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Full Cost Accounting in Action: Case Studies of Six Solid Waste Management Agencies

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The Five Major FCA Principles

FCA embodies several key concepts that distinguish it from cash accounting techniques. The following list highlights the five basic tenets of FCA, all of which are used, to some degree, in the case studies.

1. **Accounting for costs rather than outlays.** An **outlay** is an expenditure of cash to acquire or use a resource. A **cost** is the dollar value of the resource as it is used. For example, an **outlay** is made when a collection truck is purchased, but the **cost** of the truck is incurred over its active life (e.g., 10 years). The **cost** of the truck needs to be allocated over the period of its use because every year of use contributes to the deterioration of the truck's value.

2. **Accounting for hidden costs.** With FCA, the value of goods and services is reflected as a **cost** even if no cash **outlay** is involved. A community might receive a grant from a state, for example, to purchase solid waste equipment. This equipment has value, even though the community did not pay for it in cash. The equipment, therefore, should be valued in an FCA analysis.

3. **Accounting for overhead and indirect costs to individual solid waste services.** FCA accounts for all overhead and indirect costs, including those that are shared with other public agencies. Overhead and indirect costs might include administrative support, billing, data processing, legal services, and purchasing.

4. **Accounting for past and future costs.** FCA includes past and future costs that often do not appear on annual budgets under cash accounting systems. **Past (or upfront) costs** are initial investments necessary to implement MSW services such as the acquisition of vehicles, equipment, or facilities. **Future (or back-end)** costs are costs that will be incurred to complete MSW operations such as landfill closure and postclosure care and postemployment health and retirement benefits.

5. **Accounting for costs according to activities or paths.** There are two ways of disaggregating costs for an entire MSW system. You can focus on the **activities** that are the building blocks of the system or the **paths** that MSW follows in the course of integrated solid waste management (i.e., the point of generation through processing and ultimate disposition). **Activities** include waste collection, operation of transfer stations, transport, waste processing and/or disposal, and sale of by-products. MSW **paths** include recycling, composting, waste-to-energy, and land disposal. Both the path and the activity ways of looking at MSW costs can be useful. Understanding the costs of each MSW **activity** often will be necessary for compiling the costs of the entire system and helps you evaluate whether to provide a service yourself or contract out for it. However, in considering changes that affect how much MSW ends up being recycled, composted, converted to energy, or landfilled—you should focus on the costs of the different **paths**. Understanding the full costs of each path is an essential first step in discussing whether to shift the flows of MSW one way or another.

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1. Introduction

Today's municipal solid waste (MSW) management systems are more complex than ever. With each passing year, the number of options available for managing MSW continues to grow. Cities and counties now offer a range of collection programs, from household hazardous waste drop-off sites to curbside collection of garbage, recyclables, yard trimmings, and white goods. These programs use a variety of facilities, including material recovery facilities, compost sites, waste-to-energy plants, and municipal landfills.

With the growing complexity of today's waste management systems, solid waste managers find it increasingly difficult to track and evaluate the costs and benefits of their operations. Tracking costs is particularly important, however, given the rising costs of waste management services. In fact, failure to develop adequate cost data can have serious consequences. Without full cost information, for example, agencies might reject potentially cost-effective options or overlook opportunities to expand recycling and waste reduction programs.

To help municipalities improve the cost-effectiveness of their solid waste programs, the U.S. Environmental Protection Agency (EPA) promotes the use of full cost accounting (FCA). FCA provides a common-sense approach to identifying and controlling the costs of managing a solid waste program. It offers a framework to aid decision-makers with short- and long-term program planning, and it can help identify measures for streamlining and improving operations. Knowing the full cost of MSW programs ensures fiscal accountability and enables agencies to make more informed decisions, respond better to citizens' needs, and more efficiently address environmental concerns.

EPA developed this set of six case studies to illustrate the ways that different agencies developed unique FCA systems and applied those systems to address local issues. The issues ranged from establishing user fees to cover service costs to developing a financial strategy for closing an ash landfill. Although each case study is unique, all of them illustrate how FCA became an integral part of these agencies' everyday budgeting, management, and decision-making processes. For each agency, the use of FCA is viewed as a good management practice.

> ***Full cost accounting is a systematic approach for identifying, summing, and reporting the actual costs of solid waste management, taking into account past and future outlays, oversight and support service (overhead) costs, and operating costs.***

CASE STUDY ORGANIZATION

Each case study provides information on MSW system operations and costs, describes local FCA data and its development, and explains how these data were used to address one or more local issues. Because this publication focuses on agencies that have been using FCA for the past 5 to 10 years, it does not address the early planning stages of incorporating FCA into existing budget and accounting procedures. Instead, each case study highlights the overarching uses and benefits of FCA. For information on planning for and implementing FCA, refer to the EPA publication *Full Cost Accounting for Municipal Solid Waste: A Handbook* (see inside back cover for a list of available publications).

Each chapter of this report contains the following sections:

- **Introduction.** These sections introduce the agencies and describe how and why each one started using FCA. They summarize some of the main points that will be discussed throughout the case studies.
- **Background.** These sections provide an overview of community demographics, services provided by the agencies, annual budget data, revenue sources, and, when applicable, enterprise fund structures.
- **FCA in [Case Study Site].** These sections explain how the agencies use FCA, including specific FCA tools and principles used. They present influences that have affected each agency's use of FCA, information about contractors or special software used, and techniques used to analyze costs.
- **FCA in Action.** These sections describe how the agencies used FCA to address, evaluate, or analyze recent local solid waste issues. The examples are used to illustrate the FCA principles and mechanisms used within the structure of each particular agency.
- **Lessons Learned.** To assist other agencies that might be evaluating the use of FCA, these sections present suggestions and insights that each agency gleaned from its own experience. They also present other varied uses of FCA that were not described under FCA in Action.

METHODOLOGY

EPA began the case study selection process based on a list of potential agencies compiled over the past several years. This list consisted of agencies identified through two nationwide satellite programs on FCA in 1995 and 1996, an FCA roundtable in 1996, and an FCA workgroup[1] with representatives of recycling, government, and other solid waste organizations and agencies that has been meeting with EPA over the past several years. The criteria used to select case study agencies included:

- **Data Availability.** Agencies had disaggregated data on the cost of all solid waste management services, including fully allocated indirect/overhead costs, as well as complete data on the tonnage of materials managed and associated revenues. In short, agencies were able to describe how their data are organized and how they were developed.
- **FCA Uses.** Agencies used FCA successfully to analyze one or more of the following issues: implementation or modification of a fee system, privatization of solid waste services, and modification of an existing solid waste system in a way that had major, short-term cost implications.
- **Distribution.** Agencies represented a geographically and demographically diverse group of MSW agencies across the United States.

COMMUNITY PROFILES

This publication contains detailed case studies for the following communities:

Broward County, Florida — Office of Integrated Waste Management

Broward County (population 1,070,047 in 1990) began using FCA more than a decade ago to develop a financial strategy for closing an existing landfill and to plan a new county integrated waste management system. Today, FCA is embodied in the financial, budgeting, and accounting system used by the county's Office of Integrated Waste Management (OIWM). OIWM uses the system to assist in managerial decision-making, facilitate communication with elected officials and municipalities within the county, and ensure that users of the county solid waste system are charged for services on a fair and equitable basis. Recently, Broward County used FCA to bring ash disposal service charges in line with the useful life of its ash disposal cells, ensuring that current and future users of this resource bear its full cost.

[1] The FCA workgroup consists of representatives from the following agencies and organizations: American Public Works Association, International City Management Association, Maryland Department of the Environment, National Association of Counties, National Solid Wastes Management Association, National Recycling Coalition, Solid Waste Association of North America, the U.S. Conference of Mayors, and the U.S. Environmental Protection Agency (Office of Solid Waste).

Columbia, Missouri — Public Works Department

The Public Works Department in Columbia (population 69,101 in 1990) began using FCA as part of a citywide enterprise financing initiative in the early 1970s. This effort required service-based city agencies to develop user fees that would provide sufficient revenue to cover service costs. The department developed a spreadsheet system that uses FCA principles to convert budget and operating information into full cost data. When this process was complete, the department was able to clearly identify detailed service costs and associated revenue requirements.

The department's FCA system also serves as an important planning and performance analysis tool. Since 1988, the department has added a variety of residential diversion and processing services and has invested substantial funds in its landfill to ensure compliance with the Subtitle D requirements of the Resource Conservation and Recovery Act. In expanding and improving its operations, the department used its FCA system to plan, evaluate, select, and integrate the most cost-effective service options. Recently, Columbia used FCA to develop separate residential, commercial, university, and roll-off service charges and landfill tipping fees that cover the majority of its annual operating costs.

Glendale, Arizona — Field Operations Department

A combination of regional and local issues motivated Glendale (population 180,038 in 1990) to begin developing an FCA system in the early 1990s. Increased regional competition from nearby, privately owned landfills with lower tip fees resulted in a substantial reduction in waste flow to the Glendale landfill between 1990 and 1995. Consequently, Glendale's landfill tip fee revenues dropped by 50 percent. Faced with the prospect of increasing local service rates, Glendale used an FCA approach to develop a dynamic cost-based rate model. The rate model continues to help the Field Operations Department isolate the important relationship between landfill costs, tip fee revenues, and the rates for both collection and disposal services. Glendale's use of the rate model has enhanced and improved the cost and efficiency of its solid waste system so that it now has the lowest residential solid waste service rate in the region.

Indianapolis, Indiana — Solid Waste Division

Indianapolis (population 741,592 in 1990) began using FCA in 1993 as part of a citywide effort to provide the highest quality public services to residents at the lowest cost. The division began using FCA to facilitate the adoption of market mechanisms—particularly competitive bidding by public employees for solid waste collection contracts—and to develop performance indicators. Since the division began competing against private haulers to provide trash collection services, the city's solid waste costs have decreased by more than $5 million. The division relied on FCA to develop successful competitive bids that have resulted in these cost reductions.

Southeast Public Service Authority (SPSA) — Virginia

The Southeast Public Service Authority (SPSA), a regional agency (serving a population of 1,012,789 in 1990) based in Chesapeake, Virginia, began using FCA in 1988. Initially, SPSA used FCA to guide the allocation of debt service costs to its services and facilities. It then set prices to recover these costs. In the 1990s, SPSA faced increased competition for waste from private landfills in the region. Using FCA, SPSA was able to identify strategic pricing and investment options which allowed it to keep waste flowing to its facilities. Recently, SPSA used FCA to evaluate the options for obtaining additional landfill capacity.

San Diego, California — Environmental Services Department

The Environmental Services Department in San Diego (population 1,110,549 in 1990) has been using FCA since the 1980s. FCA principles are reflected in department practices, such as the use of lease-purchase agreements to match cost recovery as closely as possible to equip-

ment lifetimes. In general, the department uses FCA as a framework to analyze issues of particular importance. Recently, when considering whether to implement an automated trash collection system, the department used FCA to determine whether cost savings could be achieved by switching to a new system. The findings provided the impetus the department needed to make the switch from manual collection.

LESSONS LEARNED

"Know what your costs are so you can control them." This is a guiding principle of FCA, which was stated succinctly by Lowell Patterson, Director of Public Works in Columbia, Missouri. While the communities featured in the case studies consider FCA to be an integral part of doing business, the solid waste directors were able to isolate some of the key lessons that might assist other communities that are evaluating the use of FCA. Lessons learned and general observations include:

- Structure budget and accounting systems so they are consistent with the internal and external services provided by the agency.
- Develop standard forms and procedures that make FCA automatic.
- Invest necessary resources up front to develop FCA systems and allow sufficient time for implementation.
- Maintain and update FCA systems on a regular basis.
- Use FCA for management purposes rather than just accounting.
- Ensure that senior management is committed to FCA.
- Consider involving consultants with the development and implementation of FCA tools.
- If needed, solicit technical support for staff training, data development, and development of an appropriate FCA system.
- Recognize that using FCA often leads to innovations and the adoption of other best management practices and tools.
- If long-term debt is an issue, try to match financing terms with facility or equipment life so that debt service expenses are in line with the depreciated cost (or "economic value") of the resource in question.

2. Broward County, Florida
Office of Integrated Waste Management

INTRODUCTION

In the early 1980s, Broward County relied on FCA to develop a state-of-the-art integrated waste management system within the Broward Solid Waste Disposal District (BSWDD). The BSWDD is comprised of 24 of the 29 municipalities in Broward County as well as all of the county's unincorporated areas. The Office of Integrated Waste Management (OIWM) was created in 1991 to manage the integrated solid waste management system on behalf of its member jurisdictions.

OIWM's use of FCA today is strongly influenced by its role as a contract administrator. Virtually all of the OIWM's costs must be covered through fees or levies paid by member jurisdictions that use the solid waste services. Inter-local agreements restrict OIWM from increasing annual fees for members by more than 70 percent of the consumer price index in any given year. Thus, OIWM relies on FCA to ensure that costs do not fluctuate dramatically from year to year based on capital requirements and associated financing arrangements.

BACKGROUND

Located in the southern part of the state, Broward County is one of the largest and most densely populated counties in Florida. In addition to its permanent population, nearly 90,000 part-time residents reside in Broward County during its peak season, and more than 3,000,000 tourists visit the county each year.

OIWM does not own most of the processing and disposal capacity in the BSWDD, but rather serves as a contract administrator. OIWM provides collection services, through franchised haulers, to its unincorporated residents only (who comprise about 44,000 single and 26,000 multifamily households in the unincorporated areas of BSWDD). Its major focus is on the county's resource recovery system (a combination of recycling, incineration and ash disposal, and landfilling), which all municipalities and unincorporated areas in the BSWDD use. In addition, it provides recycling, technical assistance and contract services to government, institutional, and commercial establishments in the county. OIWM does own and operate a small landfill, which is used for non-combustible and bulky materials that cannot be incinerated.

Demographic Characteristics, Broward County, Florida, Solid Waste Disposal District

Population (1990)	1,070,047
Area (square miles)	337
Density (persons per square mile)	3,175
Households	445,590
Household Income (1989 $)	$30,731
Housing in 1- to 4-unit structures	55%

OIWM employs a staff of 80 to operate or administer its system. Thirty-four are involved directly with the landfill, while the remainder devote their time to contract and general administration as well as outreach and technical assistance. See Table 1 on page 11 for additional details on services provided by OIWM.

