angeles and San Francisco, which both opted for semi-automated collection of much larger containers.
- The design of the dual-collection vehicles being tested for Philadelphia has been successful in other municipalities. The truck has been designed and retrofitted under the scrutiny of very accomplished personnel in Philadelphia's Streets and Fleets Department.
- All workers involved in the pilot have been trained. The union representative from AFSCME Local 427, while skeptical, has "no objections" to testing new technologies.
- The pilot does not call for changes in the current MRF contracts. Tipping facilities for trash and recycling do not present a problem. With the exception of glass, all materials collected are being recycled. Waste Management is crushing glass and using it as a cover on landfills that the company operates.
- The pilot includes thirteen daily segments comprising three collection routes. For purposes of evaluation, baseline data have been established for each daily segment. A criterion has also been set to evaluate the progress of the pilot over a six-month period. The details and format for the baseline data and the schedule for progress reports have not been announced, nor have plans or options been offered for the Department's response to the results of the pilot.

SECTION FIVE: DOES DUAL COLLECTION WORK?

Dual collection works to reduce costs and increase collection efficiency, under specific conditions. Collection compartments must be properly sized to match collection volumes. Tipping facilities for recyclables and trash must be within ten miles of each other. Streets must be large enough to accommodate the added length of collection vehicles or the reach of mechanized features. Routing, crew size, and public participation must also be considered. Ultimately, public works and municipal officials must be willing to plan for and endure some setbacks while developing an approach that will work.

There is no such thing as a standard municipal recycling program. Replicating dual collection and other collection efficiency strategies requires consideration of local circumstances. All municipalities are unique, with differences in size, housing types, configuration of streets, geography, demographics, and waste composition. Municipalities considering major changes in their waste and recycling programs should scrutinize their options and develop plans that take their own special circumstances into account.

The municipalities cited in this report were motivated to automate trash collection because of the need to reduce costs, increase collection efficiency, and increase waste diversion. Each city was unique, but all engaged in similar planning processes for setting goals, adding materials to be collected, and launching pilots to test new methods, collection trucks, and containers. Ultimately, each municipality called on residents to handle waste very differently than they had in the past.

If dual collection and automation are implemented in Philadelphia, its residents can expect the same magnitude of change.

Lessons from the Municipalities Profiled in This Report

- Municipalities chose to modernize in order to increase public participation; improve collection efficiency; reduce service costs, worker injuries, street litter, and scavenging; and meet waste diversion targets.
- Continuing education and outreach are critical. Each city implemented extensive education and outreach programs coupled with distribution of containers for trash and recycling.
- PAYT was effective as an incentive for residents to generate less trash and to recycle. High recycling rates without enforcement resulted, given dual-stream collection programs and uniform practice citywide. Large containers and single-stream collection may encourage residents to avoid extra fees by “hiding” trash in containers dedicated to recycling. If private haulers are not held to the PAYT policy practiced by the municipality, residents opt for the less-expensive, more-convenient option, recycling less and generating more trash.
- The materials added for collection included mixed paper, corrugated cardboard, and yard waste. Addition of yard waste and other organic materials was critical to reaching diversion rates over 35 percent.
- Selection of collection containers required testing to “fit” the container to the needs of the municipality. Containers must be large enough to hold available materials between collections but should not be obtrusive in the home or unwieldy in set-out or collection. They must also be compatible with the collection vehicle.
- Specialized collection vehicles have been developed for manual, semi-automated, and fully automated collection of trash and recyclables, with separate compartments to accommodate dual-stream recycling systems. These vehicles cost \$120,000 to \$192,000. Municipal collection programs initially retrofitted existing vehicles, later purchasing new vehicles as part of their regular fleet replacement schedule. Many program administrators recommend that municipalities purchase new trucks in order to avoid higher maintenance costs.
- Collection systems are evolving toward trucks operated by a single worker and longer collection routes, with household collection rates increasing by 80 to 300 percent per scheduled crew hour.

- Workers have generally benefited from automation, with reductions in lifting-related injuries and improved working conditions. Unions have not opposed automation. Generally skeptical at first, they have been reassured by policies promising no automation-related layoffs. Cost reductions have been achieved by shifting workers to yard waste collection, by worker attrition, and by freezing new hires.
- Where recyclables are cocollected with trash or collected commingled, contamination is increasing to levels of 20 percent or more. This issue is being studied by representatives of several California cities and MRF operators under the direction of the California Integrated Solid Waste Management Board (CISWMB).
- MRFs are evolving toward single-stream systems, receiving commingled recyclables. This sets a trend that includes evolution to a single container, and a vehicle of the same model as that used to collect trash. This method shows great promise provided the contamination problem can be overcome.

Recommendations for review of Philadelphia's Dual-Collection Pilot

1. Support the Philadelphia Streets Department's continuing use of pilots to learn about the feasibility of dual collection and other collection efficiency strategies. Pilots may raise new issues. Expect and encourage promising approaches to be re-addressed in future pilots. Encourage implementation of results.
2. Participate in the pilot, encourage community participation, and provide constructive feedback to the Streets Department. Encourage more substantial involvement of RAC and SWAC before and during pilots.
3. Review the results of the pilot program, with specific consideration of the following questions:
 - Will it work in every neighborhood and on every street? If not, what should the city do in those areas where it will not work?
 - Should we provide alternative-sized containers or alternative collection options for residents with special needs or constraints?
 - Consider, as appropriate, the additional questions offered in Appendix seven. Work with the Streets Department to develop a timeline to adequately review the pilot and provide feedback and further development of the program.
4. For purposes of future pilots and program development, the following should be considered:
 - Test larger set-out containers for recycling and the use of semi-automation and the split cart for dual-stream recycling, as in Milwaukee. Focus these efforts in high-participation areas.
 - Consider contract provisions limiting the acceptable levels of contamination residues in recovered materials. Los Angeles' contract provisions limit contamination residues to 10 percent or less.
 - Beware of the single-stream MRF and commingled collection. The City's consideration of this technology should be based on the resolution of contamination issues
 - Consider public ownership and private operation of MRFs to protect the City's considerable investment in trucks, containers, and education of the citizenry.
5. Due consideration should be given to the following principles:
 - All changes in the City's program should consider recyclable materials markets first, supporting the ultimate use of collected materials for the manufacture of new products.
 - It is the municipality's responsibility to deliver high volumes of uncontaminated recyclables to the MRFs. Limits for contamination should be set, collected materials should be monitored, and problems should be promptly addressed through education, enforcement, and fine-tuning collection methods.
 - Ensure by contract or ownership that MRFs employ the proper technology and are of adequate capacity to handle the types and volume of materials delivered for processing so that they meet market specifications.

APPENDIX ONE: PROFILES OF SELECTED MUNICIPALITIES

This appendix opens with Table 7: Statistical Profile of Selected Municipalities and Philadelphia, followed by detailed profiles of the six municipalities reviewed for this document:

A1-1: Los Angeles, California

A1-2: Loveland, Colorado

A1-3: Milwaukee, Wisconsin

A1-4: Oakland, California

A1-5: San Francisco, California

A1-6: Visalia, California

Each profile contains statistical information describing the geographic and demographic characteristics and municipal collection services, followed by a consolidation of the information on each municipality as found throughout the report and contact information.

NOTE TO THE READER: The information provided in this appendix will also be found, organized by theme (Outreach and education, Use of collection containers, Recycling collection vehicles and Union Issues) in Appendices Two thru Five. The alternative format is provided for the convenience of the reader in response to suggestions offered by the reviewers.

TABLE 7: Statistical Profile - Selected Municipalities and Philadelphia

SELECTED MUNICIPALITIES	Los Angeles	Loveland	Milwaukee	Oakland	San Francisco	Visalia	PHILADELPHIA
Population (2000 Census):	3,802,700	50,608	628,088	399,484	723,959	91,565	1,432,287
Geography							
Square Miles	469.3	23.5	96.1	53.8	47	27	135
Population Density (per square mile)	8,102.92	2,153.53	6,535.78	7,425.35	15,403.38	3,391.30	10,609.53
Demographic Profile							
1-White or European American	30%	86%	60%	11%	44%	66%	48%
2-Black or African American	11%	>1%	29%	38%	8%	>2%	40%
3-Hispanic/Latino	47%	6%	6%	22%	14%	25%	6%
4-Asian or Pacific Islander	10%	1%	2%	18%	31%	6%	3%
5-American Indian & Alaska Native	1%	>1%	1%	2%	1%	>1%	>1%
6-Other	2%	3%	3%	10%	2%	1%	4%
Income (1990 Census)							
Less than \$5,000 to 14,999	21%	19%	32%	40%	21%	24%	33%
\$15,000 to \$49,999	47%	57%	54%	67%	47%	50%	49%
\$50,000 to \$99,999	24%	38%	13%	26%	23%	21%	15%
\$100,000 or more	8%	38%	1%	7%	7%	4%	2%
Median household income (dollars)	\$34,965	\$43,218	\$23,627	\$27,095	\$33,414	\$29,463	\$ 24,603
Residential Profile							
Total Number of Households	1,299,963	14,049	240,540	157,508	346,527	32,654	674,899
Household Density	2,770.0	597.8	2,503.0	2,927.7	7,372.9	1,209.4	4,999.3
Persons/Household	2.93	3.60	2.61	2.54	2.09	2.80	2.12
% Owners	44%	64%	45%	41%	35%	61%	62%
% Renters	56%	36%	55%	59%	65%	39%	38%
Municipal Collection Services	<i>FY2000</i>	<i>FY2000</i>	<i>FY2000</i>	<i>FY2000</i>	<i>FY2000</i>	<i>FY1997</i>	<i>FY1999</i>
Number of Households Receiving Collection	720,000	20,829	190,000	157,508	333,000	26,000	533,771
Tons of MSW Collected	889,911	12,043	173,778	112,687	1,348,000	25,538	646,766
Tons - Recycling Collections	186,422	6,347	32,038	28,950	210,000	8,316	44,435
Tons – Composting	459,905	9,865	26,931	25,989	358,000	16,952	6,183
Total Tons-Waste Diversion	646,327	16,212	58,969	54,939	568,000	25,268	50,618
Diversion as % of Total Waste	42%	57%	25%	33%	30%	50%	7%
Recycling Budget	\$33,000,000	\$1,113,000	\$10,000,000	\$3,600,000	\$2,152,000	\$2,429,251	\$7,033,910
MSW Budget	\$152,000,000	\$2,270,000	\$23,000,000	NA	4,800,000	\$2,827,896	\$79,696,296
Total MSW lbs/Household	2,472	1,156	1,829	1,431	8,096	1,964	2,423
Waste Diversion lbs/Household	1,795	1,557	621	698	3,411	1,944	190

Appendix 1-1

LOS ANGELES, CALIFORNIA RECYCLING/SOLID WASTE MANAGEMENT PROFILE

STATISTICAL BACKGROUND

Population:	3.8 million
Square Miles:	447
Total Number of Households:	1,299,963
Household Density:	N/A
Persons/Household:	3.1
<u>Income</u>	
Less than \$5,000 to \$14,999:	21%
\$15,000 to \$49,999:	47%
\$50,000 to \$99,999:	24%
\$100,000 or more:	8%
<u>Demographic Profile</u>	
European-American:	19%
African-American:	11%
Hispanic/Latino:	38%
Asian:	11%
Other:	21%
<u>Housing Tenure</u>	
Owners:	64%
Renters:	36%
<u>Municipal Collection Services</u>	
Number of Households Receiving Municipal Collection Services:	720,000
Tons of MSW Collected:	889,911
Tons---Recyclables Collected:	186,422
Tons---Yard Trimmings:	459,905
Total Tons---Waste Diversion :	646,327
Recycling Budget:	\$33 million
MSW Budget:	\$152 million
Total MSW (lb./Household):	2,472
Waste Diversion (lb./Household):	1,795

BACKGROUND---SOLID WASTE AND RECYCLING PROGRAM

The State of California requires that all jurisdictions achieve compliance with AB 939, a state mandate to divert 50 percent of the waste stream by the year 2000. The City of Los Angeles carefully developed a Solid Waste Management Plan to meet the state mandate. This plan consisted of implementing a residential curbside program and a commercial technical assistance program. The residential program (the subject of this profile) is called the LA Solid Resources Program and is managed by the Solid Resources Collection Division (SRCD). The Solid Resources Citywide Division (SRECD) manages the commercial program and other citywide services.

The City of Los Angeles converted from manual to automated collection of refuse and yard trimmings, as well as manual curbside collection of two-stream recyclables, in 1988, with a 50 percent goal set by Mayor Bradley. A curbside-recycling pilot had been launched several years earlier, in 1985, expanding to 95,000 households by 1989.

A separate, 16,000-resident pilot targeting trash collection and testing automation was also launched in 1988. It demonstrated that automated trucks could service more than twice as many homes per day as the older manual trucks. Since automated trucks required only one operator; the additional workers were assigned to recycling vehicles.

A new campaign, Recycling System Choices First, began in September 1990. Several curbside recycling pilot programs were established, serving a total of 90,000 households. The pilot programs used three different types of collection: dual-purpose (commingled recyclables and refuse, separated into different containers and truck compartments); commingled; and a three-bucket source-separated system. Based on this experience, the City chose a commingled system, because it generated the highest participation rates during the pilot program. A 16-gallon yellow bin was selected for household recyclables.

Another pilot program was launched in spring 1996 to determine the impact of increased container capacity (from a 16-gallon yellow bin to a 95-gallon blue container) and improved convenience in converting from a two-stream sort to single-stream recycling. The impact was immediate and so highly positive that the City distributed 95-gallon blue containers to 720,000 residences in 14 months, culminating in December 1998.

- Los Angeles targeted fully automated collection in order to “increase public participation, improve collection efficiencies, reduce driver injuries and deter scavenging.”¹⁹
- At 447 square miles, Los Angeles is the largest residential collection district in the United States.
- Recycling tonnage increased by 150 percent as a result of the citywide conversion from manually collected 16-gallon bins and the dual-stream method to semi-automated 95-gallon blue carts and the single-stream method. The customer approval rating for the conversion to 95-gallon single-stream containers was 92 percent.

EDUCATION, OUTREACH, AND ENFORCEMENT

Los Angeles has a culturally, ethnically, and economically diverse citizenry. The city is spread over 450 square miles, and its residents speak more than 60 languages. Los Angeles’ education and outreach program uses a multifaceted, grassroots approach, employing a non-profit youth training organization and public relations firms that specialize in communicating with different ethnic communities. The elements of the education program have grown with the pilots.

The public education team informs residents about curbside recycling and automated collection as the programs come to their neighborhoods. This education program is interactive; residents have an opportunity to ask questions, face-to-face.

The public education team promotes programs in a variety of ways, including speakers at community and homeowner organization meetings; information booths at community events; school curricula for second-, fifth-, and eighth-grade students; and stories in community newspapers and organization newsletters. The Bureau of Sanitation also has a five-language, toll-free recycling hotline and various brochures and fact sheets on its different programs.

The public outreach program employs 150 young adults under contract with the Los Angeles Conservation Corps (LACC), a non-profit youth training organization that works on environmental improvement projects and performs community service. For example, ten LACC members go door-to-door to explain the new curbside recycling program and describe how to separate waste using the new receptacles.

MATERIALS COLLECTED AND COLLECTION CONTAINERS

Materials targeted for collection in Los Angeles include:

<u>All clean, dry paper</u>	<u>Containers</u>	<u>Yard waste</u>
<ul style="list-style-type: none">• Newspaper• Mixed paper• Corrugated cardboard	<ul style="list-style-type: none">• Glass bottles and jars• Aluminum and other metal cans• Plastic bottles and jugs	

Sixteen-gallon bins were being used for recyclables when the City decided to test the use of a single 95-gallon open cart for commingled recyclables versus a 95-gallon split cart into which residents deposited targeted commingled containers and paper products separately. The split cart met the majority of the department’s objectives, including improving collection efficiency, increasing tonnage, improving or maintaining revenue, and reducing scavenging.

¹⁹ Shirley Plews, “L.A. Recycles: The Next Generation,” *Waste Age*, July 1997.

However, SRCD experienced reduced collection speed because the gripper arm had to be lined up at each stop and cardboard was frequently wedged in the container. The open cart had no such problems, and its large lid and volume also discouraged scavengers, since retrieving returnables took more time and effort. Ultimately, the 95-gallon container for commingled recyclables fared better citywide, and this system was selected for citywide use.

There were other benefits. Neighborhoods, even upscale areas, were noticeably free of litter. The new containers completely eliminated what had been a major problem: trash spilling out of containers overturned by dogs and children.

More containers were distributed in low-income communities to match the sizes of families. If there are more than six people in a household, additional containers are provided at no cost. Beyond that, additional containers cost \$5 for each 30-gallon increment for refuse, or \$2.50 for each 30-gallon increment for yard trimmings.

A small number of residents, primarily the elderly, complained about the size, appearance, and difficulty of storage of the larger containers at their residences, so the City offered a smaller, 35-gallon container upon request.

COLLECTION VEHICLES

Los Angeles is currently in the process of converting its entire collection fleet to dual-fuel (diesel/liquid natural gas) vehicles to meet a mandate by the South Coast Air Quality Management District. This program is in its infancy, so no data or results are available yet.

Los Angeles tested a variety of vehicles before settling on its current fleet of fully and semi-automated collection trucks, each collecting a single stream: trash, commingled recyclables, or yard waste. Dual-collection vehicles were tested in 1990, but were not selected due to a preference for dedicated collection vehicles. The city then purchased 177 new recycling trucks at a cost of \$80,000 each. Bureau of Sanitation officials helped design the new trucks, which feature automated side-loading hoppers to help prevent back problems.

After the successful 1988 pilot for automated trash collection, the city purchased 178 new automated trucks and retrofitted 217 of its 700 manual-loading trucks at a cost of \$30,000 each. Due to the success of the 1996 pilot, the fully and semi-automated compactors were used for separate, dedicated collection of trash, commingled recyclables, or yard waste. A profile of the complete collection fleet is given below.

Equipment Costs

<u>Equipment</u>	<u>Unit cost</u>
510 fully automated collection trucks (232 for refuse; 144 for yard trimmings; and 134 for recyclables); mostly Amrep bodies with Peterbilt or Volvo chassis	217 vehicles were retrofitted at \$30,000 each; new vehicles were purchased at \$125,000 each
64 semi-automated trucks with McNeilus or Heil bodies, with Peterbilt chassis for hard-to-collect areas (e.g., steep terrain, narrow alleys, etc.)	\$160,000 each
40 trucks for bulky items	Not available
720,000 blue 95-gallon automated containers (Otto and Rehrig Pacific) for single-stream recyclables	
720,000 green 60-gallon automated containers (Otto, Rehrig Pacific, Plastic Omnium Zarn, and Plastopan) for yard trimmings	All 2,160,000 containers were purchased for \$74 million
720,000 black 60-gallon automated containers (Otto, Rehrig Pacific, Zarn, and Plastopan) for refuse	

WORKER TRAINING AND UNION ISSUES

The Los Angeles Solid Resources Collection Division provides sanitation services for all single-family residences and multi-family dwellings with four units or fewer. Manual collection crews were reduced from three to two workers in the 1960s and from two workers to one in the 1970s.

Automation has reduced the workforce by 25 percent over three years, (from 1,000 to 750 employees), saving \$7.6 million a year. Virtually no issues arose in the conversion from manual to automated collection, for a number of reasons:²⁰

- The City made a commitment at the outset not to lay anyone off because of automation.
- A freeze on new hiring, plus attrition, achieved the necessary staff reduction.
- One-person crews normally loaded their collection vehicles; once they experienced the ease and convenience of loading by automation, they supported the conversion. When the decision was made to automate, everyone wanted to be involved.
- A joint labor/management team established an automated work standard of 145 containers collected per hour. Automated trucks collected twice as much as had previously been collected manually.

Employees were recruited to be part of the decision-making process. PATs were formed in each of the six district yards so that drivers, supervisors, and managers could meet regularly to discuss and plan for future efficiency improvements. Other improvements included the following:

- Truck availability was increased to meet daily route needs.
- Vehicle inspection procedures were standardized, allowing repairs to be performed at night, with trucks ready to run the next morning.
- Radios were installed in each truck, improving coordination and instilling a sense of teamwork among drivers in each district.
- On-board computers were installed, helping drivers to evaluate their performances and identify areas for improvement.

MATERIALS PROCESSING AND MARKETING

Los Angeles' program is served by six privately-owned and operated MRFs; one located in each of the City's six Sanitation districts. Contamination at the MRFs ran less than 10 percent through the 1996 pilot program using 95-gallon containers for single-stream commingled collection. As time passed, the level of contamination increased, and some districts now experience contamination rates in excess of 25 percent. A concerned CISWMB has joined with Los Angeles officials to determine the contamination sources and identify solutions. Los Angeles is conducting comprehensive waste characterization studies, and the City has hosted two forums on contamination, involving representatives from San Francisco and San Diego, Los Angeles' six MRF operators, and other industry leaders.

CONTACT INFORMATION

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²⁰ Conversation with John De la Rosa, Manager, Solid Resources Collection Division, Los Angeles Bureau of Sanitation, July 2001.

Appendix 1-2

LOVELAND, COLORADO
RECYCLING/SOLID WASTE MANAGEMENT PROFILE

STATISTICAL BACKGROUND

Population (2001):	53,000
Square Miles (2001):	26
Total Number of Households:	21,287 (18,487 single-family and 2,800 multifamily)
Household Density:	819 households per square mile
Persons/Household:	2.5

Income

Less than \$5,000 to \$14,999:	19%
\$15,000 to \$49,999:	37%
\$50,000 to \$99,999:	37%
\$100,000 or more:	6%

Demographic Profile

European-American:	86%
African-American:	>1%
Hispanic/Latino:	6%
Asian:	1%
Other:	6%

Housing Tenure

Owners:	64%
Renters:	36%

Municipal Collection Services (FY2000)

Number of Households Receiving Municipal Collection Services:	20,829
Tons of MSW Collected:	12,043
Tons---Recyclables Collected:	6,347
Tons---Composting:	9,865
Total Tons---Waste Diversion :	16,212 (57%)
Recycling Budget:	\$581,000
Yard Waste Budget:	\$532,000
Residential Solid Waste Budget:	\$2,270,000

Total Residential Solid Waste (lb./Household):	1,156
Residential Waste Diversion (lb./Household):	1,557

GENERAL DESCRIPTION-SOLID WASTE AND RECYCLING PROGRAM

Loveland implemented one of the first and most heralded dual-collection programs in the United States, which it has recently decided to abandon. Loveland uses a PAYT fee structure, and dual collection of trash and recyclables was originally implemented in “response to rising worker’s compensation insurance rates due to the lifting of overloaded containers of yard wastes and other materials and the need to replace an aging fleet.”²¹

²¹ U.S. EPA, “Cutting the Waste Stream in Half,” June 1999, p. 105.