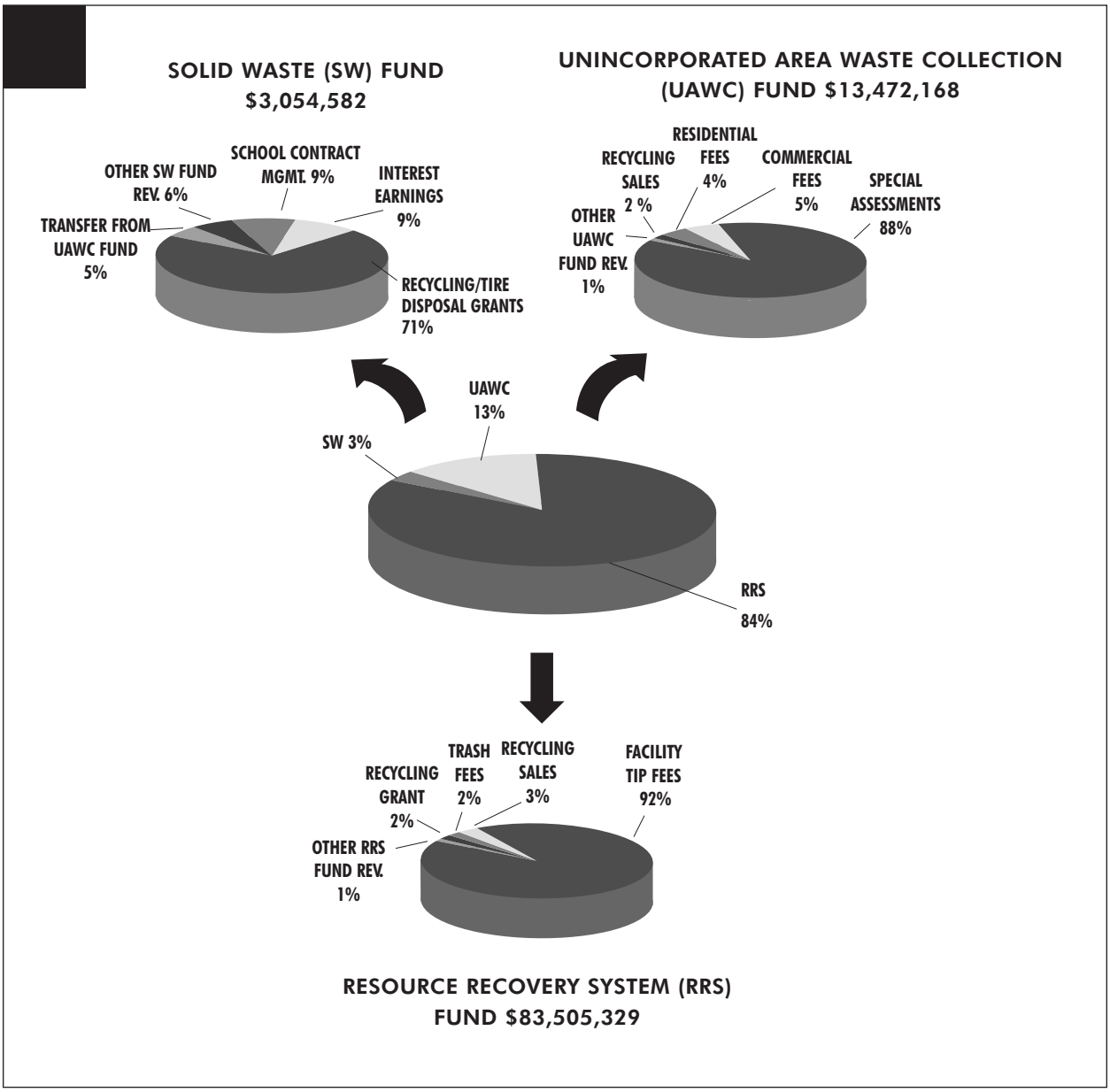
Figure 1 on page 6 provides a breakdown of the revenue sources for OIWM's operations. OIWM's waste management activities are financed through the following three interlinked enterprise funds:

- The Resource Recovery System Fund covers costs associated with the facility-side of the resource recovery system. This is the largest of OIWM's three funds, representing 84 percent, or roughly $83.5 million, of OIWM's annual revenue of $100 million. Facility tip fees (a direct user fee) make up 92 percent of the revenue generated by this fund.
- The Unincorporated Area Waste Collection Fund covers costs and revenues associated

with providing collection services to unincorporated areas of the county. A special assessment on those residential units receiving collection services comprises 88 percent of this fund's revenues.

- The Solid Waste Fund covers costs associated with recycling activities and closed facilities. Recycling and tire disposal grants from the state make up 71 percent of this fund's revenues.

FIGURE 1: OIWM SOURCES OF REVENUE (TOTAL REVENUE = $100,031,979)



FCA IN BROWARD COUNTY

OIWM's role as a contract administrator strongly influences its use of FCA. The agency's member constituents (i.e., municipalities and unincorporated areas) incur varying costs for solid waste services. OIWM carefully tracks these costs so it can collect fees that are sufficient to cover its contractual obligations and operational expenses. Moreover, OIWM is restricted by inter-local agreements from increasing annual rates for its members by more than approximately 70 percent of the consumer price index in any given year. OIWM, therefore, must have an accurate understanding of both short- and long-term costs.

OIWM uses a commercially available software application to organize its accounting, budgeting, and financing information. Information in the software is organized based on OIWM's enterprise fund structure and the 18 activity-based cost centers shown in the accompanying text box. Thus, the Unincorporated Area Waste Collection Fund, which covers costs associated with providing collection services to unincorporated areas of the county, includes "mandatory collection," "mandatory recycling," and "trash transfer" cost centers. Each cost center is comprised of detailed cost components such as personnel, contracts, administrative expenses, and other operating costs.

OIWM is primarily an administrative agency; therefore, its treatment of administrative and overhead costs is particularly noteworthy. OIWM accounts for both "external" and "internal" overhead costs. External overhead costs include fees that OIWM pays to other county departments for services such as printing, budgeting, and legal expenses. Table 2 on page 12 indicates that OIWM paid a total of $521,651 in external overhead fees to other county departments during fiscal year (FY) 1996. The table also provides details on the allocation procedures the county uses to charge OIWM for these services. OIWM, in turn, assigns these fees to each of its three enterprise funds based on the respective fund's direct usage of external overhead services. Thus, for example, the Resource Recovery Fund incurred $287,160 in external overhead costs for services provided by other county departments.

Internal overhead expenses include OIWM supervisory and administrative personnel as well as OIWM's administrative operating and capital expenditures. OIWM allocates costs incurred for these expenses across the three enterprise fund cost centers using a variety of techniques. For example:

- The OIWM allocates administrative staff salaries and associated fringe benefits based on staff time spent or billed to specific cost centers.
- OIWM allocates other operating expenses (such as supplies, printing, utilities, dues, and memberships) and small capital expenses based on either the percentage of the overall budget (excluding administration) the fund cost center comprises or the percentage of office space footage the cost center utilizes.

OIWM Enterprise Funds and Related Activity-Based Cost Centers

1. Unincorporated Area Waste Collection Fund Cost Centers
   - Mandatory Collection
   - Mandatory Recycling
   - Trash Transfer Stations
2. Solid Waste Fund Cost Centers
   - Recycling Technical Assistance
   - Pompano Incinerator (closed)
   - Davie Landfill (closed)
   - Waste Tire Grant
3. Resource Recovery System Fund Cost Centers
   - Solid Waste Operations
   - Solid Waste Landfill Closure
   - Household Hazardous Waste
   - Administration
   - Resource Recovery Board
   - North Resource Recovery Plant
   - South Resource Recovery Plant
   - South Ash Landfill
   - Materials Recovery Facility
   - Debt Service
   - Debt Service Reserve

As an illustrative example, Table 3 on page 13 provides details on the specific types of administrative costs tracked for the Resource Recovery Fund (note that this includes the $287,160 in external overhead described in the preceding paragraph). OIWM tracks similar types of administrative costs for the other two funds as well (they are not shown in the text box because they are not as large as the administrative cost center for the Resource Recovery Fund).

OIWM has also developed FCA techniques to account for past and future outlays associated with long term assets, such as its disposal capacity. For example, in considering landfill costs it accounts for land depletion costs, closure costs, and land improvement costs. The text box above illustrates a formula that OIWM uses to account for land improvement costs in its annual landfill costs. Similar formulas are used to estimate current costs of future outlays, such as closure and postclosure care.

Accounting for Past Outlays at the Broward County Landfill

1.	$5,125,000	Land Improvement
2.	$4,000,000	Site Development
3.	$9,125,000	Total Costs [Line 1 + Line 2]
4.	$4,282,759	Total Amortization as of 9/30/96
5.	$4,842,240	Unamortized Costs [Line 3 - Line 4]
6.	3,300,000	Estimated Capacity (tons)
7.	898,645	Tons Delivered Through 9/30/96
8.	2,401,355	Remaining Capacity (tons) [Line 6 - Line 7]
9.	$2.02	Cost Per Ton [Line 5 ÷ Line 8]

FCA IN ACTION: BALANCING COSTS AND FINANCING OF LONG-TERM INVESTMENTS

Converting cash outlays for long-term resources into costs is one of the principles of FCA. While cash outlays for long-term assets are often based on the type and term of financing arrangements, costs are accrued over an asset's useful life. Thus, cash outlays for and costs of long-term resources can differ. If, for example, the term of a loan (or other financing mechanism) differs from the operating life of a given resource, then cash outlays for loan payments will not reflect the accrued cost of the resource. When resource costs and financing are out of sync, problems can arise. The following discussion illustrates this point for an important and unique element of OIWM's integrated solid waste system. Although the focus of the discussion is on OIWM's ash disposal capacity, the same general principles apply for many long-term resources such as vehicles, transfer stations, or recycling facilities.

In 1989, OIWM entered into a 20-year service agreement with a private contractor to provide incineration and ash disposal capacity for the county. As part of this agreement, OIWM's contractor agreed to finance development and construction of ash disposal cells, and OIWM agreed to reimburse the contractor for these financing costs over the 20-year term of the service agreement. The agreement allowed OIWM to essentially spread the term of financing for the ash disposal cells over a 20-year period.

OIWM anticipated needing two cells over the 20-year life of the agreement. The first cell was constructed in 1991 and had a projected life of 8 to 10 years. After the first cell reached its capacity, a new cell would be built for ash disposed of over the remaining life of the contract.

As mentioned in the previous section, OIWM must collect fees from its member agencies that are sufficient to cover its contractual obligations and operational expenses and cannot raise fees in any given year by more than 70 percent of the consumer price index. In the first 5 years of the operation, OIWM charged an ash disposal fee (a component of the tip fee revenue shown in Figure 1) based on cash outlays associated with the 20-year financing agreement for cell one, even though the cell would only last for 8 to 10

years. Thus, during the first 5 years, annual tip fee revenues were significantly lower than the cost of ash disposal over the life of the 20-year service agreement (see schematic below), creating the following problems:

1. If tip fees remained at or near 1990 through 1995 levels, revenues would be insufficient in future years to cover costs associated with construction and closure of the second cell because OIWM could not raise fees by more than 70 percent of the consumer price index in any given year.
2. Between 1990 and 1995, users of the first cell were not paying a tip fee that was based on the 20-year financing, yet the first cell would be depleted in 8 to 10 years. This meant that costs associated with the first cell were effectively being deferred and would need to be covered in the tip fee charged to users of the second cell.

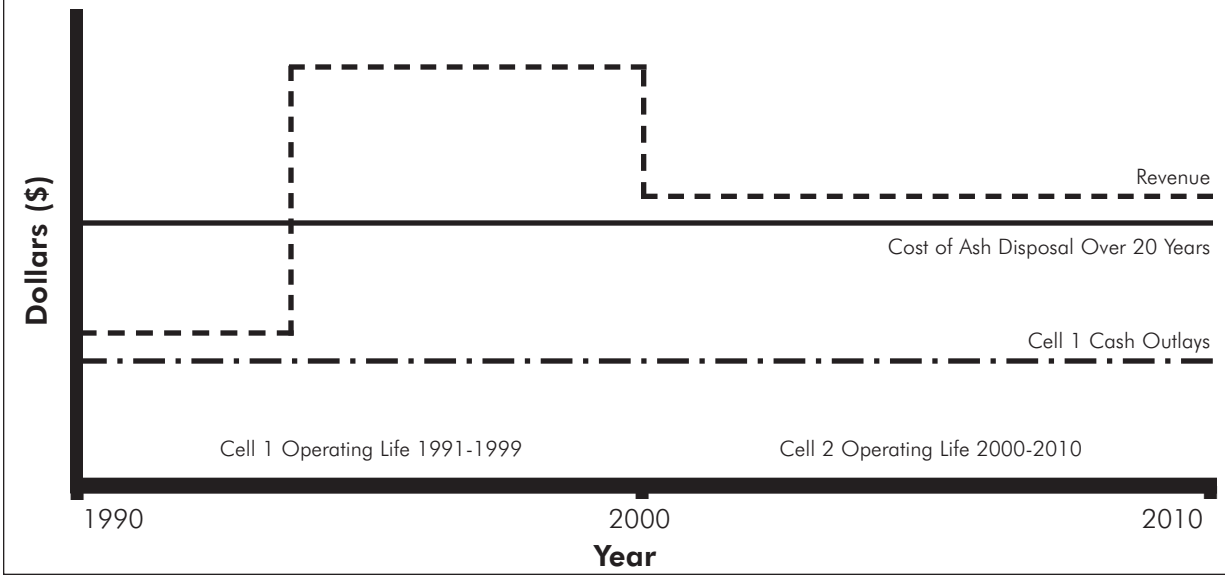
To address these issues, OIWM devised a way of spreading financing for both cells over their useful life so financing, revenues, and cost would balance and users of the landfill would be responsible for bearing its full cost.

OIWM estimated that $10 million would be required over the remaining 3 to 5 years of the first cell's life to cover all outstanding costs associated with its development, construction, operation, and closure. Based on this estimate, OIWM recommended that the county establish a dedicated reserve fund that would set aside $2 million annually from incineration tip fees (no increase in tip fees was needed because $0.90 per ton was already included in the tip fee for general reserves). Although OIWM cannot use the dedicated fund directly to pay off costs for the first cell, it can use the fund to offset costs associated with construction of the second cell. Thus, forecasted cost increases resulting from undercharging users of the first cell based on financing terms instead of accrued costs could be offset by cell two construction savings. As OIWM reasoned with the county commission, using the fund in this way would allow OIWM to effectively "charge" users of the first cell on an accrual basis for the full cost of the asset provided to them. The county commission approved OIWM's proposal.

LESSONS LEARNED

As a large regional agency, the Broward OIWM has used FCA to help in its decision-making processes. A major aspect of OIWM's current use of FCA involves executing, administering, and monitoring solid waste service contracts. In addition, OIWM believes FCA

Conceptual Overview of Revenue, Cost, and Funding Imbalances for Ash Disposal Capacity



improved its credibility among its 24 member communities and the unincorporated areas of the county. OIWM indicates, for example, that without FCA, it would not have been possible for the agency to cap annual rate increases for its members at 70 percent of the consumer price index. FCA provided OIWM with a complete picture of the system costs that were needed to enter into such an arrangement.

Based on its experience with FCA, OIWM offers the following advice:

- *Structure budgets and accounting systems so they are consistent with the internal and external services provided by the agency.* OIWM uses 18 activity-based cost centers that are consistent with the services it provides to organize its budget, revenue, and cost information.

- *Develop standard forms and procedures that make FCA automatic.* For internal budgeting and accounting functions, OIWM uses off-the-shelf software that has been customized to reflect full allocation of costs to its activity-based cost centers. The software helps accounting and managerial staff members track and allocate costs.

- *Invest necessary resources up front to develop the FCA system.* OIWM spent 600 to 700 hours setting up its automated FCA accounting system and training staff in its use. With the system now in place, accounting and budgeting functions have been streamlined and the system only requires about 8 hours of staff time per month for maintenance and data entry.

Other Uses of FCA in Broward County, Florida, 1984 through 1998

- Developing a financial strategy for closing an existing landfill.
- Planning and implementing a new integrated system that included recycling and waste-to-energy components.
- Balancing costs, revenue, and financing for long-term assets in order to develop fair and equitable rates for the use of long-term resources such as disposal capacity.
- Responding to state reporting requirements that require public solid waste service providers to calculate and disclose the full cost of solid waste services.

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TABLE 1: BROWARD COUNTY OIWM SUMMARY OF SERVICES AND FACILITIES

Solid Waste Services and Facilities	Service Provider A=Agency C=Contract	Tonnage Managed	Comments
Source Reduction/Recycling Outreach	A	N/A	Provides outreach to the residential sector on source reduction and backyard composting, a buy-recycled campaign, and a mobile recycling fair. Provides technical assistance to businesses and unincorporated area apartment complexes.
Curbside Recycling	C	9,200	Contracts for weekly collection from unincorporated 1 to 9 family structures and apartment complexes.
Household Hazardous Waste (HHW)	A and C	207	Operates one county-owned HHW collection site and three special waste depots. Packaging and disposal is contracted to a private company; OIWM provides outreach and administration.
Bulky Item Collection	C	4,450	Contracts for monthly bulky item collection from unincorporated 1 to 9 family structures.
Residential Trash Collection	C	60,870	Contracts for twice weekly collection from unincorporated 1 to 9 family structures.
Institutional/Public Recycling	C	3,700	Contracts for school recycling pickup, participates in government office recycling, and has incentive program to clean up public tire piles.
Commercial Trash Collection	C	38,000	Manages permits of three franchised haulers in the unincorporated areas of the county. Businesses can choose among them as they please.
Other Solid Waste Management Services	A	N/A	Runs an adopt-a-street program, a community cleanup program, and a lot clearing program in the unincorporated areas.
Recycling Facilities	C	73,000	Contracts with a private company for the construction and operation of a materials recovery facility (MRF). Revenue is returned to participating cities. The MRF handles all residential material and a small amount of commercial material.
Waste-to-Energy Facilities	C	1,010,000	Contracts with a private company to design, construct, own, and operate two waste-to-energy facilities. These facilities are capable of processing 4,500 tons of waste per day. The county has a contractual requirement to provide 1,095,000 tons to the facilities each year.
Bulky Waste Drop-Off Facilities	C	2,400	Contracts operation of three drop-off sites that are used in conjunction with unincorporated bulky waste service.
Landfills	A and C	87,450	Owns and operates a landfill that handles noncombustible and bulky materials; also has as-needed contract with a private company. The landfill has an estimated life of 50 years, or about 24 million cubic yards of remaining capacity.