EDUCATION, OUTREACH, AND ENFORCEMENT

Loveland residents were introduced to PAYT, recycling/yard waste collection, and dual collection through a pilot program designed around five routes totaling 2,300 households.

Prior to the program, introductory letters were sent to every participating household. In addition, the local newspaper ran several feature stories on Loveland's efforts to improve residential collection services, explaining the need for the changes prior to the pilot program's kick-off.

Loveland staff spoke at community and civic group meetings to explain the new program. Points that were emphasized included the equity of the variable-rate system, improved operational efficiencies, and the advantages of extending landfill life by diverting materials from the waste stream.

Public meetings were held to solicit comments from the residents. When the pilot program began, Loveland staff received a large number of inquiries and complaints from citizens, many of whom did not understand the PAYT concept. Complaints decreased over time as the program was explained and residents had the opportunity to adapt to the new system.

MATERIALS COLLECTED AND COLLECTION CONTAINERS

Materials collected curbside:

- Newspaper
- Glass
- Metals
- Plastic bottles

- Yard waste (for an additional \$5.00/month, April to November only)

Materials collected at the drop-off site:

- All the materials listed above, including yard waste
- Cardboard
- Paperboard and mixed paper
- Magazines and catalogues
- Mixed office paper
- Phone books
- Scrap metal and appliances
- Waste oil
- Auto and household batteries
- Fluorescent lamps

Loveland provides weekly curbside collection of recyclable materials; yard waste is collected weekly, April through November.

Loveland's set-out method calls for newspaper to be placed in a 12-gallon blue container and for commingled containers to be placed in a 15-gallon green container. Residents are asked to set out containers only when they are full in order to cut equipment and labor costs. The program is driven by a "pay as you throw" rate system, where residents are charged a flat monthly fee of \$5.25 and supplemental fees of \$0.50 for a 13-gallon City bag and \$1.00 for a 32-gallon City bag, or, if private-label bags are used, \$0.40 for a 13-gallon stamp and \$0.80 for a 32-gallon stamp. There is also an option for a 64- or 96-gallon trash cart at \$9.50 or \$13.50 per month, respectively. Yard waste can be self-hauled to a drop-off facility at no charge to residents, or collected curbside weekly (April 1 to November 30); a 96-gallon yard waste container is available at an additional charge of \$5.00 per month.

COLLECTION VEHICLES

Loveland had one of the first and most successful dual-collection programs in the country. The citywide program was implemented in 1993, expanding from a pilot of 2,300 to approximately 21,300 households currently. The City uses eight dual collection vehicles (six are run daily, with two back-ups) manufactured by the May Manufacturing Company of Arvada, Colorado, at an original cost of \$120,000 each. The switch to dual collection saved the City \$110,000 in capital costs by making it possible to purchase a single vehicle for trash and recycling collection instead of separate trucks. Each dual collection truck is a combination of a 10-cubic-yard E-Z Pack rear-loading

trash packer and an 18-cubic -yard May Western Curbside Collector side-loading recycling body. Recyclables can be loaded from both sides of the truck into the recycling body, situated between the cab and the compaction unit. The smaller of the two bins holds 7 cubic yards of newspaper, while the second bin holds 11 cubic yards of commingled containers. The space between the bins was designed to hold flattened old corrugated boxes. The previous trash-only trucks and two-person crews serviced 450 households per day; the dual collection system services 925 households per day. Hundreds of residential set-outs were studied in order to determine how to size the compartments so that none filled prematurely. By design, the truck would finish at least half of its route before one of the three compartments filled. Unfortunately, this is increasingly no longer the case, since a decrease in recyclables and an increase in trash has resulted in an imbalance. Each truck now collects more than two loads of trash per day, while the recycling body is increasingly underutilized.

Due to PAYT trash rates, a yard debris pick-up program, and a free drop-off center, average household trash was reduced from 6.6 pounds per day in 1989 to 2.6 pounds per day in 1996, a 60 percent reduction. Average household trash is now at 3.1 pounds per day, and the volume of household recyclables is decreasing (see below).

After nearly nine years, the City of Loveland is poised to retire its dual collection vehicles and is planning to employ a separate, three-truck system. These new trucks will be fully automated and semi-automated front loaders operated by one-person crews. Three reasons were offered for this change. First, the dual collection vehicles were custom-designed prototypes that presented continuing maintenance problems.

Second, because of circumstances beyond staff control, trash and recyclables are sometimes tipped at two distant locations rather than at a combined MRF/landfill facility. During the winter and spring months, the Loveland area is subject to sudden, unpredictable 45+-mile-an-hour winds that necessitate the closure of the landfill in accordance with State regulations to reduce wind-blown trash. Since the dual collection trucks had to make two trips to the landfill and MRF daily, the closure of the landfill before the first load was dumped posed a significant inconvenience to the City. Rather than dumping both trash and recyclables at the landfill/MRF complex, trucks would travel first to the MRF, to off-load recyclables, and then to a transfer station 25 miles away. This resulted in crews being out on the route well into the evening, working very late—a considerable safety hazard. Separate trucks will allow for collection of each route in a single load, and in the event of landfill closure, trash can remain in the truck and be tipped the next day.

Third, the City's PAYT rate structure was undermined by private haulers who offered trash carts in an effort to get a foothold in the Loveland market. Responding to competitive pressures, the City of Loveland also began offering 64- and 96-gallon carts for trash. There are no State or local ordinances regulating private waste hauler access to the Loveland market, and apparently there is little interest in doing so. The ease, convenience, and minimal cost of trash disposal are having a significant negative impact on waste reduction. The City has noted that a growing number of trash carts now regularly contain yard wastes and recyclables. Curbside recycling levels have fallen 5 percent from the first six months of 2000 to the first six months of 2001. What was once a premier waste reduction and recycling program is now slipping backward.

Equipment Costs*

<u>Equipment</u>	<u>Unit Cost</u>	<u>Total Costs</u>
5 dual-collection vehicles: a Crane Carrier chassis with a 10-cubic-yard EZ Pack Apollo rear-loading compactor and a May Manufacturing two-bin Western Curbside Collector	\$120,000	\$600,000
2 yard waste collection trucks	\$76,000	\$152,000
1 roll-off truck	\$95,000	\$95,000
35,671 recycling bins	\$4	\$142,684
4,278 yard waste collection carts	\$52	\$222,456

* Source: Institute for Local Self Reliance, 1999. These are costs from Loveland's initial program start-up in 1993. Several more vehicles have since been purchased.

WORKER TRAINING AND UNION ISSUES

Early in the development of Loveland's program, City officials sought to promote crew cooperation with changes brought by dual collection and to show receptiveness to employees' ideas. Loveland launched several programs for the benefit of front-line workers.

- A fund was established to provide chiropractic treatments or therapeutic massage to workers experiencing back pain. This preventive care program reduces overtime costs and temporary labor needs, and is less expensive than dealing with serious back injuries.
- As an image booster, a dress code was established and each crew member was provided with a clothing allowance. Now, crews wear dark-blue pants and safety-yellow shirts. Most crew members have responded favorably and have reported an increase in a sense of professionalism.
- Steel-toed boots were previously required as a safety measure. Under the new working conditions, constant entering and exiting of the cab made these shoes painful. As a result, the safety shoe requirement was dropped. Loveland increased the shoe allowance to \$200 a year and encouraged workers to wear sturdy shoes that offer good ankle support and puncture resistance.

These actions demonstrated to workers Loveland's concern for their welfare, and improved communication between managers and crews. The crews report that residents now treat them with more respect, and they are proud to be recognized as leaders in the field of recycling.

MATERIALS PROCESSING AND MARKETING

Loveland uses a MRF owned by Larimer County and operated by Waste Management Inc. (WMI). The facility receives newspaper and commingled glass, metal, and plastic containers. Materials are processed and marketed, and revenues are shared with the County. WMI also pays Loveland and other haulers for sorted commodities but not for other materials.

Several materials are problematic. While amber glass is marketed to Coors, green and flint are both used as an alternative daily cover at the nearby County landfill. According to Loveland's solid waste superintendent, the facility is undersized, with limited tipping floor and storage space. In addition, the MRF has reached its operational capacity. Loveland previously collected old corrugated cardboard (OCC) at curbside and mixed it with old newspaper (ONP), but the MRF claimed it could no longer sort the two commodities. As a result, the City discontinued curbside collection of OCC and installed a stationary compactor at its recycling and yard waste drop-off site at which residents can unload their OCC. Despite the inconvenience, residents' delivery of OCC to Loveland's drop off has equaled the volume previously collected curbside. The City has strongly encouraged the County to switch from #8 to #7 ONP (newspaper, office paper, junk mail, magazines, and catalogs all commingled), but the County is reluctant to do so until its MRF can be expanded to handle a greater volume of materials.

CONTACT INFORMATION

Mr. Bruce Philbrick, Solid Waste Superintendent, City of Loveland Solid Waste Management Utility, 105 West Fifth Street, Loveland, CO 80537. Phone: (970) 962 2529. E-mail: philbb@ci.loveland.co.us. Web site: <http://www.ci.loveland.co.us>

Appendix 1-3
MILWAUKEE, WISCONSIN
RECYCLING/SOLID WASTE MANAGEMENT PROFILE

STATISTICAL BACKGROUND

Population:	628,088
Square Miles:	96.1
Total Number of Households:	240,540
Household Density:	2,503 households per square mile
Persons/Household:	2.6

Income

Less than \$5,000 to \$14,999:	32%
\$15,000 to \$49,999:	54%
\$50,000 to \$99,999:	13%
\$100,000 or more:	1%

Demographic Profile

European-American:	60%
African-American:	29%
Hispanic/Latino:	6%
Asian:	2%
Other:	>4%

Housing Tenure

Owners:	45%
Renters:	55%

Municipal Collection Services (FY2000)

Number of Households Receiving Municipal Collection Services:	190,000
Tons of Residential MSW Collected:	173,778
Tons---Recyclables Collected:	32,038
Tons---Composting:	26,931
Total Tons---Waste Diversion:	58,969 (25.3%)
Recycling Budget:	\$10M
MSW Budget:	\$23M
Total MSW (lb./Person):	553
Waste Diversion (lb./Person):	188

GENERAL DESCRIPTION---SOLID WASTE AND RECYCLING PROGRAM

Milwaukee was the first urban municipality to implement semi-automated collection of recycling using split containers. It is also the only documented municipality to effectively address the issues of recycling in low-income areas by tailoring the collection program to neighborhood needs.

EDUCATION, OUTREACH, AND ENFORCEMENT

Milwaukee used a show-and-tell approach to educate the public about the new system. A die-cut replica of the cart with a fold-up lid was created to show the compartments for particular items. In addition, the promotion piece included directions for preparing recyclables and recycling tips. As each cart was delivered, the promotion piece was attached, along with a recycled plastic litterbag and a refrigerator magnet.

The slogan "Do the Blue" was used in all types of media, from billboards to home mailers.

Also, a "Do the Blue" rap video with a segment from the mayor was produced and distributed door-to-door in neighborhoods with low participation.

The city's recycling program was presented to the Milwaukee Public School system, and as a result, recycling was offered as a facet of the School to Work program.

In addition, an Environmental Education Resource and Tour Center was established in cooperation with Keep Greater Milwaukee Beautiful. This organization staffs the facility, which provides tours of the MRF, hands-on exhibits, and a library of resources on all aspects of recycling and pollution prevention.

The sanitation division mails a biannual update to participants in the spring and autumn. This four-sided foldout includes topics such as leaf collection, a focus on individual commodities and their proper recycling preparation, drop-off site operation hours, and a reminder of what is recyclable.

To help correct problems with individual cart use, the collector attaches a bright red tag to the container that explains what the resident did incorrectly and suggests ways to remedy the situation.

MATERIALS COLLECTED AND COLLECTION CONTAINERS

Materials targeted for collection and recycling in Milwaukee include the following:

<u>Paper:</u>	<u>Containers:</u>	<u>White goods</u>
<ul style="list-style-type: none">• Newspaper• Mixed paper• Corrugated	<ul style="list-style-type: none">• Glass• Metal<ul style="list-style-type: none">- Steel cans- Aluminum cans• Plastic<ul style="list-style-type: none">PET (#1)HPDE (#2)	

Recycling collections are made monthly for split carts and weekly for bins. Beyond traditional collections of leaves (mid-October to mid-November), there is no collection program for yard waste.

Milwaukee converted from manual to semi-automated trash collection over an eleven-year period beginning in 1978. Curbside collection of recyclables began in 1989 with 20-gallon bins. Worker injuries on bin collection routes led to a pilot program in 1991 to evaluate an automated recycling collection system using carts. Based on the results of a resident survey, a decision was made to switch from bins to 95-gallon split carts and from weekly to monthly collection in January 1995.

As the year progressed, Milwaukee found the split cart to be impractical in highly transient, low-income neighborhoods. Recycling carts were frequently contaminated with garbage and consequently were left behind for as long as six weeks, posing a possible health threat. In addition, these neighborhoods generated much lower recycling tonnages. As a result of meetings with aldermen and neighborhood groups, the city replaced the carts with 20-gallon bins. Weekly collection reduced scavenging and left the community cleaner than it had been with split containers.

Participation in this area of highly transient population also increased from about 8 to 15 percent, due to a combination of factors: a specific educational campaign, a designated collection day, and less contamination and scavenging.

The current system was in place citywide by 1996, with 32,000 residents using bins for recycling collection and 160,000 using split carts. The changes saved approximately \$300,000 annually. The monthly collection frequency has pushed the cart capacity to the limit.

Equipment Costs

<u>Equipment</u>	<u>Unit Cost</u>
75 trash trucks with G&H bodies mounted on low-entry, dual-side-drive, Crane Carrier or Oshkosh chassis	\$118,000
33 G & NH Manufacturing trucks with Crane Carrier chassis	\$135,000
192,000 95-gallon green Otto carts	\$38
160,000 95-gallon split container	\$43
32,000 20-gallon bins	\$4

COLLECTION VEHICLES

The City of Milwaukee began the transition from manual to semi-automated collection in the late 1970s. At the time, trash was collected by 118 crews, each consisting of three laborers and a driver. In 1978 semi-automated carts were introduced, reducing crew size to one laborer and a driver. By 1989, when the system had expanded citywide, the number of crews was reduced to 91. Recycling was first introduced in 1989, recycling bins were introduced by 1993, and carts in 1995. The system was adjusted to its current configuration, employing 75 garbage crews and 33 recycling crews, in 1996.

The split cart is used exclusively for recycling paper on one side and containers on the other and is loaded onto rear-loading trucks. In 1993 new trash trucks cost \$118,000 each, and new recycling trucks cost \$135,000 each.

WORKER TRAINING AND UNION ISSUES

The primary issues for Milwaukee's union concerned privatization and worker safety. The union supported the move toward one-person crews because this was the state of the art. Although this change reduced the number of workers, it also reduced costs, as well as the threat of privatization. Ultimately, the union encouraged automation and the cart system on the grounds of safety.

MATERIALS PROCESSING AND MARKETING

Milwaukee's MRF was constructed and is operated for the City under a \$6 million, seven-year contract by CRINC of New England. This MRF has the capacity to process 18 tons of paper and 10 tons of containers per hour, with an overall capacity of 50,000 tons per year.

There are no issues in marketing of collected materials. Processing residues are in the range of 4 to 8 percent.

CONTACT: Michael J Englebert, Resource Recovery Manager, City of Milwaukee, Sanitation Division, Room 516, Municipal Building, 841 N. Broadway, Milwaukee, WI 53202. Phone: (414) 286 2355. E-mail: mengel@mpw.net. Web site: <http://www.mpw.net>

Appendix 1-4

**OAKLAND, CALIFORNIA
RECYCLING/SOLID WASTE MANAGEMENT PROFILE**

STATISTICAL BACKGROUND

Population:	399,484
Square Miles:	53.8
Total Number of Households:	157,508
Household Density:	2,928 households per square mile
Persons/Household:	2.5

Income

Less than \$5,000 to \$14,999:	24%
\$15,000 to \$49,999:	50%
\$50,000 to \$99,999:	21%
\$100,000 or more:	4%

Demographic Profile

European-American:	11%
African-American:	38%
Hispanic/Latino:	22%
Asian:	2%
Other:	>10%

Housing Tenure

Owners:	41%
Renters:	59%

Municipal Collection Services (FY2000)

Number of Households Receiving Municipal Collection Services:	157,508
Tons of MSW Collected:	112,687
Tons---Recyclables Collected:	28,950
Tons---Composting:	25,989
Total Tons---Waste Diversion :	59,939 (33%)
Recycling Budget:	\$3.6 million
MSW Budget:	NA*
Total MSW (lb./Household):	1,829
Waste Diversion(lb./Household):	621

*This is not a municipal expense; MSW costs are borne by generators, billed directly by service providers under contract to the City.

GENERAL DESCRIPTION---SOLID WASTE AND RECYCLING PROGRAM

Oakland had an early urban dual-collection program, implemented by Waste Management of Alameda County, Inc. (WMAC) under the direction of Philadelphia's current Streets Commissioner, William Johnson. Oakland's semi-automated "One Pass" system was implemented "to reduce workers' compensation claims and reduce the cost of service."²² All households receive solid waste collection services from WMAC, which has an exclusive franchise citywide for solid waste collection (including nonresidential solid waste), as well as for residential "single-family" (one to four units) yard trimmings (which are collected biweekly by a "one pass" procedure). WMAC also provides "one-pass" recycling collection (biweekly, alternating weeks with yard trimmings collection) in one half of the city as part of its franchise agreement. California Waste Solutions (CWS) picks up recyclables weekly, under contract, in the other half of the city.

²² *BioCycle*, July 1996, "One pass takes off in Oakland," page 51.

EDUCATION, OUTREACH, AND ENFORCEMENT

At the beginning of the dual-collection program, residents received a packet of information, including an instructional brochure, a collection calendar, and a refrigerator magnet with which to hang up the calendar. The packet accompanied the semi-automated carts that were delivered as part of the change from backyard collection in containers provided by residents to curbside semi-automated collection. The two companies that hold contracts with the City for trash removal and recycling each operate a telephone bank to answer questions and solve problems for the customers in their service area. There are a number of problems with Oakland's promotions. First, the involvement of two private collection companies and the mix of services are a source of confusion for residents. Second, the phone banks, which were set up when the program began have never operated very effectively. Online delays in responding to customers who called in, and early problems in meeting residents' needs, led to a tainted public perception of the program that continues five years after its inception. There is also a problem in reaching apartment dwellers, since most buildings do not provide access for the recycling program's outreach activities. As a consequence, 60 percent of the population is difficult to reach and has never been properly oriented.²³

MATERIALS COLLECTED AND COLLECTION CONTAINERS

The City of Oakland provides collection for recycling or composting of the following materials:

<u>Paper:</u>	<u>Containers:</u>	<u>Yard Waste</u>
<ul style="list-style-type: none">• Newspaper• Mixed paper• Corrugated cardboard	<ul style="list-style-type: none">• Glass• Metal<ul style="list-style-type: none">- Steel cans- Aluminum cans- Empty paint cans- Empty aerosol cans• White goods• Narrow-neck plastic containers (all grades)	
<u>Miscellaneous:</u> <ul style="list-style-type: none">• Clean aluminum foil and food trays• Oil and oil filters		

Collection services for recyclables and yard waste are provided on a biweekly basis. Oakland residents have been provided with four containers: a yellow and a blue bin (18 gallons each), a 64-gallon green cart for yard trimmings, and a brown cart with a capacity of 20, 35, 64, or 96 gallons at the resident's choice. The yellow bin is for glass, metal, and plastic containers, the blue bin is for recyclable paper products, the green cart is for yard waste, and the brown carts are for trash. The base fee covers the bins and carts for each resident. Additional bins and carts are provided if needed, but fees are increased for each 35-gallon increment used for trash, and for additional 64-gallon yard trimmings carts. Residents can also acquire free oil and oil filter recycling kits, featuring directions, two plastic gallon jugs, and a special oil filter bag.

Some customers have had difficulty wheeling carts to the curb due to physical limitations or obstacles such as stairs. Backyard collection is provided free to residents with doctor-certified physical limitations and significant "lay-of-the-land" obstacles (e.g., stairs, hills); it is also available to others for an additional monthly fee.

COLLECTION VEHICLES

Waste Management of Alameda County developed the city's one-pass system. A Kahn Manufacturing truck collects trash, recyclables, and yard waste from 100,000 residents. Operated by one person, the truck can service 400 to 500 households per day.

Equipment Costs

Waste Management invested \$19 million in the purchase of vehicles, carts, and recycling bins, and in advertising/public education. A breakdown of actual costs was not available.

MATERIALS PROCESSING AND MARKETING

The firms that have entered into recycling collection agreements with Oakland, Waste Management of Alameda County and California Waste Solutions, both operate their own MRFs. There are no reported market issues, and residues are low at 2 to 5 percent.

²³ Conversation with Mark Gagliardi, City of Oakland, July 2001.

CONTACT INFORMATION

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Appendix 1-5

**SAN FRANCISCO, CALIFORNIA
RECYCLING/SOLID WASTE MANAGEMENT PROFILE**

STATISTICAL BACKGROUND

Population:	776,733
Square Miles:	47
Total Number of Households:	333,000
Household Density:	7,085 households per square mile
Persons/Household:	2.33

Income

Less than \$5,000 to \$14,999:	21%
\$15,000 to \$49,999:	47%
\$50,000 to \$99,999:	23%
\$100,000 or more:	7%

Demographic Profile

European-American:	44%
African-American:	8%
Hispanic/Latino:	14%
Asian:	31%
Other:	3%

Housing Tenure

Owners:	35%
Renters:	65%

Municipal Collection Services

Number of Households Receiving Municipal Collection Services:	333,000
Tons of MSW Collected:	1,348,000
Tons—Recyclables Collected:	210,000
Tons—Composting:	35,000
Total Tons---Waste Diversion :	568,000
Recycling Budget:	\$2,152,000
MSW Budget:	\$4,800,000
Total MSW (lb./Person):	3,480
Waste Diversion (lb./Person):	1,500

GENERAL DESCRIPTION—SOLID WASTE & RECYCLING PROGRAM

San Francisco is a large urban municipality that has also tested or implemented all of the collection efficiency practices described in Section one. Among the selected municipalities its experiences are the most extensively documented. San Francisco's primary hauler, Sunset Scavenger Company, is implementing a semi-automated collection system "focused on reducing street litter and associated costs while striving to increase efficiency in collection of all materials."²⁴

EDUCATION, OUTREACH, AND ENFORCEMENT

Promotions for the pilots were extensive, and outreach methods were established as the program expanded citywide. An estimated 42 percent of San Francisco's residents do not speak English as their primary language at home. Materials were distributed in three languages: English, Chinese, and Spanish. Distributed materials included a direct mailing enclosing a detailed brochure and a letter from the Mayor, additional flyers delivered with the bins; and labels affixed to each bin listing materials accepted and not accepted. In some areas and pilots, residents were also

²⁴ *BioCycle*, February 2000 "San Francisco Takes Residential Organics Collection Full-Scale", p. 54.

telephoned regarding their new collection containers to make sure that they received information and understood the program.