TABLE 2: OIWM OVERHEAD FEES PAID TO OTHER CITY DEPARTMENTS FOR SERVICES (FY 1996)

Service	Allocation Method Used	OIWM Cost
Motor Pool	Motor pool charges for services	$66,598
Risk Management	Risk management charges for services	$5,188
Print Shop	Print shop charges for services	$5,334
County Attorney	Legal service fees per user department	$2,615
Budget Management	Budget transactions processed	$35,953
Management Services	Number of employees per department and number of revenue and expenditure transactions per department	$10,234
Information Technology	Pieces of mail processed per department, number of stops per department, radio units per department, and number of staff hours per department served	$51,367
Human Resources	Various allocation methods based on types of employees	$33,188
Purchasing	Number of purchase order line items per department, number of formal bids per department, and number of employees per department	$56,917
Accounting	Number of revenue and expenditure transactions per department, number of outstanding debt issues per department, and number of payment vouchers processed per department	$67,654
Other	Costs are calculated for a wide variety of other specific indirect expenses incurred by OIWM for services provided by other county departments such as finance and administration services, revenue collection, commission auditor, citizens service center, intergovernmental affairs, public information, employment/small business development, charter review commission, county commission, and county administrator. Various allocation techniques (e.g., direct charge, number of employees, number of transactions, etc.) are used to calculate OIWM's costs for these services depending on the service provided	$186,603
Total		**$521,651**

TABLE 3: BROWARD COUNTY OIWM ADMINISTRATIVE COST COMPONENTS FOR RESOURCE RECOVERY FUND (FY 1996)

Cost Component	Cost
Personnel	
Executive Salaries	$244,054
Regular Salaries	$598,992
Overtime	$1,474
FICA	$66,274
Retirement	$148,089
Group Insurance	$73,540
Workers Compensation	$2,090
Unemployment Compensation	$0
Operating Expenses	
Auditing Fees	$20,000
Contractual Services	$9,065
Contractual Services — Temporary Personnel	$2,092
Travel Per Diem	$5,135
Business Travel	$5,680
Motor Pool Expenses	$3,795
Auto Allowance	$345
Telephone	$16,919
Postage	$8,923
Utilities — Electricity	$15,615
Rent — Other	$13,460
Rent — Office and Building	$172,879
Rental Equipment	$0
Self — Insurance	$7,240
Equipment Maintenance	$6,395
External Printing	$2,474
Internal Printing	$1,531
Cost Allocations (from County Central Services)	$287,160
Office Supplies	$7,286
Office Equipment	$1,498
Safety Supplies	$416
Dues and Memberships	$5,435
Subscriptions	$1,574
Miscellaneous Expenses	$3,362
Capital Expenditures	
Machinery and Equipment-New	$3,337
Computer Hardware	$44,645
Computer Software	$3,659
TOTAL	**$1,784,433**

3. City of Columbia, Missouri
Public Works Department

INTRODUCTION

The Columbia, Missouri, Public Works Department began using FCA in the early 1970s as part of a citywide enterprise financing initiative that required service-based city agencies, like the Public Works Department, to develop user fees that would provide sufficient revenue to cover service costs. The first step in developing such fees was accounting for service cost. To do this, the department developed a spreadsheet system that uses FCA principles to convert budget and operating information into full cost data. When this process was complete, the department was able to clearly identify detailed service costs and associated revenue requirements.

Although developing cost-based service fees provided the original impetus for using FCA in Columbia, the department's FCA system also has served as an important planning and performance analysis tool. Since 1988, the department has added new residential recycling and composting services and has invested substantial funds into its landfill to ensure compliance with the Subtitle D requirements of the Resource Conservation and Recovery Act. The department has relied upon FCA to evaluate and implement cost-effective new operations. FCA helped the department control costs of existing operations by providing a framework in which specific cost centers can be evaluated on a regular basis. Therefore, despite increased service levels, the department's use of FCA has helped it to maintain competitive service rates.

BACKGROUND

Located in Boone County, in central Missouri, Columbia is a small but rapidly growing city of about 70,000 people. Two private colleges and the University of Missouri-Columbia provide a student population that constitutes more than a quarter of the city's population. As a "college" town, a substantial percentage of Columbia's population is highly educated and transient in nature.

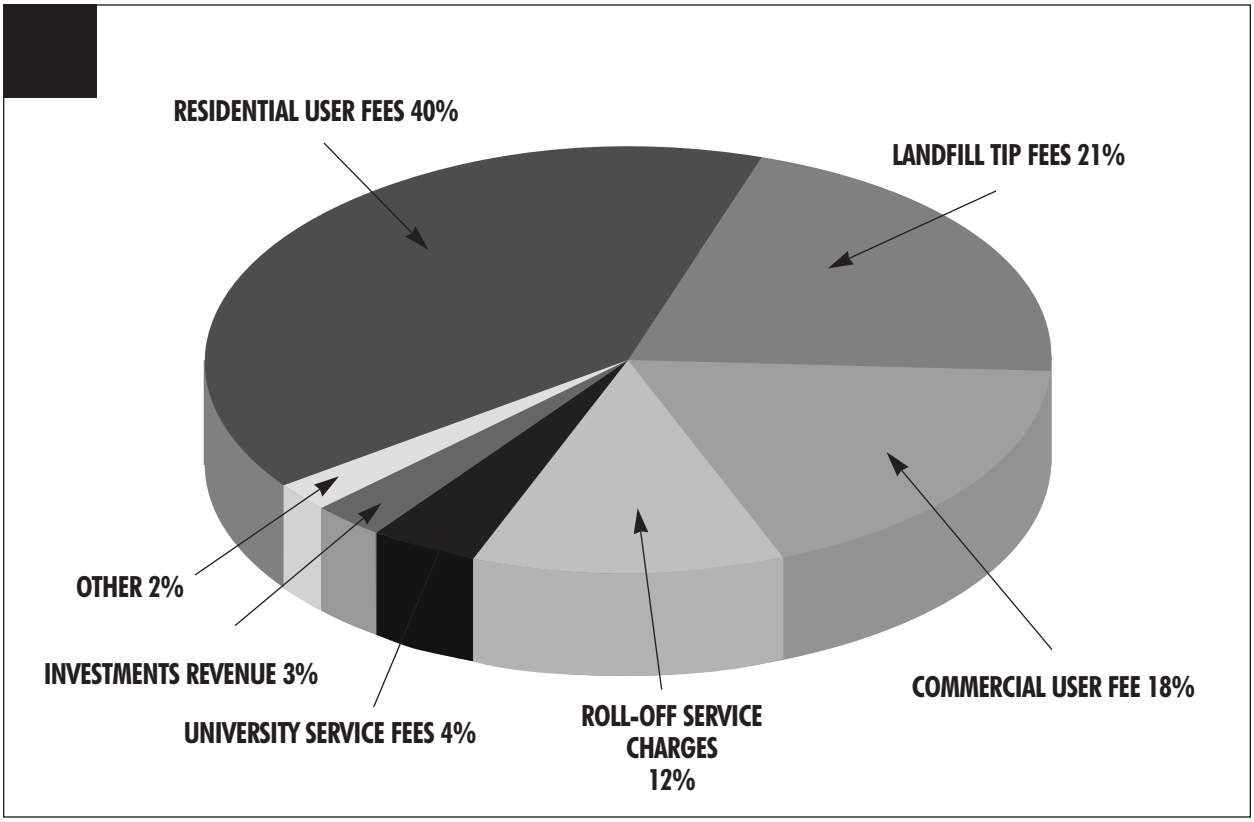
Demographic Characteristics, City of Columbia, Missouri

Population (1990)	69,101
Area (square miles)	44
Density (persons per square mile)	1,570
Households	25,842
Household Income (1989 $)	$22,059
Housing in 1- to 4-unit structures	66%

Columbia's Public Works Department provides a full range of solid waste management services (see Table 4 on page 20 for a description of the solid waste services offered by the department). It collects recyclables, yard trimmings, bulky waste, and garbage from the entire residential community. In addition, it competes with private haulers to collect refuse from the commercial sector, which generates more than 69 percent of the solid waste collected by the department. The department owns and operates a landfill that is used by private and public haulers from throughout the region. Approximately 44 percent of the waste disposed of at the landfill is from sources outside Columbia. At the landfill, drop-off sites for recyclables, yard trimmings, and household hazardous waste (HHW) are available to all commercial and residential customers. To oversee these services, the department has an operating and administrative staff of approximately 61 full-time employees and 25 temporary employees.

For FY 1998, the department's total operating and capital budget was approximately $7.7 million. Since the department is financed through an enterprise fund, direct user fees and tip fees support its budget expenditures. Figure 2 on page 15 provides a breakdown of the department's revenue sources.

FIGURE 2: COLUMBIA PUBLIC WORKS DEPARTMENT SOURCES OF REVENUE (REVENUE REQUIREMENT = $7.7 MILLION)



FCA IN COLUMBIA

The Public Works Department's annual budget expenditures provide a starting point for FCA in Columbia. These expenditures are tracked in the city's central financial system, which organizes expenditures into "cost centers" that track detailed costs (such as labor, materials, and insurance). The department has 20 operational cost centers in the central financial system, several of which have been added in the past 10 years (see text box on page 16).

Although these cost centers provide much of the raw data needed for FCA, the department modifies this information in two ways:

1. Allocating expenditures into 10 service categories and/or customer groups defined by the department. These categories include administration, district planning, recycling, composting, residential, commercial, roll-off, University of Missouri, landfill, and larvaciding (mosquito control).
2. Converting cash outlays for a given service category into costs. To convert these expenditures, the department uses FCA techniques such as depreciation, amortization, and full allocation of administrative and overhead costs to specific service categories.

The Public Works Department has created a spreadsheet to assist in modifying financial (e.g., cash and budget) data to full cost data. The spreadsheet template and associated data are shown in Table 5 on page 21. In general, calculating full costs for the 10 service categories involves the following steps:

- Directly assigning the 20 cost centers tracked in the central financial system to one or more of the department's 10 service categories (see column 1 of Table 5—bold faced items are department service categories, cost centers appear indented under each boldfaced service category). The department assigns cost centers to service categories based on department service definitions and customer classifications. The recycling category in Table 5, for example, includes curbside and drop-off

Public Works Cost Centers Tracked in City's Central Financial System

Administration
Solid Waste District*
Commercial Collection
Container Repair
Downtown Containers
Roll-Off Service
Residential Service
Landfill Operations
Composting*
Larvaciding
University Collection
Curbside Recycling*
Drop-Off Recycling*
Volunteer Program*
White Goods Collection
HHW*
Yard Trimmings Collection*
Debt Retirement
Closure and Postclosure*
Depreciation

* Indicates new cost center added within the past 10 years.

recycling as well as white goods, HHW, volunteer education, and yard trimmings collection services. In many cases, a cost center that is tracked individually in the city's central financial system is assigned to more than one of the department's 10 service categories. For example, the administration, container repair, and depreciation cost centers are assigned not only to the recycling service category but also to the residential, commercial, roll-off, university, and landfill service categories. A description of how the department allocates these shared costs among its service categories is provided below.

- Entering total annual operating budgets for each of the cost centers (see column 2 of Table 5). Total annual operating budgets for a given cost center, for example, are based on several detailed costs including personnel, fringe, materials, supplies, and utilities.
- Assigning depreciation costs to service categories based on actual capital and equipment usage by service category (see column 3 of Table 5). Using depreciation information results in comparable cost estimates that are based on the economic value of resources over their useful life instead of annual cash outlays on resources, which can fluctuate dramatically from year to year.
- Assigning landfill closure and postclosure costs, which are tracked as a separate cost center in the central financial system, to the landfill services category (see column 5 of Table 5).
- Allocating administration costs to service categories based on the service center's percentage of budget size (see column 6 of Table 5). Administration costs include overhead, indirect costs, and intergovernmental charges for services provided by other city agencies. The recycling operating budget ($841,621), for example, represents about 14 percent of the department's operating budget, minus administration ($5,953,315). The recycling service's share of administration costs, therefore, is 14 percent ($145,780) of the total administrative budget ($1,025,911).
- Allocating container repair and roll-off services used by several of the department's 10 service categories based on budget size (see columns 7 and 8 of Table 5).

After allocating these costs, the department calculates the full cost of services as shown in the text box on page 18 (see column 9 of Table 5 for more details). While the department's annual operating budget totals approximately $7 million, the full cost of department services increases to $9 million when costs associated with depreciation, debt retirement, and closure and postclosure are included (see columns 3 through 7 of Table 5). The budget differs from the full costs of individual services as well. These differences illustrate clearly the information FCA can provide for solid waste program managers.

Columbia FCA Information

Service Category	Operating Budget	Full Cost*
Administration	$1,025,911	$0
Recycling	$841,621	$1,086,963
Composting	$153,856	$180,506
Residential Service	$1,536,451	$1,965,192
Commercial Service	$1,261,463	$1,544,165
Roll-Off Service	$405,013	$482,350
Missouri University	$197,059	$301,044
Landfill Service	$1,477,505	$ 3,307,137
District Planner	$56,936	$56,936
Larvaciding	$23,411	$27,466
TOTAL	**$6,979,226**	**$8,951,759**

*Includes allocated operating and non-operating costs.

FCA IN ACTION: DEVELOPING COST-BASED PRICES FOR SERVICES AND CUSTOMER GROUPS

Development of Columbia's landfill tip fee and residential service charges—the two largest sources of revenue for the city—illustrates how the Public Works Department uses FCA to develop cost-based rates for specific solid waste services.

Calculating Landfill Tip Fees

City of Columbia trucks, public haulers from nearby communities, private haulers, and residential and commercial establishments bring waste to Columbia's landfill. All landfill customers have access to the composting, recycling, and HHW drop-off facilities located there. As a result, landfill tip fees also must incorporate costs for these services.

To calculate the landfill tip fee, the department allocates certain compost and recycling service costs to the landfill cost category as shown in column 3 of Table 6 on page 22. The department, for example, allocates the $180,506 compost service cost, which includes administration and depreciation costs as well as the annual operating budget to the landfill service category. Similarly, it allocates drop-off recycling and HHW costs to the landfill service category as shown in column 3 of Table 6. Note, however, that the re-allocated drop-off and HHW costs are each $39,348 higher than the full costs for these services shown in column 9 of Table 5. The extra $39,348 reflects the department's assumptions about administration, container repair, and depreciation costs incurred by these programs, which must be transferred along with the other program costs to the landfill cost center. The remaining recycling category cost ($751,600) represents the department's cost of providing recycling services—including curbside recycling, volunteer outreach, curbside white goods collection, and curbside yard trimming collection—exclusively to residents in the city of Columbia.

In total, the Public Works Department re-allocates $180,506 and $335,363 from the compost and recycling service categories, respectively, to the landfill service category, increasing overall landfill service costs by $515,869. The revised full cost of the landfill ($3,823,006) reflects the cost of the landfill and all of its associated drop-off services. To derive the tip fees, the department allocates this full cost across five specific customer classes (i.e., residential, commercial, roll-off, University of Missouri, and waste disposed of by other public and private haulers) based on the relative tonnage of waste landfilled by each class (see column 5 in Table 6). Forty-four percent (56,597 tons) of waste disposed of at the landfill, for example, is from public or private haulers. Forty-four percent of the total landfill cost is $1,694,606 (column 6 in Table 6). Dividing this amount by 56,597 tons disposed of by haulers other than the city yields a tip fee of $29.94, as shown in column 8.

Calculating Residential Service Fees

In addition to landfill tip fees, the Public Works Department charges a monthly fee to city residents to cover costs associated with the collection of trash, bulky items, recyclables, and yard trimmings. To develop the residential fee, the department first calculates the costs associated with all collection, processing, and disposal services provided to residential customers. As shown in Table 6, these costs include:

- $751,600 for recycling service, which is the full cost of all curbside collection programs, net of drop-off recycling and HHW costs (these are included in the landfill tip fee calculation described above).
- $1,965,192 for garbage collection, including administration, container repair, depreciation, and annual operating expenses (e.g., labor, materials, capital, and insurance).
- $654,793 in landfill tip fees, which is the $29.94 tip fee (described above) multiplied by the tonnage of waste disposed of by Columbia residents (21,869 tons).