MATERIALS COLLECTED AND COLLECTION CONTAINERS

Sunset Scavenger Company, the City of San Francisco's primary permitted hauler, provides collection of materials for landfilling as well as of the following materials for recycling or composting:

<u>Paper:</u>	<u>Containers:</u>	<u>Compostables:</u>
<ul style="list-style-type: none">• Newspaper• Mixed paper• Corrugated	<ul style="list-style-type: none">• Glass• Metal<ul style="list-style-type: none">- Steel cans- Aluminum cans- Empty paint cans- Empty aerosol cans• Plastic<ul style="list-style-type: none">- PET (#1)- HDPE (#2)	<ul style="list-style-type: none">• Yard trimmings• Food scraps• Food-soiled paper
<u>Miscellaneous</u>		
<ul style="list-style-type: none">• Clean aluminum foil and food trays• White goods		

Collection services for recyclables and compostables are provided on a weekly basis.

San Francisco started with a two-stream recycling program using 12-gallon blue bins. The bins held glass, metal, and plastic containers, while a variety of mixed paper products were set-out in a paper bag or tied with string. Gray and blue rolling carts for mixed paper and commingled containers, respectively, were supplied to apartment buildings with more than five units. After studies indicated that organic material comprised 26 percent of the waste stream, 32-gallon carts and 64-gallon split carts (32 gallons to a side) were tested in several pilots to collect (or dual-collect) organics, trash, and recyclables in automated, semi-automated, and dual-compartment collection vehicles.

The first pilots, starting in July 1997, demonstrated that 32-gallon containers collected organic material equal to 11 percent of the total trash generated. In the fall of that year a second 32-gallon container, collecting paper, was tested, and residents were encouraged to use the blue bin for commingled containers. The result: an increase of 15 percent in recycling levels. Another pilot, run simultaneously, directed residents to commingle all recyclables in a single 32-gallon container, which was provided. In this pilot, recycling rates increased 10 percent.

Split containers were tested in the spring of 1998. The objective was to completely change the concept of separation between trash and recyclables and, in doing so, to make collection of both more efficient. Three different pilots were set up. The first tested collection of trash on one side of a split container and a mix of yard waste and food waste on the other. Blue bins continued to be used for recyclables. The second tested collection of trash and commingled recyclables (residents stopped using the blue bins), and the third tested collection of organics and commingled recyclables. The first pilot showed an increase of 27 percent given the addition of organics. The second increased recycling tonnage collected by 20 percent over previous collection, registering 90 percent monthly participation and 80 percent weekly set-outs. The third pilot's diversion of organics comprised 13 percent of total trash generated, and the recyclables diverted increased by 20 percent over pre-pilot collection.

Based on an analysis of all three systems, a new pilot, integrating the best elements of all three programs, was launched in 1999. In this, the "Fantastic Three pilot," each of 2,800 households received three 32-gallon carts: blue carts for commingled recyclables; green carts for yard waste, food (vegetable and meat) waste, and food-soiled paper; and black carts for trash that was neither recyclable nor compostable. From May through December 1999 an average of 46 percent of the total waste stream was diverted from landfilling. Surveys indicated that 73 percent of residents like the new program better than the previous trash and collection service.

Ultimately, the Fantastic Three pilot became the template for citywide expansion. The City and Sunset Scavenger Company believed the Fantastic Three system offered the most flexibility and maximized diversion and efficiency. As a result the current plan was developed to roll out this three-cart program to as many one- to five-unit residential buildings as possible, a total of more than 128,000 households in Sunset's service area by 2004. Apartment buildings and small businesses are also being offered the program, but they are not given the compostables cart unless they request it. In addition, Golden Gate Disposal and Recycling Company, which serves the remaining

northeast downtown area of the city, plans to roll out the three-cart program to its individually serviced households. Sunset Scavenger and Golden Gate Disposal Companies are both subsidiaries of Norcal Waste Systems.

COLLECTION VEHICLES

Prior to the pilot, Sunset Scavenger used a conventional, rear-loading compactor with a crew of three for waste removal, and a two-compartment, side-loading Lodal with a crew of one to collect recyclables. Both semi- and fully automated side-loading vehicles were tested as part of the pilot program; a variety of standard side-loaders were tested on the dedicated-cart pilot routes. For the split-cart pilots, specially designed, two-compartment compacting vehicles were developed to accommodate the split carts as well as the dedicated carts. These have approximately 20 percent higher capital costs than the single-chamber compactors, and slightly greater maintenance needs. However, the ability to accommodate both split carts and dedicated carts maximizes flexibility and efficiency; it also allowed for future use of the vehicle regardless of the container chosen for implementation. As previously noted, the use of separate, dedicated carts was ultimately selected as the primary collection system. The collection fleet reflects a hybrid of the tested vehicles, addressing the range of San Francisco's geography and density. Side-loading, split compactor vehicles are used to dual-collect recyclables and trash, using a 40/60-volume compartment split. Compostables are collected separately with single-compartment side loaders.

The split vehicle dual-collection serves approximately 1,300 to 1,800 household accounts per week, while the vehicles collecting compostables may serve as many as 6,000 accounts (or more) per week. This results in approximately four dual-collection routes for every compostables route, and a complete change in collection routes to maximize efficiency.

Equipment Costs*

<u>Equipment</u>	<u>Unit Cost</u>
Dual-compartment side-loading compacting body by Labrie and Volvo chassis	\$207,000
Single-compartment side-loading organics collection vehicle	\$187,700
32-gallon container	\$35
64-gallon container	\$41
2-gallon kitchen pail	\$3.50 to \$4
Container delivery w/outreach materials (per cart)	\$2 to \$3

Source: Jack Macy, Organics Recycling Coordinator, City of San Francisco, and Ken Planin, Sunset Scavenger Company (San Francisco). February 2000 and July 2001.

* Sunset Scavenger plans to finance the complete overhaul of its collection system over seven years through increased rates charged to its customers. In a City-approved five-year rate increase order that took effect July 2001, 109 dual-collection routes were projected for Sunset Scavenger with 14 spares, for a total of 123 trucks, and 14 dual-collection routes were projected for Golden Gate Disposal & Recycling with 1 spare, for a combined total of 138 dual-compartment trucks for citywide roll-out. The total projected seven-year lease cost for these dual-compartment vehicles is \$29,045,891. A projected 24 single-compartment side-loading vehicles will be used for organics collection citywide, with a corresponding projected seven-year lease cost of \$5,584,000. The total cost of providing the carts citywide (a total of 431,520 carts) has a projected seven-year lease capital cost of \$15,701,000, plus \$661,000 for residential kitchen pails to collect food scraps and \$3,243,751 to assemble and deliver all bins to residents and small businesses. In addition, \$683,940 will be spent for outreach materials and \$175,000 for truck cameras. All these capital costs for program roll-out total a projected \$55,094,582 over a seven-year period.

MATERIALS PROCESSING AND MARKETING

Norcal Waste System companies process and market recyclables, yard waste, and food waste. All trash and compostables passing through the transfer station in San Francisco owned by Norcal Waste Systems Recyclables go to a new single-stream MRF located in Pier 96 in San Francisco near the transfer station. Compostables are transferred to Norcal's B & J Composting facility in Vacaville, California, located 65 miles northeast of San Francisco.

CONTACT INFORMATION

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Appendix 1-6

**VISALIA, CALIFORNIA
RECYCLING/SOLID WASTE MANAGEMENT PROFILE**

STATISTICAL BACKGROUND

Population:	91,565
Square Miles:	27
Total Number of Households:	32,882
Household Density:	1,209
Persons/Household:	3

Income

Less than \$5,000 to \$14,999:	24%
\$15,000 to \$49,999:	50%
\$50,000 to \$99,999:	21%
\$100,000 or more:	4%

Demographic Profile

European-American:	66%
African-American:	>2%
Hispanic/Latino:	25%
Asian:	6%
Other:	>2%

Housing Tenure

Owners:	61%
Renters:	39%

Municipal Collection Services (FY 1997)

Number of Households Receiving Municipal Collection Services:	26,000
Tons of MSW Collected:	25,538
Tons---Recyclables Collected:	8,316
Tons---Composting:	16,952
Total Tons---Waste Diversion:	25,268 (50%)
Recycling Budget:	\$2,429,251
MSW Budget:	\$2,827,896
Total MSW (lb./Household):	1,964
Waste Diversion (lb./Household):	1,944

GENERAL DESCRIPTION---SOLID WASTE AND RECYCLING PROGRAM

Visalia, California, conceived, developed, and implemented the split container and the dual-collection system, allowing for simultaneous, semi-automated collection of trash and recyclables in the same container. Visalia added automated collection of recyclables to its pre-existing automated trash collection in order to meet waste reduction targets set in State law.

EDUCATION, OUTREACH, AND ENFORCEMENT

Visalia undertook an extensive outreach campaign in conjunction with a pilot in 1991. Neighborhood meetings were held to show off the truck and the container. Each resident received full system instructions twice---once prior to receiving the container, and again when the container was delivered. Two months into the program, a survey showed a 98 percent acceptance rate. The last phase of the pilot combined radio and television advertising with

meetings with service clubs and seniors' groups, school recycling programs, and neighborhood meetings. Time was always set aside before and after meetings to address individual issues. Personal contact was reported to be the most important element in creating a successful program.

All promotions ended with the first pilot. Since that time, contamination levels have risen and the diversion rate has dropped from nearly 50 percent to 30 percent. Contamination of 28 percent is generated primarily in low-income neighborhoods. Forty percent of the adult population is illiterate. A renewed education and promotion program is under consideration.

MATERIALS COLLECTED AND COLLECTION CONTAINERS

Visalia provides collection for recycling or composting of the following materials:

<u>Paper:</u>	<u>Containers:</u>	<u>Yard Waste</u>
<ul style="list-style-type: none">• Newspaper• Mixed paper• Corrugated	<ul style="list-style-type: none">• Glass• Metal<ul style="list-style-type: none">- Steel cans- Aluminum cans• Plastic<ul style="list-style-type: none">- PET (#1)- HDPE (#2)	<ul style="list-style-type: none">• Untreated scrap wood and lumber• Tree trimmings, fallen limbs• Grass clippings, weeds, leaves, and faded blossoms and other "green" waste
<u>Miscellaneous</u>		
<ul style="list-style-type: none">• Clean aluminum foil and food trays• White goods		

Collection services for recyclables and yard waste are provided on a weekly basis. Yard waste is collected on a different day than recyclables and trash.

In 1991 the City launched recycling pilots based on manual collection of bins and bags. Both approaches resulted in poor productivity rates in comparison with the fully automated trash collection system. Seeking to develop a system that replicated the efficiency of its fully automated trash collection program, the City teamed up with the distributor of its trash truck to design and patent the split-container system. A 110-gallon split container, with one side for commingled recyclables and the other for trash, was successfully piloted. A previous second day for trash collection was replaced with a "green" collection day for yard waste using 60- or 105-gallon carts previously used for trash collection. Households generating trash in excess of the capacity of the 110-gallon container can pay \$8.45 per month for an extra trash container and \$4 per month for yard waste. The dual-collection system was successfully expanded citywide by 1996.

Many residents complain that the split container is too small to hold all their recyclables. There are also perceptions among some in the community that the truck is not divided, and that all materials are mixed and trashed.

COLLECTION VEHICLES

Visalia City staff teamed up with the distributor of its trash trucks to design a special 110-gallon split container and a dual-compartment automated-collection vehicle. After a successful pilot in 1992, the city implemented the program citywide, serving 26,000 households, in April 1996. The dual-compartment, 33 cubic-yard truck is operated by a crew of one. As a split container empties its contents into the truck, the center divider in the container lines up with an inner divider in the truck. The recyclables drop into a top compartment (40 percent of the truck's volume), while the wastes are directed to a lower compartment (60 percent of the truck's volume). The lower compartment has a compaction ratio of 8 to 1. Each truck serves 900 households per day. Twelve modified side-loading automated Heil 7000 packers were purchased at \$164,500 each. Twelve automated side-loading Heil 7000 packers previously used for trash collection were committed to hauling green waste. The dual-collection vehicles cost approximately 20 percent more than trash-only trucks. In FY97 the recycling program diverted 16 percent of the City's residential waste, saving \$300,000 per year in tipping fees. Total diversion, including yard waste, is 50 percent.

Equipment Costs

<u>Equipment</u>	<u>Unit Cost</u>	<u>Total Costs</u>
12 dual-collection vehicles: modified side-loading Heil 7000 Packers	\$164,500	\$1,974,000
26,520 10-gallon split carts	\$90	\$2,173,500
12 yard waste collection vehicles	\$144,500	\$1,734,000
26,520 90- & 100-gallon roll-out carts	\$68	\$1,642,200

Source: Institute for Local Self Reliance, 1999.

MATERIALS PROCESSING AND MARKETING

Visalia's dual-collection truck delivers its load to a landfill/recycling transfer site in Visalia. After the truck dumps its trash, recyclables are unloaded to an asphalt pad and transferred to roll-off containers by a front-end loader. The containers are then delivered to a privately run processing facility, Tulane County Recycling, five miles from the center of town. This facility is a "dirty MRF" in addition to source-separated recyclables, it also receives loads of commercial waste that are rich in recyclable materials. Only 55 percent of this commercial waste is recovered, and market rejection is high at 20 to 30 percent by weight. MRF residuals are also high at 28 percent.

CONTACT INFORMATION

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APPENDIX TWO: OUTREACH AND EDUCATION

Milwaukee. Milwaukee used a show-and-tell approach to educate the public about its new system. A die-cut replica of the cart with a fold-up lid was created to show the compartments for particular items. In addition, the promotion piece included directions for preparing recyclables and recycling tips. It was attached to each cart delivered, along with a recycled plastic litterbag and a refrigerator magnet.

The slogan "Do the Blue" was used in all types of media, from billboards to home mailers.

In addition, a "Do the Blue" rap video with a segment from the mayor was produced and distributed door-to-door in neighborhoods with low participation.

The city's recycling program was presented to the Milwaukee Public School system, and as a result, recycling was offered as a facet of the School to Work program.

In addition, an Environmental Education Resource and Tour Center was established in cooperation with Keep Greater Milwaukee Beautiful. This organization also staffs the facility, which provides tours of the MRF, hands-on exhibits, and a library of resources on all aspects of recycling and pollution prevention.

The sanitation division mails a biannual update to participants in the spring and autumn. This four-sided foldout includes topics such as leaf collection, a focus on individual commodities and their proper preparation for recycling, drop-off site operation hours, and a reminder of what is recyclable.

To help correct problems with individual cart use, the collector attaches to the container a bright-red tag that explains what the resident did incorrectly and suggests ways to remedy the situation.

Los Angeles. Los Angeles has a culturally, ethnically, and economically diverse citizenry. The city is spread over 450 square miles, and its residents speak more than 60 languages. Los Angeles uses a multifaceted, grassroots approach, employing a non-profit youth training organization and public relations firms that specialize in communicating with different ethnic communities. The elements of the education program have grown with the pilots.

The public education team informs residents about curbside recycling and automated collection as the programs come to their neighborhoods. Residents can ask questions, which lend a face-to-face element to the programs.

The public education team promotes its programs in a variety of ways, including speakers at community and homeowner organizations; information booths at community events; a school curriculum for second-, fifth-, and eighth-grade students; and stories in community newspapers and organization newsletters. The Sanitation Bureau also has a five-language, toll-free recycling hotline and various brochures and fact sheets on its different programs.

The public outreach program employs 150 young adults by contracting with the Los Angeles Conservation Corps (LACC), a non-profit youth training organization that undertakes environmental improvement projects and performs community service. For example, ten LACC members go door-to-door to explain the new curbside recycling program and describe how to separate waste using the new receptacles.

Loveland. Loveland introduced residents to PAYT, recycling/yard waste collection, and dual collection through a pilot program designed around five routes totaling 2,300 households.

Prior to the program, introductory letters were sent to every participating household. In addition, the local newspaper ran several feature stories on Loveland's efforts to improve residential collection services, explaining the need for the changes prior to the pilot program's kick-off.

Loveland Public Works' staff spoke at community and civic group meetings to explain the new program. Points that were emphasized included the equity of the variable-rate system, improved operational efficiency, and the advantages of extending landfill life by diverting materials from the waste stream.

Public meetings were held to solicit comments from the residents. When the pilot program began, Loveland staff received a large number of inquiries and complaints from citizens, many of whom did not understand the PAYT concept. Complaints decreased over time as the program was explained and residents had the opportunity to adapt to the new system.

San Francisco. San Francisco carried out extensive promotions for pilots and for citywide expansion of its program. Outreach materials included several trilingual brochures (in English, Chinese, and Spanish; 42 percent of San Francisco's residents do not speak English), a direct mailing including a letter from the Mayor, a detailed brochure delivered with the bins, and labels affixed to each bin with the do's and don'ts. Residents were also telephoned within a week of receiving their new collection containers to make sure they had received the information and understood the program.

Oakland. Oakland has the only urban program that was begun without a preceding pilot. A packet of information, including an instructional brochure, a collection calendar, and a refrigerator magnet with which to hang up the calendar, was delivered. Each of the two companies that provide trash removal and recycling services under contract with the City runs a telephone bank to answer questions and solve problems for customers in its franchise area. There are a number of problems with Oakland's promotions. First, the two franchise contractors and the mix of services are a source of confusion for residents. The phone banks, which were set up as the program began, have never operated very effectively. Online delays in responding to customers who called in and early problems in meeting residents' needs led to a tainted public perception of the program that continues five years after its inception. There is also a problem in reaching apartment dwellers, since most buildings do not provide access for the recycling program. As a consequence 60 percent of the population is difficult to reach and has never been properly oriented.²⁵

Visalia. Visalia undertook an extensive outreach campaign in conjunction with a pilot in 1991. Neighborhood meetings were held to show off the truck and the container. Each resident received full system instructions twice---once prior to receiving the container, and once again when the container was delivered. Two months into the program, a survey showed a 98 percent acceptance rate. The last phase of the pilot combined radio and television advertising with meetings with service clubs and seniors' groups, school recycling programs, and neighborhood meetings. Time was always set aside before and after meetings to address individual issues. Personal contact was reported to be the most important element in creating a successful program.

All promotions ended with the first pilot. Since that time, contamination levels have risen and the diversion rate has dropped from nearly 50 percent to 30 percent. Contamination of 28 percent is generated primarily in low-income neighborhoods. Forty percent of the adult population is illiterate. A new education and promotion program is under consideration.

²⁵ Conversation with City staff, City of Oakland, July 2001.

APPENDIX THREE: USE OF COLLECTION CONTAINERS

Milwaukee. Milwaukee converted from manual to semi-automated trash collection over an eleven-year period beginning in 1978. Curbside collection of recyclables began in 1989 using 20-gallon bins. Worker injuries on bin collection routes led to a pilot program in 1991 to evaluate an automated-cart recycling collection system. Based on the results of a resident survey, a decision was made to switch from bins to 95-gallon split carts and from weekly to monthly collection in January 1995.

As the year progressed, Milwaukee found the split cart to be impractical in highly transient low-income neighborhoods. Recycling carts were frequently contaminated with garbage and consequently were left behind for as long as six weeks, posing a possible health threat. In addition, these neighborhoods produced much lower recycling tonnages. As a result of meetings with aldermen and neighborhood groups, the city replaced the carts with 20-gallon bins. Weekly collection reduced scavenging and left the community cleaner than it had been with split containers.

Participation also increased from about 8 to 15 percent, due to a combination of factors: a specific educational campaign, a designated collection day, and less contamination and scavenging.

The current system was in place citywide by 1996, with 32,000 residents using bins for recycling collection and 160,000 using split carts. The changes saved approximately \$300,000 annually. The monthly collection frequency has pushed the cart capacity to the limit.

Los Angeles. Twenty-gallon bins were being used for recyclables when the City decided to test the use of a single 95-gallon open cart for commingled recyclables versus 110-gallon split carts into which residents were asked to deposit commingled containers and paper products separately. The split cart met the majority of the department's objectives, including improving collection efficiency, increasing tonnage, improving or maintaining revenues, and reducing scavenging. The open cart's large lid and commingled containers also discouraged scavengers, since retrieving returnables took more time and effort. Ultimately, the 95-gallon container for commingled recyclables and a single stream of materials fared better citywide, and this system was selected for citywide use.

There were other benefits. Neighborhoods, even upscale areas, were noticeably freer of litter. The new containers completely eliminated what had been a major problem of trash spilling out of containers overturned by dogs and children.

More containers were distributed in low-income communities to match the sizes of families. If there were more than six people in a household, additional containers were provided at no cost; beyond that, additional containers cost \$5 for each 35-gallon increment.

Some residents complained about the size and appearance of the container and the difficulty of storing it at their residences. The City offered a smaller, 35-gallon container, available after a one-month tryout period.

Cart maintenance and repair was an issue overlooked in the initial planning. Several full-time employees whose positions were scheduled for reduction were reassigned to this task.

Loveland. Loveland's set-out methods call for newspaper to be placed in a 12-gallon blue container, and commingled containers in a 15-gallon green container. Residents are asked to set out containers only when they are full in order to cut labor costs. The program is driven by a "pay-as-you-throw" rate system, where residents are charged a flat monthly fee of \$5.25 and supplemental fees of \$0.50 for a 13-gallon city bag and \$1.00 for a 32-gallon city bag, or, if private-label bags are used, \$0.40 for a 13-gallon stamp and \$0.80 for a 32-gallon stamp. Due to the pressure of competition from unregulated private waste haulers that have infiltrated the community, there is also an option for a 64- or 96-gallon trash cart at \$9.50 or \$13.50 per month, respectively. Yard waste can either be self-hauled to a drop-off facility at no charge to residents or collected curbside seasonally (April 1 to November 30); a 96-gallon container is available at an additional charge of \$5.00 per month.