After calculating costs for these services (see column 7 of Table 6), the department divides the resulting adjusted recycling and residential service costs ($751,600 and $2,619,986, respectively) by the number of residential households served (approximately 33,000). The department then divides this figure by 12 months to arrive at the unit costs of $1.99 and $6.93, respectively (shown in column 9 of Table 6). The sum of these values, $8.92 per household per month, is the department's monthly fee for residential service.

LESSONS LEARNED

The FCA system that the department uses to calculate service costs and associated rates also helps it improve performance and control costs. The department uses the information provided in Tables 5 and 6, for example, to evaluate the incremental costs of services on a year-to-year basis. Thus, if the cost of residential services increases, the department can identify the source and, if appropriate, implement cost control measures. In this way, the department's use of FCA has helped it to maintain competitive rates while increasing the level of services it provides to its customers. Other general ways the department has used FCA in the last 10 years are summarized in the text box below.

Based on its experience with FCA, the Public Works Department offers the following advice:

- *Use FCA for management purposes rather than just accounting.* Although the department uses FCA to obtain a more accurate understanding of solid waste service costs, accounting is not the department's primary motivation for using FCA. The department uses FCA to improve pricing, planning, performance, and decision-making.
- *Allow FCA to grow out of the unique operations and services provided by a given department or agency.* Clearly defined services provide a structure for organizing costs and performance data. Without clear service definitions, it is difficult or impossible to assemble and interpret useful cost information.

Other Uses of FCA in Columbia, Missouri, 1987 through 1997

- Developing residential, commercial, university, and roll-off service charges, and landfill tip fees that together cover the full cost of operating the solid waste system.
- Identifying, implementing, and administering cost-effective new programs and services, including drop-off and curbside yard trimming composting, white goods collection, and HHW collection programs.
- Identifying incremental costs of specific services and controlling costs by providing an analytical framework in which the cost of a given service can be compared against a previous year's cost of service.
- Tracking costs associated with implementation of RCRA Subtitle D requirements (see column 5 in Table 5 on page 21).

- *Maintain and update FCA systems on a regular basis.* The department has developed detailed record-keeping procedures at all levels of its operations to enhance its ability to track and evaluate the cost of services on a regular basis. The department's timesheet and other record-keeping systems, for example, have been restructured to reflect the eight specific service categories defined by the department.
- *Allow sufficient time for FCA systems to be implemented.* Developing the analytical structure and associated record-keeping and data collection procedures requires the most time, effort, and staff training.

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TABLE 4: COLUMBIA SUMMARY OF SERVICES AND FACILITIES (FY 1997)

Solid Waste Services and Facilities	Service Provider A=Agency C=Contract	Tonnage Managed	Comments
Source Reduction/ Recycling Outreach	A	N/A	Full-time waste minimization coordinator and a volunteer network to help with recycling and source reduction projects.
Drop-Off Recycling	A and C	1,513	Collects from six drop-off areas daily. Transports materials to a private processor. Both residents and nonresidents use drop-off sites.
Curbside Recycling Collection	A and C	686	Offers curbside collection to single- through four-family houses every other week as part of the monthly residential trash collection fee. Materials are processed at a private MRF.
Curbside Yard Trimmings Collection	A	2,645	Offers weekly yard trimmings collection to single- through four-family households. Ten bags per year are included as part of the residential monthly trash collection fee, while additional bags are collected for $0.50 per bag.
HHW	A	62	Collects used oil from single- through four-family households along with other recyclables; all residents may bring HHW to a city-run facility. Approximately 1,525 vehicles dropped materials off at the facility in 1996.
Bulky Item Collection	A	N/A	Collects on a call-in basis. Residents must pay $5 per white good collected, while other bulky items are collected free of charge. Roughly 95 tons of white goods are collected annually.
Residential Trash Collection	A	21,869	Offers weekly pickup to single- through four-family households. Residents must use bags, but 75 bags per year are included in the residential monthly trash collection fee. Apartment complexes also receive city collection.
Commercial Trash Collection	A	25,523	Provides mandatory collection from all establishments that generate food. Others can use private haulers, but city collection is cost-competitive.
Roll-Off Trash Collection	A	18,261	Provides roll-off collection containers and services by request.
University of Missouri Trash Collection	A	5,432	Provides collection services to the university, which is a large enough account that it warrants its own budget category.
Compost Facilities	A	6,000	Operates a compost site at the landfill. Site is used by residential and nonresidential haulers.
Mulching Sites	A	N/A	Operates two drop-off mulching facilities. Both residents and nonresidents use the drop-off facilities.
Landfills	A	127,682	Collects 56 percent of incoming waste; the rest is brought in by private haulers and imported from outside the city. The landfill area available is estimated at 80 years, given its current usage.
Miscellaneous Services	A	N/A	Funds one full-time solid waste district planner through a state grant. This category also covers costs for a larvaciding program (e.g., mosquito and fly control) from early spring until late fall.

TABLE 5: FULL COST ACCOUNTING IN COLUMBIA (FY 1998)

1	2	3	4	5	6	7	8	9
SERVICE Cost Center	**Operating Budget**	**Depreciation Allocation**	**Debt Retirement**	**Closure & Post-Closure**	**Admin. Allocation**	**Container Repair**	**Roll-Off Services**	**Adjusted Full Cost**
ADMINISTRATION	**$1,025,911**				**($1,025,711)**			**$0**
Depreciation		$5,280			($5,280)			$0
SW DISTRICT PLANNER	**$56,936**							**$56,936**
RECYCLING	**$841,621**				$145,780			**$1,086,963**
Administration								$145,780
Container Repair						$9,541		$9,541
Curbside	$383,510						$17,153	$400,663
Drop-Off	$150,202						$31,448	$181,650
Volunteer Program	$70,231							$70,231
White Goods	$19,281							$19,281
HHW	$75,017							$75,017
Yard Trimmings	$143,380							$143,380
Depreciation		$41,420						$41,420
COMPOSTING	**$153,856**							**$180,506**
Administration					$26,650			$26,650
Composting	$153,856							$153,856
Depreciation		$0						$0
RESIDENTIAL	**$1,536,451**							**$1,965,192**
Administration					$266,133			$266,133
Container Repair						$22,898		$22,898
Residential	$1,536,451							$1,536,451
Depreciation		$139,710						$139,710
COMMERCIAL	**$1,261,463**					**($190,818)**		**$1,544,165**
Administration					$218,502			$218,502
Commercial	$1,064,505							$1,064,505
Container Repair	$190,818					$104,950		$104,950
Downtown Containers	$6,140							$6,140
Depreciation		$150,068						$150,068
ROLL-OFF	**$405,013**						**($405,013)**	**$482,350**
Administration					$70,153			$70,153
Container Repair						$38,164		$38,164
Roll-Off							$324,010	$324,010
Depreciation		$50,023						$50,023
MISSOURI UNIVERSITY	**$197,059**							**$301,044**
Administration					$34,133			$34,133
Container Repair						$9,541		$9,541
Roll-Off							$32,401	$32,401
Missouri University	$197,059							$197,059
Depreciation		$27,910						$27,910
LANDFILL	**$1,477,505**							**$3,307,137**
Administration					$255,923			$255,923
Container Repair						$3,816		$3,816
Landfill	$1,477,505							$1,477,505
Depreciation		$892,815						$892,815
Interest Expense			$234,078					$234,078
Debt Retirement[1]			$175,000					$175,000
Closure & Postclosure				$268,000				$268,000
LARVACIDING	**$23,411**				**$4,055**			**$27,466**
TOTALS	**$6,979,226**	**$1,307,226**	**$409,078**	**$268,000**				**$8,951,759**

[1] Debt retirement is financial data that are generally not considered relevant to FCA.

TABLE 6: DERIVATION OF COST-BASED RATES FOR SERVICES (FY 1998)

1	2	3	4	5	6	7	8	9
SERVICE Cost Center	**Adjusted Cost (from Table 5)**	**Service Cost Re-Allocation**	**Adjusted Service Costs**	**Tons Processed**	**Landfill Allocation**	**Adjusted Service Cost**	**Cost Per Ton**	**Cost Per Res. Unit**
RECYCLING	**$1,086,963**	**($335,363)**	**$751,600**	**5,001**		**$751,600**	**$150.30**	**$1.99**
Administration	$145,780							
Container Repair	$9,541							
Curbside	$400,663		$465,588	686			$679.01	$1.23
Drop-Offs	$181,650	($220,998)		1,513				
Volunteer Program	$70,231		$80,068					$0.21
White Goods	$19,281		$23,216	95			$243.56	$0.06
HHW	$75,017	($x114,365)		62				
Yard Trimmings	$143,380		$182,728	2,645			$69.08	$0.48
Depreciation	$41,420							
COMPOSTING	**$180,506**	**($180,506)**	**$0**					
Administration	$26,650							
Composting	$153,856							
Depreciation	$0							
RESIDENTIAL	**$1,965,192**	**$0**	**$1,965,192**	**21,869**	**$654,793**	**$2,619,986**	**$119.80**	**$6.93**
Administration	$266,133							
Container Repair	$22,898							
Residential	$1,536,451							
Depreciation	$139,710							
COMMERCIAL	**$1,544,165**	**$0**	**$1,544,165**	**25,523**	**$764,200**	**$2,308,364**	**$90.44**	
Administration	$218,502							
Commercial	$1,064,505							
Container Repair	$104,950							
Downtown Containers	$6,140							
Depreciation	$150,068							
ROLL-OFF	**$482,350**	**$0**	**$482,350**	**18,261**	**$546,764**	**$1,029,114**	**$56.36**	
Administration	$70,153							
Container Repair	$38,164							
Roll-Off	$324,010							
Depreciation	$50,023							
MISSOURI UNIVERSITY	**$301,044**	**$0**	**$301,044**	**5,432**	**$162,643**	**$463,687**	**$85.86**	
Administration	$34,133							
Container Repair	$9,541							
Roll-Off	$32,401							
Missouri University	$197,059							
Depreciation	$27,910							
LANDFILL	**$3,307,137**	**$515,869**	**$3,823,006**	**56,597**	**$1,694,606**	**$1,694,606**	**$29.94**	
Administration	$255,923							
Container Repair	$3,816							
Landfill	$1,477,505							
Compost		$180,506						
Drop-Off Recycling		$220,998						
HHW		$114,365						
Depreciation	$892,815							
Interest Expense	$234,078							
Debt Retirement[2]	$175,000							
Closure & Postclosure	$268,000							
LARVACIDING	**$27,466**	**$0**	**$27,466**			**$27,466**		
TOTALS	**$8,894,823**	**$0**		**132,683**	**$3,823,006**	**$8,894,823**		**$8.92**

[2] Debt retirement is financial data that are generally not considered relevant to FCA.

4. City of Glendale, Arizona
Field Operations Department

INTRODUCTION

A combination of regional and local issues motivated Glendale, Arizona, to begin using FCA in the early 1990s. Increased regional competition from nearby, privately owned landfills with lower tip fees resulted in a substantial reduction in waste flow to the Glendale landfill between 1990 and 1995. Consequently, Glendale's landfill tip fee revenues dropped by 50 percent. Faced with the prospect of increasing local service rates—which were already among the highest in the region—in order to offset revenue losses, Glendale developed an FCA system to isolate the important relationship among landfill costs, tip fee revenues, and the rates for both collection and disposal services. Glendale's FCA system has enhanced and improved the cost and efficiency of its solid waste system so that it now has the lowest residential solid waste service rate in the region.

Glendale's use of FCA also was motivated by a need to develop long-term reserves and financial plans for its integrated solid waste system. In the late 1980s, approximately $600,000 in landfill reserve funds was absorbed by the general fund because the department did not have a well articulated long-term spending plan. Today, the department uses its FCA system to ensure the existence of long-term reserve funds and to justify the need for such funds.

BACKGROUND

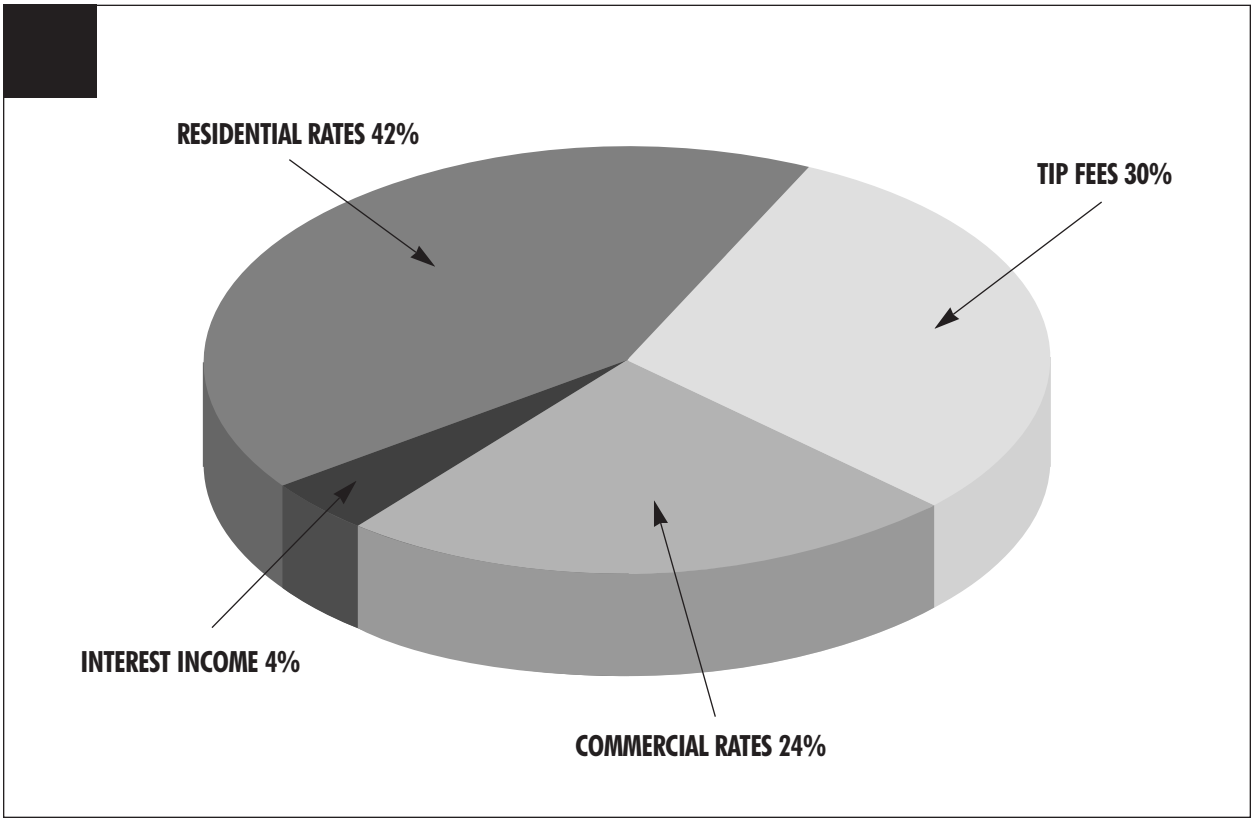
Located in the "Valley of the Sun," just west of Phoenix, Glendale is Arizona's fourth largest city. During the 1980s, Glendale's population grew by 52 percent, an expansion that continued during the 1990s. The sanitation and landfill divisions of the Field Operations Department handle solid waste management operations in Glendale. The department is a full-service solid waste management agency, utilizing contractors only for secondary sorting of recyclables and for sorting and processing of household hazardous waste (see Table 7 on page 27 for additional details on services and facilities provided by the department). The Sanitation Division provides trash collection services to all single and multi-family households and select businesses on a competitive basis. The Landfill Division operates the city's landfill and recovery operations. In total, the Field Operations Department has 72 employees, including five administrative and managerial staff.

Demographic Characteristics City of Glendale, Arizona

Population (1990)	180,038
Area (square miles)	52
Density (persons per square mile)	3,462
Households	68,604
Household Income (1989 $)	$35,769
Housing in 1- to 4-unit structures	50%

The sanitation and Landfill Divisions' total combined budget was just over $13 million in FY 1996. The largest budget category was its residential (curbside) service operation ($6,020,141), followed by the sanitary landfill budget ($4,285,568), and the commercial (container) service budget ($3,224,527). Two self-sustaining enterprise funds, the Landfill Fund and the Sanitation Fund, generate revenues to cover budgeted expenditures. The Landfill Fund covers the costs of operating the landfill and associated facilities. This fund derives nearly 88 percent of its revenues from landfill tip fees. The Sanitation Fund covers residential and commercial collection costs. Its revenues are derived almost exclusively from the monthly fees charged to residential homes and apartments and commercial establishments. Revenues from the two funds totaled more than $14 million in FY 1996. A breakdown of revenue sources for the combined funds is shown in Figure 3 on page 24.

FIGURE 3: GLENDALE'S SOURCES OF REVENUE (FY 1996) (TOTAL REVENUE = $14 MILLION)



FCA IN GLENDALE

Glendale developed three FCA-based tools to identify cost-based rates for services and evaluate long-term cost and revenue impacts associated with system and service changes. These tools include a rate model, landfill funding model, and solid waste financial plan.

The rate model is a custom software application the department uses to develop and analyze rates over a short-term period (i.e., 5 years or less). Revenue and detailed capital and operating costs are organized in the rate model by fund and functional cost centers. For example, the Sanitation Fund, which generates revenues through monthly service fees, includes residential and commercial collection cost centers (see text box at left). The rate model allows the Field Operations Department to integrate all of its cost and revenue centers in a single framework, so it can analyze cost and revenue impacts associated with system and service changes over time.

The landfill funding model helps the department account for long-term costs associated with the landfill. Input data in the model consist of engineering estimates of future cash outlays that will be required for closure and post-closure. Output data from the landfill cost model consist of estimates of the annual amount the department will have to set aside over the useful life of the landfill in order to cover all long-term outlays (see Table 8 on page 28 for a detailed description of parameters

Cost Centers in the Glendale Rate Model

1. Sanitation Fund Cost Centers
- Commercial Collection
- Residential Collection

2. Landfill Fund Cost Centers
- Sanitary Landfill
- Gas Management
- Recycling
- Wood Waste Recovery

considered in the landfill cost model). Output from the landfill cost model also is used as input in the rate model.

The Field Operations Department's financial plan is used for long-term planning and decision-making. It is the key mechanism through which the department discusses broad financial issues with city financial officials. These issues include long-term needs for cash infusions, investment strategies, and other issues pertaining to the department's financial needs. The financial plan is shaped in part by the output from the department's rate model and landfill funding model. For example, whereas the rate model is used to assess costs, benefits, and rate impacts associated with adding a new service, the financial plan is used to outline a strategy for financing the new service.

FCA IN ACTION: ANALYZING OPTIONS FOR RESIDENTIAL RATE RELIEF

The department uses the FCA tools described in the preceding section to develop cost-based rates for services and evaluate long-term cost and revenue impacts associated with system and service changes. To illustrate this process, this section describes how the department recently used its FCA system to evaluate the cost, revenue, and subsequent rate impacts associated with entering into landfill service agreements with nearby communities.

Between 1990 and 1995, waste disposed of at Glendale's landfill by sources outside the city declined substantially due to increased competition from nearby privately owned landfills with lower tip fees. By 1995, only 25 percent of landfill revenues were from non-city sources. Because more than half of the city landfill's costs are fixed, this decrease in revenue placed pressure on the Field Operations Department to either raise service rates or find alternative sources of revenues.

The department used its **rate model** and associated **landfill funding model** to identify and evaluate costs and benefits associated with alternative revenue sources. In particular, the department was interested in the possibility of entering into long-term service agreements with surrounding communities to dispose of an additional 50,000 to 200,000 tons of waste at the city landfill. The **landfill funding model** indicated that handling the additional volume of waste would only decrease the 50-year service life of the landfill by a maximum of 3 years.

The **rate model** was used to analyze short- and long-term costs (the latter calculated in the landfill funding model) associated with importing 75,000 additional tons per year. The **rate model** results suggested that the additional 75,000 tons of waste would result in a $247,000 increase in annual landfill costs, which would be more than offset by annual tip fee revenues of $1.3 million. The $1.1 million revenue surplus would allow Glendale to:

- Provide competitive tip fees of approximately $20 per ton for waste from surrounding communities instead of the $26 per ton that would be needed to cover costs without the imported tonnage.
- Provide tip fees of $19.73 per ton for waste collected by Glendale sanitation vehicles instead of the $24 per ton that would be needed to cover fixed costs without the imported tonnage.
- Lower a planned monthly increase in Glendale customer service rates from $0.90 per household to $0.25 per household and eliminate rate increases for a multiyear period. Residents paid $10.75 per month in FY 1998.

Based on this analysis, the city council directed the Field Operations Department to execute long-term landfill agreements with two nearby communities. These agreements provide for an additional 65,000 tons of waste disposed of at the city landfill annually over a 5-year period.

LESSONS LEARNED

Increased competition and a desire to more clearly articulate long-term cost and revenue structures in order to sustain reserve funds motivated Glendale to develop three interrelated FCA tools: the rate model, the landfill funding model, and the financial plan. These tools are used in combination to inform short-term rate making and long-term financial planning

Other Uses of FCA in Glendale, Arizona

- Decreasing residential service rates by entering into long-term solid waste service agreements with nearby communities. Glendale has the lowest single family residential MSW service rate in the Phoenix metropolitan area.
- Evaluating cost-effective options for expanding recycling services. The city is currently using an FCA approach to evaluate the cost and rate impacts of five separate service options for recycling.
- Creating a landfill development plan that maximizes site life while minimizing cost. The city is in the process of revamping its long-term plan for the landfill to consider long-term cost impacts associated with recreational end-uses of the landfill site.
- Expanding commercial collection services. Glendale is using FCA to evaluate and revamp commercial rate structures so that they take into account economies of scale associated with providing collection services to larger commercial accounts.

functions such as those shown in the text box above. FCA helped the department shape and develop new solid waste policies by addressing the needs of both its city council members—who are chiefly concerned with keeping residential rates as low as possible—and its staff, who must consider and justify the need for both short- and long-term expenditures.

Based on its experience with FCA, Glendale offers the following advice:

- *Allow sufficient time to develop data collection procedures.* Glendale spent approximately 2 years developing a data collection protocol that captured the correct data for its FCA tools. The city found that data collection is the most critical staff-training element.
- *Ensure that senior management is committed to FCA.* FCA requires a substantial up-front commitment of staff time for training and implementation. Therefore, top level managerial support is required.
- *Before implementing an FCA system, identify an issue of local concern that can be addressed by FCA.* Identifying a specific issue to address with FCA can facilitate development of a standard analytical structure and data collection protocol.
- *Involve consultants with the development and implementation of FCA tools.* Glendale used private consultants to help develop its rate model, landfill funding model, and financial plan. Consultants also provided the Field Operations Department with the detailed financial expertise it needed to develop its FCA approach.

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TABLE 7: GLENDALE FIELD OPERATIONS SUMMARY OF SERVICES AND FACILITIES

Solid Waste Services and Facilities	Service Provider A=Agency C=Contract	Tonnage Managed	Comments
Recycling Programs	A and C	2,000	Transports recyclables from 17 drop-off sites to a central location for sorting. Private recycling companies process sorted recyclables.
Wood and Yard Trimmings Recovery	A	6,000	Accepts yard trimmings at the landfill and processes as part of a green waste recycling program. Accepts Christmas trees at drop-off sites seasonally. Wood is separated from incoming loads, processed, and sold.
HHW	A and C	N/A	Provides HHW drop-off 1 day each year. Provided a week-long curbside collection service for HHW in 1997. Private contractor sorts, classifies, packages, and arranges for transportation of HHW.
Bulky Item Collection	A	20,442	Collects residential bulky items monthy, including tree limbs and brush, furniture, and appliances. Residents also can bring bulky materials (about 12,500 tons from 1996 to 1997) to the landfill throughout the year at no cost.
Residential Trash	A	83,000	Provides automated trash collection to all 41,778 residential customers twice weekly. Residents paid $10.50 monthly from 1996 to 1997.
Commercial Trash	A	63,000	Provides container services to all multifamily dwellings and bin or roll-off service to commercial establishments on a competitive basis with private haulers. Serves 1,400 to 1,500 clients annually through this program.
Transfer Stations	N/A	N/A	Closed transfer station from 1995 to 1996. Site is now used for recycling sorting operations.
Landfills	A	214,100	Operates landfill with approximately 50 years of remaining capacity. From 1996 to 1997, the tip fee for the city's sanitation vehicles was $24.25 per ton.
Other Solid Waste Management Services	A	469	Provides annual residential "Spring Cleanup" and dead animal collection.
Other Facilities	A	N/A	Maintains a lot and building for collection vehicles.

TABLE 8: FACTORS CONSIDERED IN GLENDALE LANDFILL FUNDING MODEL

Fiscal Year	Any year from 1996 through 2055.
Tonnage Disposed	Projected annual tonnage disposed of in the landfill plus engineering estimate of fill.
Beginning Capacity	Engineering estimate of tonnage capacity remaining in the landfill at the beginning of the fiscal year.
Ending Capacity	Beginning capacity minus tonnage disposed of.
Cumulative Tons in Place at End of Year	Beginning capacity, tonnage disposed of, and engineering estimate of fill.
Lifetime Landfill Capacity	Engineering estimate of total tonnage capacity available over the life of the landfill.
Cumulative Percent Capacity Filled	Cumulative tons in place at the end of any given year divided by lifetime landfill capacity.
Total Closure Cost Estimate	Engineering estimate based on hydroseeding costs, closure certification, cover system construction costs, quality assurance, and quality control. Total costs are estimated in 1996 dollars and inflated at an annual rate of 3 percent.
Accrued Closure Costs	Cumulative percent capacity filled (in any given year) multiplied by total closure cost estimate.
Annual Closure Expenditures	Annual amount spent on closure costs.
Inflation Adjusted Cumulative Closure Expenditures	The sum of all previous and current annual closure expenditures during any given year, assuming an annual inflation rate of 3 percent.
Remaining Accrued Closure Liability	Accrued closure costs minus inflation-adjusted cumulative closure expenditures.
Total Postclosure Cost	Engineering estimate based on postclosure costs and long-term care costs. Total costs are estimated in 1996 dollars and inflated at an annual rate of 3 percent.
Accrued Postclosure Liability	Cumulative percent capacity filled (in any given year) multiplied by total postclosure cost estimate.
Total Remaining Accrued Closure and Postclosure Liability	Accrued closure liability plus accrued postclosure liability in any given year during the landfill's expected lifetime.

5. City of Indianapolis, Indiana
Solid Waste Division

INTRODUCTION

The Indianapolis, Indiana, Solid Waste Division began using FCA in 1993 as part of a citywide effort to provide the highest quality public services to residents at the lowest cost. The division began using FCA to facilitate the adoption of market mechanisms—particularly competitive bidding by public employees for solid waste collection contracts.

Since the division began competing against private haulers to provide trash collection services, the city's solid waste costs have decreased by more than $5 million. The division relied on FCA to develop successful competitive bids that have resulted in these cost reductions. Experience in Indianapolis shows that FCA can be instrumental in helping public agencies succeed in a competitive market.

Demographic Characteristics City of Indianapolis, Indiana

Population (1990)	741,592
Area (square miles)	373
Density (persons per square mile)	1,989
Households	296,297
Household Income (1989 $)	$29,000
Housing in 1- to 4-unit structures	72%

BACKGROUND

Indianapolis is located in Marion County, in central Indiana. In 1970, many city and county government functions were combined, creating a "consolidated city." The consolidated city, which includes most of the municipalities in Marion County, explains many of the city's demographic features including size, population density, and housing mix (see text box above).

The Department of Public Works (DPW) is one of six governmental departments in the consolidated city. DPW is responsible for administering all public and private service contracts through its Contract Compliance Division. DPW's Solid Waste Division provides a range of residential solid waste services on a competitive basis. The Solid Waste Division has approximately 110 operations staff, all of whom are union employees, and 13 administrative staff.

The Solid Waste Division functions primarily as a collection service provider that actively competes with private haulers to provide solid waste services to city residents. The consolidated city is divided into 12 trash collection districts. Two of the 12 districts receive public collection services, while the remaining 10 districts are subject to a competitive bid process. To enhance competition, the city does not allow a single hauler to serve more than 3 districts within the 10 districts that are subject to competitive bid processes. Currently, the Solid Waste Division provides collection services to 3 districts in the 10 districts competition zone, as well as the 2 public collection districts. In total, the 5 districts to which the division provides hauling services represent nearly half of the consolidated city's population. The division also provides trash collection for public housing and special events, offers drop-off services for recyclables, operates a transfer station, and provides cleanup after numerous special events. Residents seeking curbside recycling services contract individually with private haulers.

DPW also contracts for essentially all trash processing services, including the operation of a waste-to-energy facility where much of the city's trash is processed. Table 9 on page 33 provides a summary of solid waste management services and facilities provided by the division, and the tonnage of waste managed.

Solid waste management services in Indianapolis are financed through the following two funds:

- The Sanitation Solid Waste Fund supports collection services offered by the city and is financed primarily through property taxes and other revenue such as limited service fees for bulky waste, special events, and dead animal collection. Budgeted expenditures for this fund were approximately $20.1 million in 1997.
- The Solid Waste Disposal Fund is an enterprise fund that supports processing and disposal fees and is financed largely through a solid waste user fee of $32 per household per year. Budgeted expenditures for this fund were about $5.2 million in 1997.

A breakdown of the division's sources of revenue is provided in Figure 4 below.

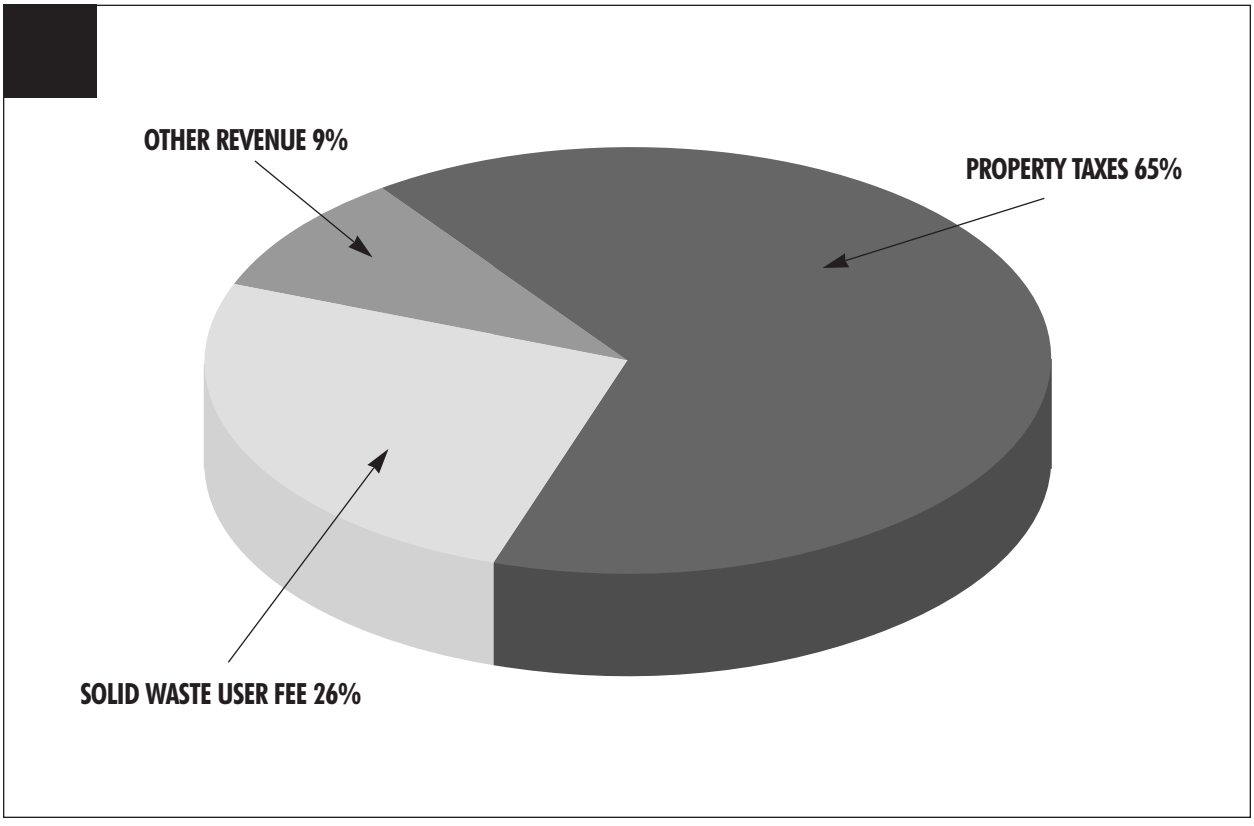
FCA IN INDIANAPOLIS

The Solid Waste Division uses a customized spreadsheet application to develop its cost and bid information. More than 100 separate costs are allocated to 10 basic division service categories (see the text box on page 31) using a two-step process:

1. Directly assigning costs associated with a single category to that category. This step accounts for more than $20 million of the division's approximately $25.7 million in full costs.
2. Spreading other major costs among categories based on well-defined cost allocation procedures.