Oakland. Oakland residents have been provided with four containers: a yellow and a blue bin (18 gallons each) and a brown and a green cart, with capacities of 35, 64, or 96 gallons. The yellow bin is for glass, metal, and plastic containers, the blue bin is for recyclable paper products, the green cart is for yard waste, and the brown cart is for trash. The base fee covers the bins and carts for each resident. Additional bins and carts are provided if needed, but fees are increased for each 35-gallon increment used for trash. Residents can also acquire free oil and oil filter recycling kits, featuring directions, two-plastic gallon jugs, and a special oil filter bag.

Some customers have had problems with carts due to physical limitations or obstacles such as stairs between their residences and the curb. Backyard collection is provided free to residents with doctor-certified physical limitations and is available to others with physical limitations for an additional monthly fee.

San Francisco. San Francisco started with a two-stream recycling program using 12-gallon blue bins. The bins held glass, metal, and plastic containers, while a variety of mixed paper products were set out in a paper bag or tied with string. Gray and blue rolling carts for mixed paper and commingled containers, respectively, were supplied to apartment buildings with more than five units. After studies indicated that organic material comprised 26 percent of the waste stream, 32-gallon carts and 64-gallon split carts (32 gallons to a side) were tested in several pilots to collect (or dual collect) organics, trash, and recyclables in automated and dual-collection vehicles.

The first pilots in July 1997 demonstrated that 32-gallon containers collected organic material equal to 11 percent of the total trash generated. In the fall of that year a second 32-gallon container for collection of paper was tested, and use of the blue bin for commingled containers was encouraged. The result: an increase of 15 percent in recycling levels. Another pilot, run simultaneously, provided a 32-gallon container in which residents were directed to commingle all recyclables. In this pilot, recycling rates increased 10 percent.

Split containers were tested in the spring of 1998. The objective was to completely change the concept of separation between trash and recyclables and in doing so to make collection of both more efficient. Three different pilots were set up. The first tested collection of trash on one side and a mix of yard waste and food waste on the other. Blue bins continued to be used for recyclables. The second tested the collection of trash and commingled recyclables (residents stopped using the blue bins), and the third tested organics and commingled recyclables. The first pilot showed an increase of 27 percent because of the organics. The second increased recycling collection by 20 percent over the previous system, registering 91 percent participation and 80 percent weekly set-outs. The third pilot's addition of organics increased overall collection by 13 percent.

Based on an analysis of all three systems, a new pilot integrating the best elements of all three was launched in 1999. In this pilot, called the "Fantastic Three," each of 2,800 residents received three 32 gallon carts: blue carts for commingled recyclables; green carts for yard waste, food (vegetable and meat) waste, and food-soiled paper; and black carts for trash that was neither recyclable nor compostable. From May through December 1999, an average of 46 percent of total waste was diverted from landfilling. Surveys indicated that 73 percent of residents like the new program better than the previous service.

Ultimately, the Fantastic Three pilot became the template for citywide expansion. The City and its contractor, Sunset Scavenging, believed that the Fantastic Three system offered the most flexibility and would maximize diversion and efficiency. As a result, a plan was initiated to roll out the program to more than 200,000 households by 2004.

Visalia. In 1991 Visalia launched recycling pilots based on manual collection of bins and bags. Both approaches resulted in poor productivity rates in comparison with the City's fully automated trash collection system. Seeking to develop a system that replicated the efficiency of its fully automated trash collection program, Visalia teamed up with the distributor of its trash truck to design and patent the split-

container system. A 110-gallon split container for deposit of commingled recyclables on one side and trash on the other was successfully piloted. A previous second trash collection day was replaced with a "green" collection day for yard waste using 60- or 105-gallon carts previously used for trash collection. Households generating trash in excess of the capacity of the 110-gallon container can pay \$8.45 per month for an extra trash container and \$4 per month for yard waste. The dual-collection system was successfully expanded citywide by 1996.

An interview with program representatives revealed issues not found in the literature. Many residents complain that the split container is too small to hold all their recyclables. There are also perceptions among some in the community that the truck is not divided, and that all materials are mixed and trashed.

APPENDIX FOUR: RECYCLING COLLECTION VEHICLES

Loveland. Loveland had one of the first and most successful dual-collection programs in the country. The citywide program was implemented in 1993, expanding from a pilot of 2,300 households to serve approximately 15,000. The City uses seven dual collection vehicles (five are run daily, with two back-ups) manufactured by the May Manufacturing Company of Arvada, Colorado, at a cost of \$120,000 each. The switch to dual collection saved the City \$110,000 in capital costs, since it was able to purchase a single vehicle instead of separate trucks for trash and recycling collection. Each dual collection truck is a combination of a 10-cubic-yard E-Z Pack rear-loading trash packer and an 18-cubic-yard May Western Curbside Collector side-loading recycling body. Recyclables can be loaded from both sides of the truck into the recycling body, situated between the cab and the compaction unit. The smaller of the two bins holds 7 cubic yards of newspaper, while the second bin holds 11 cubic yards of commingled containers. The space between the bins was designed to hold flattened old corrugated boxes. The previous trash-only trucks serviced 450 households per day; the dual collection system services 925 households per day. Hundreds of residential set-outs were studied to determine how to size the compartments so that none filled prematurely. The truck is designed to finish at least half of its route before one of the three compartments fills. Unfortunately, this is no longer the case, since a decrease in recyclables and an increase in trash has resulted in an imbalance. Each truck now collects more than two loads of trash per day, while the recycling body is increasingly underutilized.

As a result of PAYT trash rates, a yard debris pick-up program, and a free drop-off center, trash was reduced from 6.6 pounds per day in 1989 to 2.6 pounds per day in 1996, a 60 percent reduction. Trash is now on the increase, and the volume of recyclables is decreasing.

After eight and a half years, the City of Loveland is poised to retire its dual collection vehicles and is planning to return to a three-truck system with separate streams. Three reasons were offered for this change. First, the dual-collection vehicles were custom-designed prototypes that presented continuing maintenance problems.

Second, because of circumstances beyond the City's control, trash and recyclables sometimes had to be tipped in two different locations. During the winter and spring months, the Loveland area is subject to sudden, unpredictable 45+-mile-an-hour winds that necessitate the closure of the landfill in accordance with State regulations to reduce wind-blown trash. Since the dual collection trucks had to make two trips to the landfill daily, the closure of the landfill before the first load was dumped posed a significant inconvenience to the city. Trucks would have to travel to the MRF, located next to the landfill, off-load recyclables, and then drive to a transfer station 25 miles away. As a result crews were out on the route well into the evening, working in the dark—a considerable safety hazard. Separate trucks will allow for collection of one route in a single load; in the event of landfill closure, trash can remain in the truck and be tipped the next day.

Third, the City's PAYT rate structure was undermined by private haulers that offered trash carts in an effort to get a foothold in the Loveland market. Bowing to public pressure, the City of Loveland also offered 64- and 96-gallon carts for trash. There are no State or local laws or ordinances regulating private waste hauler access to the Loveland market, and apparently, there is little interest in such regulation. The ease, convenience, and minimal cost for trash disposal is having a significant negative impact on waste reduction. The City has noted that trash carts now regularly contain yard wastes and recyclables. Recycling levels have fallen 28 percent over a year (from 505 tons in June 2000 to 394 tons in June 2001). What was once a premier waste reduction and recycling program is now in jeopardy.

Milwaukee. The City of Milwaukee began the transition from manual to semi-automated collection in the late 1970s. At the time, trash was collected by 118 crews, each consisting of three laborers and a driver. In 1978 semi-automated carts were introduced, reducing crew size to one laborer and a driver. By 1989, when the system had expanded citywide, the number of crews was reduced to 91. Recycling was first

introduced in 1989, recycling bins were introduced by 1993, and carts in 1995. The system was adjusted to its current configuration, employing 75 garbage crews and 33 recycling crews, in 1996.

The split cart is used exclusively for recycling paper on one side and commingled containers on the other and is loaded onto rear-loading trucks. In 1993 new trash trucks costs \$118,000 each, and new recycling trucks cost \$135,000 each.

Oakland. Waste Management of Alameda County developed the Oakland's one-pass system. A Kahn Manufacturing Truck collects trash, recyclables, and yard waste from 100,000 residents. Operated by one person, the truck can service 400 to 500 households per day.

Durham. In 1997 Durham dropped dual collection, which had been implemented in 1988, and returned to separate collections due to continuing mechanical difficulties with dual-collection vehicles. The Oshkosh A-Series included a side-loading, semi-automated trash packer body and side-loading, semi-automated recycling compartments on a single chassis. Trash flipper springs often broke; bin partitions designed to collect recyclables kept falling out; and axle and gearbox components tended to fail. The designs of the trucks were reported to be insufficient to accommodate the loads required, and the fleet's hydraulic systems were not heavy-duty enough. Despite the problems, the curbside collection rate climbed to 4,000 tons per year. This represented an 11 percent per capita waste reduction from 1988 to 1995. According to Craig Berry, former executive director of the North Carolina Recycling Association, the failure of dual collection was not due to the system but to the equipment.

Los Angeles. Los Angeles retrofitted 217 trucks using Amrep bodies to produce side-loading dual-collection vehicles at a cost of \$30,000 each. These were used to test two-stream collection of commingled containers and paper, in contrast to a commingled and three-bucket source-separated system. The results of that effort led the City to the single-stream, commingled collection program in place today. Officials in Los Angeles warn against repeating their experience: using the retrofitted chassis was a "nightmare" at times. Apparently, the chassis were designed for rear-loading trucks, and could withstand stresses from the "to-and-fro" movement of rear loading. The new truck bodies were side loaders, stressing chassis from "side to side." This resulted in unique, unanticipated repair needs and proved difficult to remedy. Fortunately, the trucks did not present insurmountable problems, and they had been scheduled for replacement after a few years. Los Angeles' advice: use new vehicles whenever possible.

Visalia. In an effort to improve on the pilot project results, Visalia City staff teamed up with the distributor of the City's trash trucks to design a special 110-gallon split container and a dual-compartment automated collection vehicle. After a successful pilot in 1992, Visalia implemented the program citywide to 26,000 households in April 1996. The dual-compartment 33-cubic-yard truck is operated by a crew of one. As a split container empties its contents into the truck, the center divider in the container lines up with an inner divider in the truck. The recyclables drop into a top compartment (40 percent of the truck's volume), while the wastes are directed to a lower compartment (60 percent of the truck's volume). The lower compartment has a compaction ratio of 8 to 1. The truck serves 900 households per day. Twelve modified side-loading automated Heil 7000 packers were purchased at \$164,500 each. Twelve automated side-loading Heil 7000 packers previously used for trash collection were committed to hauling green waste. The dual-collection vehicles cost approximately 20 percent more than trash-only trucks. In FY97 the recycling program diverted 16 percent of Visalia's residential waste, saving \$300,000 per year in tipping fees. Total diversion, including yard waste, is 50 percent.

A telephone interview provided more recent information about the program. Today's total diversion is down to 30 percent. Residents complain that the 55-gallon containers are inadequate to accommodate trash and recyclables. Contamination has become a serious problem.