The Solid Waste Division organizes costs into one of five general cost categories: personnel expenses, supplies, contracts and other costs, equipment, and nondivision administrative costs (see Table 10 on page 34).

FIGURE 4: INDIANAPOLIS' SOURCES OF REVENUE (1997) (TOTAL REVENUE = $25.3 MILLION)



Indianapolis FCA Information

SERVICES	FULL COST
Residential Trash Collection:	
Manual	$14,795,360
Automated	$2,501,287
Heavy Trash	$1,063,193
Illegal Dumping	$215,311
Special and Support Services	$1,129,533
Dead Animal Collection	$125,677
Emergency Disposal	$306,261
Leaf Diversion	$662,546
Drop-Off Recycling	$1,211,052
Final Disposal	$3,741,879
Total	**$25,752,099**

Specifically, the division:

- Assigns personnel expenses, including both salary and non-salary expenses (i.e., costs such as workers compensation and social security taxes), directly to services.
- Allocates costs for supplies primarily in proportion to direct labor hours provided for each service.
- Assigns approximately $15 million in contract costs directly to specific division service categories based on current contract arrangements.
- Assigns equipment costs, primarily for collection vehicles, to service categories based on equipment usage rates by service categories.
- Allocates fleet service costs in proportion to tonnage collected by each vehicle (or percent of total tonnage collected).
- Allocates $1,129,533 in administrative charges in proportion to the direct labor hours provided for each service.

In addition to this cost information, the spreadsheet includes performance factors such as the tonnage collected, number of houses serviced, and the number of crew members or vehicles on route. This information helps the division develop performance indicators that track cost impacts associated with specific changes in performance. The division, for example, can calculate the full cost of collecting from a specific collection district and provide a corresponding service "output" (i.e., houses serviced or tons collected).

FCA IN ACTION: DEVELOPING COMPETITIVE PUBLIC SOLID WASTE SERVICE BIDS AND CONTRACTS

The Solid Waste Division began using FCA in 1993 in response to a government reform process instituted by the city's new mayor. To ensure that taxpayers' dollars were being spent as wisely as possible, the mayor pledged to "provide customers with a dollar's worth of service for every dollar it takes in taxes." The mayor also promised to engage city agencies in a "comprehensive effort to link costs and outcomes and create a budget that [city] customers could easily review." To follow through on these promises, city officials were required to identify each service provided, determine the full cost of that service, analyze options for reducing costs and/or increasing service quality, and explain the results to the city's residents and businesses. In addition, some city agencies were required, for the first time, to compete against private service providers to win city contracts for services.

In 1993, Indianapolis made residential trash collection an area of public-private competition. Before 1993, densely populated portions of the urban core received solid waste services from the division, while residents living in outlying areas contracted individually with private haulers. When competition was introduced, the consolidated city was divided into 12 collection districts. Two of the 12 districts would continue to receive public collection services, while the remaining 10 districts were subject to a competitive bid process.

FCA helped the Solid Waste Division develop a competitive bid by revealing opportunities for improving performance and streamlining costs. For example, FCA revealed that certain indirect supervision costs were excessive and could be reduced or eliminated. In addition, FCA helped the division link performance indi-

cators and costs so it could accurately determine costs for fixed levels of service (i.e., costs of providing collection services to a well-defined collection district).

The Solid Waste Division won contracts with the city in three collection districts—the maximum number of open districts that could be served by a single service provider. After winning the collection contracts, the division realized a 30 percent improvement in performance based on the number of houses served daily. During the year following the advent of competition, increased efficiency and cost reduction measures reduced the Solid Waste Division's budget by $5.1 million.

LESSONS LEARNED

With the exception of Indianapolis, the subjects of these case studies all receive the majority of their income from fees and payments related to the provision of solid waste management services. This gives the other case study subjects a clear financial incentive to control the cost of their services. Indianapolis receives the majority of its revenues from property taxes, not fees. The impact of this funding arrangement, however, must be considered in the context of the city's overall commitment to efficiency in government. For Indianapolis, maximizing the efficient use of taxpayer dollars through competition is, in fact, a major reason for the use of FCA.

In Indianapolis' case, FCA has proven useful in fostering public-private competition, resulting in both lower costs and improved performance. Based on its experience with FCA, the Solid Waste Division offers the following advice for other communities:

- *Solicit technical support, if needed, for staff training, data development, and development of an appropriate FCA system.* Consultants familiar with the FCA approach and its requirements were useful during the start-up phase, assisting in both data development and staff training.
- *Focus on implementing FCA concepts and data development procedures to ensure the FCA system is understood and being used.* As the division's use of FCA evolved, it abandoned the original proprietary software application provided by a consultant in favor of a customized spreadsheet application it can support and maintain with in-house staff.
- *Recognize that using FCA often leads to innovations and the adoption of other best management practices and tools.* Once the division knew its costs, it naturally became interested in improving performance. This, in turn, led to the division's use of other tools and approaches such as geographic information systems for route optimization.

Other Uses of FCA in Indianapolis, Indiana

- Developing an incentive-based compensation system that shares the benefits of increased efficiency and productivity with division workers.
- Rebidding collection service contracts. The division has developed a custom spreadsheet application for future city bid processes based on lessons learned during the initial bid process.

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TABLE 9: INDIANAPOLIS SUMMARY OF SOLID WASTE SERVICES AND FACILITIES

Solid Waste Services and Facilities	Service Provider A=Agency C=Contract	Tonnage Managed	Comments (All tonnage estimates and comments relate to division service unless otherwise noted.)
Source Reduction and Recycling Outreach	A	N/A	Division and DPW develop public service announcements, publish information and promotional materials, and present school and media programs.
Recycling Drop-Off Programs	A and C	9,000	Division transports recyclables from 30 drop-off sites to a private facility.
Leaf Composting	A and C	6,594	Division collects leaves each fall and transports to a private compost facility.
HHW	A and C	N/A	DPW provides residential drop-off services year-round. A private contractor handles the HHW received (7,000 participants in 1996).
Bulky Item Collection (Division Tonnage Only)	A	9,319	Division collects heavy trash once per month. Each household may set out up to two bulky items on heavy trash days, including items containing chlorofluorocarbons.
Residential Trash (Division Tonnage Only)	A	119,367	Division collects from all low-density housing and from designated multifamily structures generally containing no more than 10 units.
Institutional Trash	A	4,581	Division collects garbage from public housing, parks, and city departments.
Other Solid Waste Management Services	A	N/A	Division provides dead animal collection; collects from neighborhood clean-ups, parades, and other events; and investigates illegal dumping.
Emergency Disposal Response	A	N/A	Division responds to emergency city disposal needs, including storms, tornadoes, snow removal.
Waste-to-Energy Facilities (Includes non-city waste)	C	677,000	DPW administers contract with the operator of waste-to-energy facility, the Indianapolis Resource Recovery Facility (IRRF). This facility receives waste from non-city sources as well.
Transfer Stations	A and C	N/A	Division owns one small transfer station in Indianapolis; residents can leave materials there for a small fee. Operation of facility is contracted to private service provider.
Landfills	C	Monofill: 175,275 Landfill: 8,300	DPW provides monofill for disposal of ash from the IRRF. The monofill tonnage noted here includes ash due to all sources of waste brought to the IRRF. The city also utilizes a private landfill for disposing of bulky materials. City crews collect the landfilled tonnage noted.

TABLE 10: INDIANAPOLIS SOLID WASTE DIVISION FCA SUMMARY INFORMATION (FY 1997)[3]

	Manual Trash Collection	Automated Trash Services	Heavy Trash	Illegal Dumping	Leaf Diversion	Drop-Off Recycling	Final Solid Waste Disposal	Special and Support Services	Dead Animal Collection	Emergency Disposal Response	**TOTAL**
Personnel Expenses											
Salaries	$1,743,949	$375,923	$132,463	$27,356	$0	$132,464	$172,268	$405,779	$48,024	$0	$3,038,226
Performance Incentive	$56,700	$10,500	$3,500	$700	$0	$3,500	$6,000	$11,900	$1,400	$0	$94,200
Overtime	$168,287	$32,054	$18,275	$9,000	$50,000	$16,000	$4,000	$33,614	$4,000	$100,000	$435,230
Other Personnel Costs	$502,583	$133,117	$55,612	$15,970	$8,891	$48,238	$42,481	$122,684	$15,456	$7,114	$952,146
Supplies											
Medical and Food Supplies	$16,421	$0	$0	$0	$0	$0	$2,000	$0	$0	$0	$18,421
Office and Computer Supplies	$11,068	$2,000	$0	$0	$0	$2,800	$62,359	$2,000	$0	$0	$80,227
Building Supplies	$10,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$10,000
Other Supplies	$16,500	$1,000	$1,000	$2,000	$0	$0	$52,000	$2,000	$0	$0	$74,500
Contracts and Other Costs											
Waste Collection/Disposal	$10,628,374	$1,100,000	$500,000	$10,000	$500,000	$250,000	$2,722,757	$100,000	$39,000	$0	$15,850,131
Temporary Services	$80,000	$0	$0	$0	$0	$0	$10,000	$0	$0	$0	$90,000
Utilities	$76,996	$0	$0	$0	$0	$0	$0	$0	$0	$0	$76,996
Insurance Premiums	$89,652	$0	$0	$0	$0	$0	$0	$0	$0	$0	$89,652
Postage and Freight	$30,640	$0	$5,000	$0	$0	$5,000	$16,269	$0	$0	$0	$56,909
Other Costs	$117,000	$8,227	$0	$60,000	$0	$0	$491,084	$8,000	$0	$0	$684,311
Equipment											
Vehicles	$375,000	$420,000	$184,000	$25,000	$0	$255,000	$0	$118,000	$0	$125,000	$1,502,000
Other Equipment	$70,280	$210,750	$0	$0	$0	$50,000	$27,000	$201,000	$0	$0	$559,030
Nondivision Costs											
Fleet Services	$743,298	$178,391	$148,660	$59,464	$74,330	$104,062	$0	$104,062	$14,866	$59,464	$1,486,597
Administrative Charges	$58,612	$29,325	$14,683	$5,821	$29,325	$343,988	$133,661	$20,514	$2,931	$14,683	$653,543
TOTAL	$14,795,360	$2,501,287	$1,063,193	$215,311	$662,546	$1,211,052	$3,741,879	$1,129,553	$125,677	$306,261	$25,752,099

[3] Some of the data in this table merit further explanation. There are no regular salary costs associated with emergency disposal response and leaf diversion because these are seasonal activities with no regular personnel assigned; all of these activities are carried out on employee overtime. In addition, costs for utilities and insurance premiums are assigned to manual trash collection. Costs for fleet services are allocated based on vehicle usage. Administrative costs for cost incurred by other city department's on behalf of the Solid Waste Division are assigned to all division budget categories except for drop-off recycling since all nondivision costs associated with drop-off recycling are directly assigned.

6. Southeastern Public Service Authority of Virginia

INTRODUCTION

The Southeastern Public Service Authority of Virginia (SPSA) began using FCA in the mid 1980s. As SPSA operates under a 50-year sunset provision, which requires that all debt obligations be paid off by 2017, it initially relied on FCA to guide the allocation of debt service costs to its services and facilities. It then set prices to recover these costs.

In the 1990s, SPSA faced increased competition for waste from private landfills in the region. Using its FCA system, SPSA was able to identify strategic pricing and investment options, which allowed it to keep waste flowing to its facilities. Recently, SPSA used FCA to evaluate the options for obtaining additional landfill capacity.

BACKGROUND

SPSA is one of six regional solid waste authorities in Virginia. It was formed in the mid-1970s by an act of the state legislature to provide southeastern Virginia with economical and environmentally sound solid waste services. SPSA member communities are the cities of Chesapeake, Franklin, Norfolk, Portsmouth, Suffolk, and Virginia Beach and the counties of Isle of Wight and Southampton (see text box at right). A board of directors appointed by the member communities governs the authority. Approximately 10 percent of SPSA's staff (50 out of 498 staff) provide administrative and managerial support; the rest of the employees are involved directly with SPSA's solid waste operations, which include collecting recyclables and processing and disposing of trash.

To provide its recycling and trash services, SPSA operates an integrated solid waste management system that includes eight transfer stations and a regional landfill. SPSA also owns a refuse-driven fuel (RDF) plant and operates an RDF-fueled electricity and steam generating plant, under contract to the U.S. Navy. Table 11 on page 39 provides a summary of the solid waste management services and facilities provided by SPSA.

Because SPSA is an independent public authority, it does not have access to "General Fund" revenues to cover its costs. SPSA's operations are funded by tip fees, payments for RDF and recyclables, income from its contract for operating the Navy power plant, and several other small sources of revenue. A breakdown of SPSA's revenue sources is shown in Figure 5 on page 36. As the figure shows, tip fees are SPSA's most important revenue source.

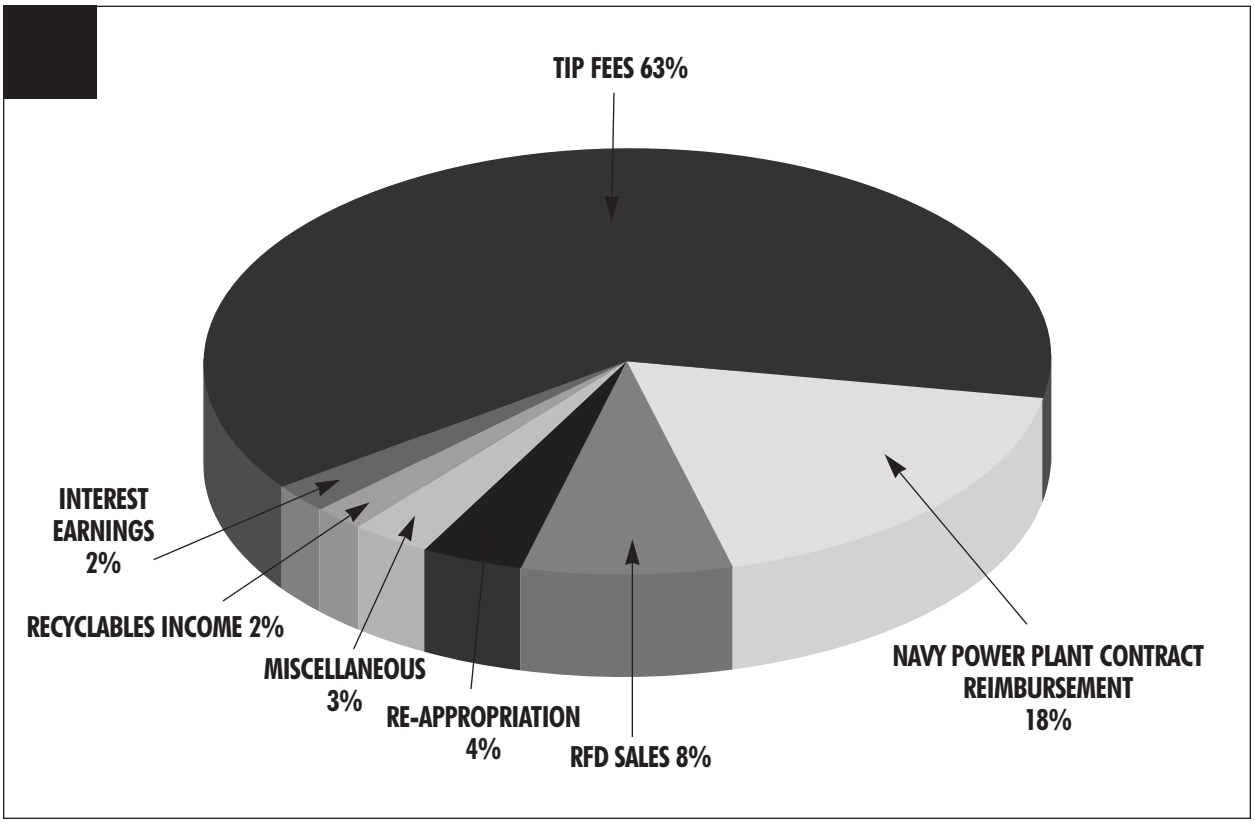
Demographic Characteristics, SPSA

Population (1990)	1,012,789
Area (square miles)	1,999.9
Density (persons per square mile)	506
Households	352,313
Household Income (1989 $)	$30,662
Housing in 1- to 4-unit structures	78%

FCA AT SPSA

After SPSA was established, the authority developed a budgeting system that allowed it to accurately track the operating costs of each of its services and facilities and the corresponding income from tip fees and other sources. When major facilities such as the RDF plant came on line in the 1980s, SPSA recognized the need to allocate debt service and overhead costs carefully among its facilities. This allocation would ensure that costs and revenues could be balanced and that the authority's growing obligations for debt service were met. In 1987, the need to allocate these costs led SPSA to modify its budgeting system to accommodate FCA information.

FIGURE 5: SPSA'S SOURCES OF REVENUE (1995) (TOTAL REVENUE = $58 MILLION)



SPSA computes the full cost of each of its services and facilities as the sum of direct and indirect costs. Direct costs consist of operating costs and other costs that can be assigned to specific services and facilities. Indirect costs, which must be allocated among SPSA's various services and facilities, include environmental management, administration, and debt service costs (as explained in the following paragraphs, SPSA's treatment of debt service comports with the accrual accounting conventions). A summary of SPSA's FCA information for its RDF plant, curbside recycling service, and compost facility is provided in the text box on page 37. Table 12 on page 40 and Table 13 on page 41 provide complete full cost data for each of SPSA's services and facilities. The FCA information presented here is based on SPSA's FY 1995 budget. This is the authority's most recent publicly available data and provides a representative example of the authority's current costs.

SPSA's debt service costs comprised 35 percent of SPSA's FY 1995 budget. Because of the "sunset provision", all debt must be paid by 2017. In order to meet this obligation, SPSA must allocate debt service costs carefully among its facilities and services and then recover the costs through fees and charges. Initially, SPSA allocated these costs based on the original cost of the assets associated with each service or facility. The use of original cost, however, can lead to situations where equipment, such as a fleet of trucks which has been fully depreciated and replaced, continues to be assigned responsibility for debt service costs. To resolve this problem, SPSA adopted net cost (i.e., original cost less depreciation) as the basis for the allocation of debt costs. The use of net cost ensures that fully depreciated equipment is not assigned any responsibility for debt service costs. This practice has also helped SPSA to structure financing terms that are more consistent with the life of the equipment or resources being

financed such that SPSA debt service payments are more consistent with what its depreciated capital and equipment costs.

SPSA's allocation of debt service costs based on net cost is consistent with the way in which SPSA currently structures its financing. To receive the best market rates, SPSA finances groups of assets. The terms of the financing permit SPSA to structure its payments so that each asset in the group is paid for over its individual useful life. This financing approach is a form of accrual accounting that recognizes and recovers costs over the useful life of the asset.

SPSA FCA Information

Cost	RDF Plant	Curbside Recycling Collection	Compost Facility
Direct Cost	$4,783,697	$2,132,002	$363,118
Indirect Cost	$8,279,447	$1,280,877	$112,867
Total Cost	$13,063,144	$3,412,879	$475,985

FCA IN ACTION: COMPETING FOR WASTE

As a consequence of increased competition during the 1990s, throughput at SPSA's RDF plant declined 20 percent between 1994 and 1995. This reduction created problems because SPSA is contractually obligated to provide certain minimum quantities of RDF to fuel the Navy power plant. Failure to do so could have led to the loss of the Navy plant as a guaranteed consumer of the authority's RDF. SPSA developed two responses to the reductions in throughput:

- Reducing tip fees for commercial waste haulers using SPSA facilities.
- Adding a bulky waste shredder at the RDF facility to allow a greater portion of waste to be processed at the facility.

Both responses were based on analyses conducted using FCA.

Historically, SPSA has processed substantial amounts of waste collected by commercial haulers. After the loss of flow control, there was increasing competition for this waste from the region's private landfills. Analysis of unit costs, with and without the commercial haulers' waste, allowed SPSA to quantify the impact of losing the commercial haulers' waste. For example, SPSA showed that loss of waste at the RDF plant translated directly into higher per-ton costs for debt and other fixed costs, driving unit costs up. This meant that, with the loss of waste, member communities would be charged higher fees in order to cover SPSA's costs. SPSA communicated the impact of lower throughput to its member communities. Based on this information, SPSA and its members decided to lower tip fees for commercial haulers. This pricing strategy has allowed SPSA to retain some of the commercial haulers' waste.

During 1994 and 1995, the amount of bulky materials in the waste received at the RDF increased. Bulky materials are problematic because the RDF plant cannot process bulky waste. Unless bulky waste is pre-processed into a size acceptable at the RDF plant, it has to be landfilled. SPSA decided to investigate the purchase of a shredder, to reduce bulky waste to a size that the RDF plant could process. SPSA's analysis began with an estimate of the amount of currently non-processable waste that could be made processable by a bulky waste shredder. It then considered the capital costs of the shredder, including delivery of all equipment and materials; contractor's overhead and profit; sales and use taxes; and engineering, design, and construction administration. It also considered operating costs for the shredder, including electricity, fuel, spare parts, and additional personnel costs. These capital and operating costs were compared to the revenues and avoided costs that would result from use of the shredder; SPSA considered revenue from the additional RDF sold; avoided transportation costs for bulky waste; and avoided landfill costs for bulky waste. SPSA used its FCA data to develop the avoided costs, ensuring that the shredder's benefits reflected the full avoided cost of transportation and landfilling. SPSA estimated that the payback period for investing in a bulky waste shredder period would be less than 2 years, and therefore decided to go forward with

installation of the shredder. Based on actual costs and throughput, SPSA now estimates that the shredder will pay for itself at the end of 3 years of operation.

LESSONS LEARNED

Specific issues that have confronted the authority, particularly the allocation of debt service costs, have guided FCA development and use by SPSA. The following lessons learned by SPSA also are related to these issues:

- *Financing term should match facility life.* Initially SPSA financed all of its capital costs, including items such as trucks and transfer stations that have very different useful lives, using the same 30-year bonds. Difficulties in allocating debt service costs arose because assets, such as the trucks, were fully depreciated and retired from service before the 30-year bonds were repaid. SPSA now believes that it is more appropriate to group assets by useful life and, to the extent possible, to finance over the life of the assets. This is essentially the same as accrual-based accounting.
- *Correct allocation of costs can be quite difficult.* SPSA did not find FCA technically difficult to implement. The Authority's staff developed SPSA's FCA system by building on existing management and data systems. Outside consultants were not used. From SPSA's perspective the challenge was not developing the system. Rather, the challenge was developing appropriate allocation methods for important, but difficult-to-allocate, items such as debt service costs.
- *Use of a facility-based budgeting system makes FCA easier to implement.* In part, SPSA found implementing FCA easy because the authority's budgeting system is organized by facility. Facility-based budgeting in turn provided the framework within which SPSA could develop its cost allocation procedures.
- *FCA data are very useful when operating in a competitive market.* SPSA also has recently used FCA to compare the cost of expanding its own landfill with outside bids. SPSA's analysis carefully documented the full cost of the expansion and showed that its cost was less than the outside bids. Based on these results, SPSA's board authorized landfill expansion to meet its needs through 2015.
- *Use of FCA can improve pricing.* SPSA has learned that it can use its FCA data, particularly its unit cost data, to better understand the cost of its services, and to improve pricing. Recently SPSA has focused its attention on transportation costs, particularly for transfer stations. Using its FCA data, SPSA has been able to pinpoint areas where it can reduce transportation costs, and thereby reduce the price of its services. Similar efforts have led to reductions in labor costs.

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TABLE 11: SPSA SUMMARY OF SERVICES AND FACILITIES

Solid Waste Services and Facilities	Service Provider A=Agency C=Contract	Tonnage Managed (FY 1994-95)	Comments
Source Reduction and Recycling Outreach	A	N/A	Offers a classroom-based environmental education program.
Drop-Off Recycling	A and C	2,080	Provides more than 35 drop-off locations in the region and delivers recyclables to a private recycling facility.
Curbside Recycling	A and C	11,000	Provides voluntary curbside recycling collection to 148,800 households and delivers recyclables to a private recycling facility.
HHW	A	4,133	Provides drop-off sites for HHW at transfer stations, the landfill, and the RDF plant.
Yard Trimmings Mulching and Composting	A	N/A	Operates yard trimmings mulching facility; all yard trimmings materials are initially processed at this site. A yard trimmings composting facility is located at the regional landfill. Approximately 40,000 cubic yards of mulch and compost are produced annually.
RFD Plant	A	516,172	Operates an RDF plant on Navy land. Contracts with the Navy to supply at least 25,000 tons of RDF per month. A bulky waste shedder was recently installed to increase throughput.
Power Plant	A	367,055	Owned by the Navy but operated by SPSA. Fueled by RDF from SPSA's plant. Provides steam and electricity for the Navy.
Transfer Station	A	531,754	Operates eight transfer stations in its service area.
Regional Landfill	A	392,361	Owns and operates regional landfill that was opened in 1985; only loads of waste that cannot be processed at the RDF plant are landfilled (primarily bulky items and construction and demolition materials). Development of new cells currently underway will meet SPSA's need for landfilling through 2015.
Virginia Beach Landfill	C	179,442	Contracts with Virginia Beach for disposal of RDF residue and power plant ash.
Tire Shredder	C	N/A	Shreds car tires and uses them for fuel at the power plant; truck tires are sold to be used as feedstock in the manufacture of industrial equipment tires. Approximately 260,000 tires are processed annually. Operation is contracted to the private sector.
Ferrous Metals Recovery Facility	C	11,000	Cleans and processes ferrous metals extracted from the feedstock at the RDF plant. Operation is contracted to the private sector.

TABLE 12: SPSA ANALYSIS OF FULL COST: TRANSFER STATIONS, LANDFILLS, AND PLANTS

FULL COST	Regional Landfill	Norfolk Transfer	Chesapeake Transfer	Franklin Transfer	Ivor Transfer	Boykins Transfer	Isle Of Wight Transfer	Oceana Transfer	Landstown Transfer	RDF Plant	Power Plant	Virginia Beach Landfill	**Total**
Direct Cost													
Operating Cost	$1,368,528	$482,788	$259,549	$95,414	$4,958	$28,271	$98,418	$214,656	$360,495	$4,205,364	$11,326,420	$1,674,350	$20,119,211
Maintenance Shop	$41,953	$11,642	$4,875	$683	$0	$0	$1,162	$6,151	$8,327	$39,048	$0	$0	$113,841
Transportation Cost	$20,735	$1,122,034	$410,069	$246,667	$10,757	$12,119	$188,407	$568,595	$837,105	$539,285	$531,016	$114,160	$4,600,949
Subtotal	**$1,431,216**	**$1,616,464**	**$674,493**	**$342,764**	**$15,715**	**$40,390**	**$287,987**	**$789,402**	**$1,205,927**	**$4,783,697**	**$11,857,436**	**$1,788,510**	**$24,834,001**
Indirect Cost													
Transportation	$12,578	$680,613	$248,743	$149,626	$6,526	$7,352	$114,286	$344,904	$507,780	$327,125	$322,109	$69,249	$2,790,891
Maintenance Shop	$47,898	$13,291	$5,566	$781	$0	$0	$1,327	$7,023	$9,507	$44,581	$0	$0	$129,974
Environmental Management	$386,229	$39,972	$21,300	$5,690	$424	$573	$4,674	$20,925	$20,575	$366,793	$0	$0	$867,155
Administrative Cost	$148,431	$70,372	$37,602	$13,260	$0	$4,450	$13,139	$30,887	$52,517	$377,130	$726,999	$0	$1,474,787
Debt Service	$5,182,378	$867,512	$279,858	$149,406	$34,148	$54,680	$121,135	$269,205	$650,654	$7,163,818	$2,097,221	$844,380	$17,714,395
Subtotal	**$5,777,514**	**$1,671,760**	**$593,069**	**$318,763**	**$41,098**	**$67,055**	**$254,561**	**$672,944**	**$1,241,033**	**$8,279,447**	**$3,146,329**	**$913,629**	**$22,977,202**
TOTAL (Direct and Indirect)	$7,208,730	$3,288,224	$1,267,562	$661,527	$56,813	$107,445	$542,548	$1,462,346	$2,446,960	$13,063,144	$15,003,765	$2,702,139	$47,811,203

TABLE 13: SPSA ANALYSIS OF FULL COST: DIVERSION SERVICES AND FACILITIES

Full Costs	Curbside Recycling Collection	Tire Shredder Contractor	Ferrous Metals System	Compost Facility	Yard Waste Facility	Other Recycling Collection	Total From Previous Table	Grand Total
Direct Cost								
Operating Cost	$2,008,437	$321,728	$0	$254,293	$365,116	$75,130	$20,119,211	$23,143,915
Maintenance Shop	$123,565	$7,165	$0	$9,728	$30,380	$26,397	$113,841	$311,076
Transportation Cost	$0	$48,891	$41,567	$99,097	$92,382		$4,600,949	$4,882,886
Subtotal	**$2,132,002**	**$377,784**	**$41,567**	**$363,118**	**$487,878**	**$101,527**	**$24,834,001**	**$28,337,877**
Indirect Cost								
Transportation	$0	$29,657	$25,214	$60,111	$56,040	$0	$2,790,891	$2,961,913
Environmental Management	$6,350	$550	$250	$200	$640	$625	$867,155	$875,770
Maintenance Shop	$149,826	$8,180	$0	$11,106	$34,684	$21,385	$129,974	$355,155
Administrative Cost	$359,417	$14,785	$14,285	$38,557	$61,088	$39,935	$1,474,787	$2,002,854
Debt Service	$765,284	$94,755	$205,591	$2,892	$249,812	$42,383	$17,714,395	$19,075,112
Subtotal	**$1,280,877**	**$147,928**	**$245,341**	**$112,867**	**$402,265**	**$104,328**	**$22,977,202**	**$25,270,808**
Total (Direct and Indirect)	$3,412,879	$525,712	$286,908	$475,985	$890,143	$205,855	$47,811,203	$53,608,685

7. City of San Diego, California
Environmental Services Department

INTRODUCTION

FCA practices emerged over time in San Diego Environmental Services Department (ESD) as part of the city's routine budgeting and planning activities. Today, FCA principles are reflected in many of ESD's business practices. For example, ESD's use of lease/purchase arrangements allows the city to recover the cost of vehicles over their useful life, and to minimize cash accounting (i.e., recognizing the full vehicle cost at the time of purchase). ESD also uses FCA when analyzing solid waste services provided by city employees and its contractors. To ensure that its services are compared on an "apples-to-apples" basis, ESD uses FCA to identify all of the costs associated with providing solid waste services. Such comparisons provide a credible, publicly defensible basis for ESD's choices between contracting for services and providing them itself.

ESD also uses FCA as a framework to analyze issues of particular importance. When considering whether to implement an automated trash collection system, for example, ESD used FCA to determine the cost savings it could achieve as a result. The findings of this analysis provided the impetus the department needed to make the switch from manual collection.

BACKGROUND

The city of San Diego, located in southern California, has the sixth largest population in the country. In the 1990s, the city grew about 1 percent annually. The city's demographic characteristics are summarized in the text box at right.

ESD provides refuse collection and disposal services to all single-family residences, and to some small businesses and multifamily residences. Curbside recycling and yard waste collection services are provided to a portion of the city's residents. Drop-off household hazardous waste collection events and recycling opportunities are provided for all residents. ESD also operates a landfill and a mulching site (see Table 14 on page 48 for details on ESD services and facilities). Although ESD uses contractors to provide some of its services, the two core waste management activities—residential trash collection and landfill operation—are both performed by the department. ESD has a staff of 471 employees, with the majority employed in field or operational positions.