Oxnard. Dual collection was started as a pilot in Oxnard, California, in order to meet the State's mandated diversion goal, address the public demand to provide increased recycling capacity, and add yard waste collection without raising ratepayers' bills. Noting the success of Visalia, Oxnard elected to

convert to a split-container system. A 1996 pilot tested a 110-gallon split container, a 105-gallon "green waste" container, and a 105-gallon trash container. The new system raised the diversion rate from 15.24 to 47.45 percent.

In order to collect trash and recyclables simultaneously, Oxnard purchased a dual-compartment, automated collection truck, manufactured by the Heil Company, which is based in Chattanooga, Tennessee. The truck has a 9-ton capacity (5.4 tons, or 60 percent, for trash and 3.6 tons, or 40 percent, for recyclables). The city now uses its residential automated side-loader vehicles, which originally collected trash, to collect green waste at curbside. Only one of the trucks, a 1985 Heil 7000, was retrofitted for the pilot; eleven new dual-collection trucks were purchased at a cost of \$150,000 to expand the program citywide by 1998.

In Oxnard's previous standard residential collection program, crews operated on eighteen routes Mondays through Thursdays each week (nine routes for trash collection and nine for recyclables collection). The new dual-collection vehicles eliminate 9 vehicle routes daily, or 1,872 vehicle routes per year. Oxnard expects a \$2,836,394 return on investment by 2009.

San Francisco. San Francisco experimented with 64-gallon split containers for dual collection of either food and yard waste with trash, food and yard waste with recyclables, or recyclables with trash in spring 1998. The pilot proved successful, increasing collections by 13 to 20 percent. Organics collection was again tested in the fall of 1998, this time combining food, yard waste, and food-soiled paper in a single container. Since the single container performed well with 1 percent less volume than the split container, the City decided to adopt the single container with a dedicated, fully automated collection system for organics, together with dedicated containers and trucks for commingled recyclables and trash.

APPENDIX FIVE: UNION ISSUES

Milwaukee. Milwaukee's union has been concerned about privatization. Union members supported the move toward one-person crews because it is the state of the art. They encouraged automation and the cart system on the grounds of safety, despite the ultimate reduction in workers and crews collecting recyclables.

Los Angeles. The Los Angeles Solid Resources Collection Division provides sanitation services for all single-family residents and multifamily dwellings with four units or fewer. Over the years, manual collection crews have been reduced from three to two workers in the 1960s, and from two workers to one in the 1970s.

Automation has reduced the workforce by 25 percent over two years (from 1,000 to 750 employees), saving \$9 million a year. Virtually no issues arose in the conversion from manual to automated collection. There were a number of reasons.²⁶

- At the outset the City made a commitment not to lay anyone off because of automation.
- A freeze on new hiring plus attrition achieved the necessary staff reduction.
- One-person crews operated collection vehicles without leaving the air-conditioned cab. Once the drivers experienced the benefits of automation, they supported the conversion. When the decision was made to automate, everyone wanted to be involved.
- A joint labor/management team established a work standard for completion of one trash and yard waste collection route (averaging 20 to 25 tons) using the automated system. Automated trucks collected 2 to 2½ times the amount that had previously been collected manually.

Employees were recruited to be part of the decision-making process. Process Action Teams (PATs) were formed in each of the six district yards so that drivers, supervisors, and managers could meet regularly to discuss operations and plan for future efficiency improvements. Other improvements include the following:

- Truck availability was increased to meet daily route needs.
- Vehicle inspection procedures were standardized, allowing repairs to be performed at night, with trucks ready to run the next morning.
- Radios were installed in each truck, improving coordination and instilling a sense of teamwork among drivers in each district.
- On-board computers were installed, helping drivers to evaluate their performance and identify areas for improvement.

Loveland. Early in the development of their program, Loveland officials sought to promote crew cooperation with changes brought by dual collection and to show receptiveness to employees' ideas. Loveland launched several programs for the benefit of front-line workers.

- A fund was established to provide chiropractic treatments or deep-tissue massage to workers experiencing back pain. This preventive care program reduces overtime costs and temporary labor needs, and is less expensive than dealing with serious back injuries.
- As an image booster, a dress code was established, and each crew member was provided with a clothing allowance. Now, crews wear dark-blue pants and safety-yellow shirts. Most crew members have responded favorably and have reported an increased sense of professionalism.
- Steel-toed boots were previously required as a safety measure. Under the new working conditions, constant entering and exiting of the cab made these shoes painful. As a result, the

²⁶ Conversation with John Delarosa, Director, Solid Resources Collection Division, Los Angeles Bureau of Sanitation, July 2001.

safety shoe requirement was dropped. Loveland increased the shoe allowance to \$200 a year and encouraged workers to wear sturdy shoes that offer good ankle support and puncture resistance.

These actions demonstrated Loveland's concern for its workers' welfare, and consequently improved communication between managers and their crews. The crews report that residents now treat them with more respect, and they are proud to be recognized as leaders in the field of recycling.

APPENDIX SIX: MATERIAL PROCESSING AND MARKETING ISSUES

Milwaukee. Milwaukee's MRF was constructed and operated for the City under a \$6 million, seven-year contract by CRINC of New England. The MRF can process 18 tons of paper and 10 tons of containers per hour, with an overall capacity of 50,000 tons per year.

Los Angeles. Los Angeles' program is served by six MRFs, one located in each of the City's sanitation districts. The City owns some of these facilities, while others operate under contract. Contamination at the MRFs ran less than 10 percent through the 1996 pilot and the first year of the citywide program, with 95-gallon containers used for single stream commingled collection. As time passed, the level of contamination increased, and some districts now experience contamination rates greater than 20 percent. Concerned, the California Integrated Solid Waste Management Board (CISWMB) has joined with Los Angeles officials to determine the contamination source and identify solutions. Los Angeles is conducting comprehensive waste characterization studies and has hosted two forums on contamination, involving representatives from San Francisco and San Diego, Los Angeles' six MRF operators, and other industry leaders.

Loveland. Loveland uses a MRF owned by Larimer County and operated by Waste Management Inc. (WMI). The facility receives newspaper and commingled glass, metal, and plastic containers. Materials are processed and marketed, and revenues are shared with the County. WMI also pays Loveland and other haulers for sorted commodities but not for other materials.

Several materials are problematic. While amber glass is marketed to Coors, green and flint are both used as an alternative daily cover at the nearby County landfill. According to Loveland's solid waste superintendent, the facility is undersized, with limited tipping floor and storage space. In addition, the MRF is close to reaching its operational capacity. Loveland previously collected old corrugated cardboard (OCC) at the curb and mixed it with old newspaper (ONP), but the MRF claimed it could no longer sort the two commodities. As a result, the City discontinued curbside collection of OCC and installed a stationary compactor at its recycling and yard waste drop-off site where residents could unload their OCC. Despite the inconvenience, residents' delivery of OCC to Loveland's drop-off has equaled the volume previously collected curbside. The City has strongly encouraged the County to switch from #8 to #7 ONP (newspaper, office paper, junk mail, magazines, and catalogs all commingled), but the County has been reluctant to do so.

Oakland. The firms holding franchise contracts with Oakland---Waste Management of Alameda County and California Waste Solutions---both operate their own MRFs. There are no reported market issues, and residues are low at 2 to 5 percent.

San Francisco. San Francisco has market arrangements for recyclables, yard waste, and food waste. All materials and trash pass through a transfer station owned by Norcal---which also owns Sunset Scavenging, the collection company. Recyclables go to a single-stream MRF located at the transfer station. Compostables and food waste are transferred to the Richmond Sanitary Composting facility, 25 miles across the Bay in the city of Richmond, or Norcal's B& J Composting facility in Dixon, California, located 65 miles north of San Francisco.

Visalia. Visalia's dual-collection truck delivers its load to a landfill/recycling transfer site in Visalia. After the truck dumps its trash, recyclables are unloaded to an asphalt pad and transferred to roll-off containers by a front-end loader. The containers are then delivered to a privately run processing facility, Tulane County Recycling, five miles from the center of town. This facility is a "dirty MRF": in addition to source-separated recyclables, it also receives loads of commercial waste that are rich in recyclable materials. Only 55 percent of this commercial waste is recovered, and market rejection is high at 20 to 30 percent by weight. MRF residuals are also high at 28 percent.

APPENDIX SEVEN: Additional Questions for Assessing Philadelphia's Pilot

BASELINE DATA

1. What were the specific criteria used to select each route?
 - Did the area receive weekly or bimonthly collection?
 - What were the historic recycling and waste collection levels for the comparable period?
 - What were the comparable weather conditions in this period?
 - What are the housing types and demographics?
 - What were the litter levels?
 - What obstacles were identified at the outset of the pilot?
2. Given that the routes were selected in part for their ability to accommodate the vehicles being used, how much of the City would be compatible?
3. Based on your experience with the workers, what would you do differently?

COLLECTION VEHICLES

4. What were the operational issues in the use of each dual-collection vehicle?
5. How did the collection rates (stops per day) for dual collection compare with those with the original collection vehicles?
6. What has been your experience with collection volumes in the several compartments? What issues has it raised, and how have they been addressed? Is this arrangement manageable?
7. What is your assessment of the use of dual-collection vehicles? (How does it compare---favorably or unfavorably---with the previous system?)
8. Based on your experience with dual-collection vehicles and automation, what would you do differently?

EDUCATION AND ENFORCEMENT

9. What education and promotion activities were performed for each segment? Did the residents understand what was expected of them? How was that measured?
10. What was the enforcement protocol? What were the issues, and how were they addressed? What is your assessment of the results?
11. Based on your experience with outreach and enforcement, what would you do differently?

COLLECTION CARTS

12. What were the residents' responses (before, during, and at the end of the pilot period) to the collection cart?
13. What were the residents' issues, and how were they addressed?
14. Based on your experience with collection carts, what would you do differently?

COLLECTION LEVELS AND SERVICE

15. What were the results and issues for yard waste collection for each segment? To what do you attribute the problems that arose, and how were they addressed?
16. Based on your experience with the pilot, what would you do differently to increase collection levels or improve yard waste collection?

WORKERS AND UNIONS

17. How have the crews responded to semi-automation? Dual collection?
18. On the average, is collection taking more or less time than it did under the previous system?
19. What benefits and liabilities are you experiencing?
20. What are the costs of the system?
21. What changes can you anticipate making that would change the results?

22. How were the workers involved in identifying and resolving collection issues?
23. How has the union reacted to the effort?
24. Based on your experience with the workers, what would you do differently?

MATERIALS PROCESSING AND MARKETING

25. What has been the experience in off-loading collections?
26. Have there been any problems with the quality of recyclables collected?
27. Have any of the loads of yard waste been rejected? If so, how has this been resolved?
28. Based on your experience with the system, what changes would you anticipate in dealing with materials processing?

REPORTING AND EVALUATION

29. What were the tools and measures used to report and evaluate the results of the pilot?
30. What were the issues and results for each segment?
31. What were the recycling set-out, participation, and capture rates for each segment?
32. What was the participation assessment for yard waste collection (amount collected as yard waste versus amount collected as trash)?
33. What was the response to outreach and enforcement?
34. How were costs measured, and how are they evaluated?
35. What were the costs?

FOLLOW-UP

36. How will the results of the pilot be used?
37. What are the next steps?

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