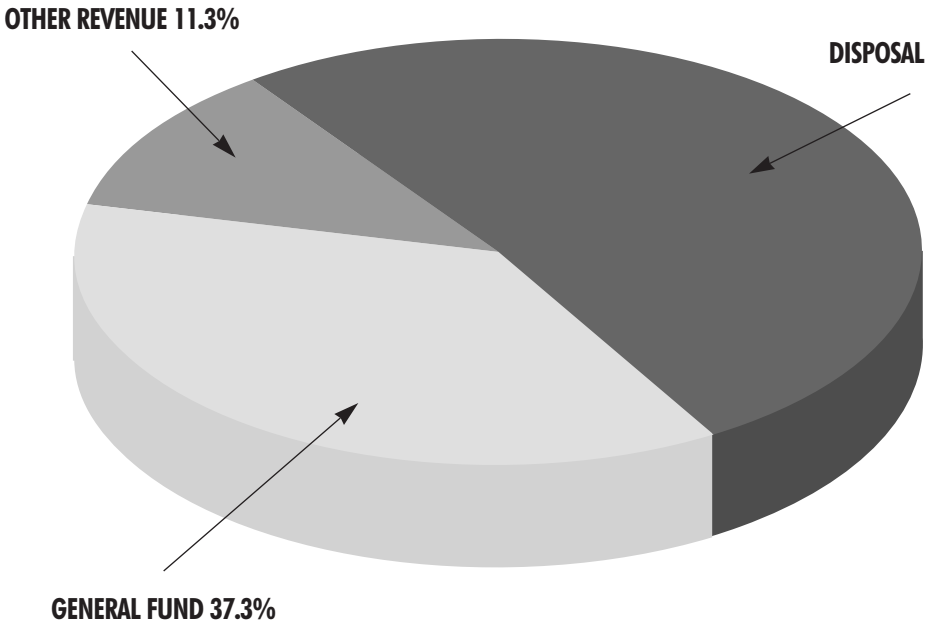
Demographic Characteristics City of San Diego, California

Population (1990)	1,110,549
Area (square miles)	331
Density (persons per square mile)	3,355
Households	406,096
Household Income (1989 $)	$33,686
Housing in 1- to 4-unit structures	65%

ESD's total FY 1998 budget is approximately $71.1 million. This includes $7.9 million for capital improvements, and approximately $63.2 million for operating expenses and equipment. Refuse collection is by far the largest budget category, accounting for a total of $33.1 million out of the total of $71.1 million, or about 47 percent.

ESD is funded by the Refuse Disposal Enterprise Fund, which receives revenues primarily from landfill tip fees, the city's General Fund, and other smaller sources of revenue (i.e., fund balance). Figure 6 on page 43 provides a breakdown of sources of revenue for the ESD.

FIGURE 6: ESD SOURCES OF REVENUE (FY 1998) (REVENUE REQUIREMENT = $71.1 MILLION)



FCA IN SAN DIEGO

For San Diego, FCA does not have a fixed scope or focus. ESD uses FCA on an "as-needed" basis in studies of issues of particular importance. ESD has a process for conducting these studies, using a combination of information reported from the Financial Management Department's Budget System, the AMRIS software system (see text box at right), and other data it processes manually to complete its analyses of the issue in question. The analysis of automated collection presented in the next section illustrates this process.

The FCA principle of accounting for costs rather than outlays is reflected in certain ESD accrual basis business practices, such as the department's use of lease-purchase agreements to match cost recovery as closely as possible to equipment lifetimes. When a significant number of additional vehicles are required, or vehicle purchase expense is significant, the city often uses a lease/purchase arrangement for acquisition. For

AMRIS Job Order System

AMRIS (the Accounting and Management Resource Information System), administered by the Auditor and Comptroller, is the city of San Diego's overall financial accounting system. The AMRIS software package can allocate appropriate fringe benefits and proportions of supplies, services, mileage, equipment, rental, energy/utilities, and overhead to a specific user-defined activity, through what is referred to as a "job order." Job orders allow ESD to flexibly define cost centers and to analyze them. ESD uses the job order system to help identify the full costs of services provided by ESD, and to determine fixed fees and charges to recover these costs where appropriate. For example, job order information is used to charge other city departments for services provided by the Environmental Services Department.

other motor vehicles, the city sets up a reserve or sinking fund. These funds are designed to accumulate the cost of replacement equipment (if applicable) over a predetermined number of years. In this way ESD spreads the cost of the equipment over its useful life, and has money available to pay for replacements. While cash accounting for vehicle purchases (i.e., recognizing the full vehicle cost at the time of purchase) cannot be completely avoided, these two procedures minimize its use.

FCA IN ACTION: AUTOMATED REFUSE COLLECTION

The city of San Diego has provided municipal refuse collection services to single family residences, small multifamily residences and small businesses since 1919 when voters initiated and approved a "People's Ordinance" which mandated this service at no additional fee to citizens. Because of the risky and physically challenging nature of the work, the risk of injury to the collection workforce has always been a major concern. To address this concern, in 1989, an initial study was conducted to evaluate the feasibility of implementing an automated refuse collection system. The initial study showed significant savings due to reduced equipment and staffing needs as well as decreased injuries and accidents. The initial study recommended a pilot program to collect data on the feasibility and cost-effectiveness of an automated refuse collection system. The pilot began in 1992 with 1,400 homes. It was expanded to include an additional 700 homes in 1993. Results from the pilot confirmed that automation increases staff productivity and decreases injuries.

Initially, a primary obstacle to automation was the cost. Automated collection would require more expensive trucks and specialized containers. Since the city cannot charge citizens for trash collection, the entire cost of the conversion would have to come from the city's General Fund. To make things worse, the recession was beginning to seriously affect city revenues. As a result, the city began to investigate the potential for lease/purchase arrangements. An FCA-based study was designed to determine if a reduced workforce together with reduced injury-related costs would offset the additional costs associated with leasing automated equipment.

The study began by identifying the scope for automated collection in San Diego. Automated collection would not be practical for the high-density, narrow streets along the beach (Mission Beach) and hard-to-collect areas on steep hills or dead-end streets. Apart from these areas, 95 percent of all city refuse stops could be collected using the automated process. Next, to maximize the efficiency of automated collection, equipment had to be fully utilized. Under the manual system, once an assigned route was collected the work day was considered complete. With automated collection, crews were not limited by fatigue and so could work a full 8 hours. Based on these assumptions, the costs and staffing requirements for each collection option were analyzed.

Key results from the study are shown in the text box on page 45. With automated collection, by 1999 the fleet would be 102 rather than the 126 vehicles, reducing the number of drivers

AUTOMATED REFUSE COLLECTION

Automated refuse collection involves a sanitation truck driver manipulating a hydraulically powered arm to pick up containers specifically designed to be used in the automated collection process. While remaining in the cab, the driver is able to lift the container, empty it into the truck, place the container back on the ground, and then drive to the next stop to repeat the process. Automated collection eliminates the need for sanitation workers to lift refuse cans.

Residents receiving automated collection services are provided with a single container constructed of a durable polyethylene material. These containers have wheels for ease of movement and attached lids that help prevent odor and restrict litter problems. The normal life span of these containers is 10 years. The standard container has a 96-gallon capacity, equal to three standard trash cans. Residents requiring a smaller container can select optional 64- or 32-gallon containers.

Comparison of Manual and Automated Collection for San Diego

Cumulative Impact: 1994-2004	Manual	Automated
Collection Costs:		
Hard-to-Collect	$59,582,177	$58,118,335
Rest of City	$122,886,781	$89,046,394
Subtotal	$182,468,958	$147,164,729
Light Duty Over Budget	$5,011,258	$1,144,466
Container Lease Costs	-0-	$21,036,000
Total Expenditures	$187,480,216	$169,345,195
Risk Management Savings	-0-	-$4,398,650
Grand Total	**$187,480,216**	**$164,946,545**
Annual Level	**$17,052,747**	**$14,999,686**

and supervisors by 71. Over the 1994-2004 period, the city could save about $22.6 million; approximately $18.8 million from reduced budget expenditures, plus an additional $3.8 million from reduced "light duty" costs, a hidden cost of the manual operation incurred when injured workers need to be reassigned less strenuous work loads.

Use of FCA entered into the refined study in a number of ways related primarily to indirect and overhead costs:

- Reductions in staff levels reduced both wages and benefits, each of which contribute substantially to labor costs.
- Use of automated collection led to reduced requirements for "light duty" for injured workers, which typically involves less efficient use of personnel.
- Use of automation reduced the risk of serious injury, and the associated cost of risk management (e.g., insurance, workers' compensation, etc.).

The last two points, which would be exceedingly difficult to quantify without a thorough FCA approach, contributed a total of about $8.3 million out of total savings of $22.6 million.

The results of this study were published in the City Manager's report of November 2, 1993. San Diego's decision to automate collection was based largely on these results. Since the adoption of automated collection, ESD has used FCA to analyze the automation of yard trimmings and recycling collection. ESD is currently considering an arrangement in which the same truck would be used to collect yard trimmings, co-mingled recyclables, and trash on a bi-weekly schedule. As in the study of automated trash collection, FCA allowed ESD to account fully for all the costs and benefits of the innovative collection system under consideration.

LESSONS LEARNED

San Diego has long used FCA to address planning and performance issues related to the solid waste services it offers. Based on its experience with FCA, San Diego has learned a number of useful lessons:

- *Developing appropriate accounting systems can foster the application of FCA.* Development of AMRIS and its job order system has facilitated ESD's use of FCA.
- *Careful accounting of indirect and overhead costs can substantially affect the comparative economics of solid waste management options.* Including reduced light duty costs as well as savings on risk management costs had a substantial impact on San Diego's assessment of automated refuse collection.
- *FCA can help solid waste management agencies function in an increasingly competitive solid waste industry.* In principle, private companies could supply collection and disposal services of the type provided by ESD. To remain competitive, ESD's services must

be cost-effective. ESD uses FCA to ensure that the costs of its services are compared to others' on an "apples-to-apples" basis.

- *Application of FCA is dependent on the type of project being considered.* FCA is not appropriate for every routine planning and operational decision that solid waste management agencies face. When major decisions arise, however, or when a need emerges for a "big picture" understanding of future opportunities and challenges, FCA can be an essential tool.

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TABLE 14: SUMMARY OF SERVICES AND FACILITIES IN SAN DIEGO

Solid Waste Services and Facilities	Service Provider A=Agency C=Contract	Tonnage Managed	Comments
Source Reduction/ RecyclingOutreach	A and C	N/A	ESD promotes residential waste minimization through several initiatives, including a home composting program and contracted public education programs. It also provides technical assistance to city departments, businesses, apartment complexes, and local military bases.
Drop-Off Recycling	A and C	1,000	ESD funds drop-off recycling through 48 park and recreation centers throughout the city. The drop-offs are unstaffed, and both ESD and contractors provide collection. Revenue gained from the sale of materials is returned to the park and recreation centers. ESD also contracts out operation of the Miramar Buy Back Center.
Curbside Recycling	A and C	24,000	Recyclables are collected weekly from roughly 82,000 single family households. ESD provides collection for approximately half of them, while a private company is contracted with to collect material from the other half. Material is taken to private processing centers.
Yard Trimmings Collection	A	N/A	Yard trimmings are collected weekly from roughly 150,000 households. Material is taken to the Greenery at the Miramar Landfill to be mulched.
HHW	A and C	200	Eight HHW collection events are held annually, the operations of which are contracted to a private company. Residents can also bring used oil, antifreeze, batteries, and oil filters to city-run recycling events held throughout the year. ESD also has a "graffiti exchange bank" to use paint collected to cover over graffiti in the city.
Bulky Item Collection	A and C	N/A	Twenty-four community cleanups are conducted annually. Residents can dispose of bulky items at this event. ESD also has a contract with a private organization that requires it to hold 35 cleanups. The Miramar Buy Back Center also accepts some bulky items.
Residential Trash Collection	A	314,000	The city provides weekly collection from 293,000 1- to 5-household structures located on public right-of-ways. Gated communities (on private streets) are excluded, as well as some multifamily units electing to use their own collection service. The vast majority of refuse is brought to Miramar Landfill, although about 8,000 tons per year go to other landfills to increase route efficiency.

<continued>

TABLE 14: SUMMARY OF SERVICES AND FACILITIES IN SAN DIEGO (CONTINUED)

Solid Waste Services and Facilities	Service Provider A=Agency C=Contract	Tonnage Managed	Comments
Government Recycling	C	222	More than 106 city offices participate in a paper and container recycling program that is operated by a contractor (currently at no charge to the city).
Commercial Trash Collection	A	N/A	ESD collects from approximately 7,000 small businesses. The tonnage handled from this program is included in the figure noted for Residential Collection.
Other SWM Services	A	N/A	These services include abatement of illegal dumping, litter, and undesired vegetation from public properties; public receptacle collection; dead animal collection; and enforcement of the solid waste provisions of the Municipal Code.
Mulching Facilities	A	84,000	The "Greenery" mulching facility handles yard trimmings from the curbside program as well as drop-off materials from residents and local landscapers. In addition, ESD has an annual Christmas tree recycling initiative, which encourages residents to drop off their trees at one of more than two dozen locations around the city.
Landfill	A	1,400,000	The city operates the Miramar Landfill, which is situated on Navy property and owned by the Navy. As part of the lease agreement, the Navy pays no tip fee for the waste it disposes of. The landfill handles most (86 percent) of the city's waste and some waste from outside the city.
Miscellaneous Services	A	N/A	ESD runs several programs for other city facilities. They include lead, asbestos, and hazardous materials technical support and management, and underground storage tank management.

8. Full Cost Accounting Glossary

Accrual basis accounting focuses on identifying the cost (dollar value) of resources as they are used. In order to match costs to resource use, accrual accounting spreads costs over the useful life of a resource using depreciation and/or amortization techniques.

Amortization is a method of determining the annual costs associated with obligations for future outlays. Landfill closure and postclosure costs, for example, are often amortized over the operating life of the landfill.

Back-end costs include expenditures to properly wrap-up operations and take proper care of landfills and other municipal solid waste facilities at the end of their useful lives; the costs of post-employment health and retirement benefits for municipal solid waste workers also fall in this category.

Capital outlay means an outlay of cash to acquire a resource that will be used in MSW operations over more than 1 year. If a community pays $500,000 for a collection fleet in a given year, for example, this would represent a capital outlay. Capital outlays (past, present, and future) must be converted into annual costs for full cost accounting purposes.

Capital replacement funds are established to ensure that sufficient cash reserves are available to replace long-term capital equipment.

Cash flow accounting, also known as cash basis accounting or general fund accounting, is a system where cash outlays are recorded as they are actually paid out for goods and services.

Cost means the dollar value of resources used for municipal solid waste management. Techniques such as depreciation are often used to convert capital outlays into annual costs. Assume that an outlay of $500,000 is made for a collection fleet that is in use for 7 years, for example. Using straight-line depreciation, accrual accounting systems would assign an annual cost for the fleet of about $71,429 over the life of the collection fleet.

Cost center is any solid waste management activity that receives separate attention through an account or group of accounts.

Debt service costs are annual expenses incurred to pay back interest and principle on a loan.

Depreciation is a method of allocating the costs of capital outlays over the useful life of the resource, which is the period of time during which the resource is expected to provide services.

Direct costs are costs that are clearly and exclusively associated with solid waste management.

Enterprise funds are financial mechanisms used by local governments to finance and operate a given activity like a private business. Agencies that use enterprise funds usually must collect sufficient revenues to cover the full cost of agency operations and services provided.

Fixed costs include interest, depreciation, and amortization for past or future landfill capital outlays and other costs (e.g., security) that cannot be reduced quickly in response to lower waste tonnage.

Flow controls are legal authorities used by state and local governments that require that waste from a defined geographic area be delivered to a specific processing, treatment, or disposal facility.

Full cost accounting is a systematic approach for identifying, summing, and reporting the actual costs of solid waste management, taking into account past and future outlays, oversight and support service (overhead) costs, and operating costs.

Future outlay means an expenditure of cash in the future that is obligated by current or prior activities.

General fund accounting — see cash flow accounting.

Hidden costs are the dollar value of activities or resources that appear to be free (i.e., no cash outlay is made. For example, many small towns have been deeded their landfills by former owners. Reqardless of how it was acquired, the landfill (asset) still has value, which is consumed over time with use. Thus, there is a cost even where there has been no outlay.

Indirect costs are costs that are not exclusively related to solid waste management but that relate to more than one local government activity. Such indirect costs for solid waste management (and other local government activities) can include accounting and payroll, personnel, legal, purchasing, data processing, records management, and executive oversight (e.g., the mayor's salary and office expenses).

Integrated solid waste management incorporates several different approaches for handling the entire municipal solid waste stream. Using a combination of approaches allows each type of waste to be managed according to environmental and economic considerations, with priority going to source reduction, reuse, and recycling, while reserving landfills as the least desirable waste management method. See also waste management hierarchy.

Net cost per household indicates the amount of service fees and assessments that must be collected on average from each household to pay for the full costs of solid waste management, after taking into account any byproduct revenues. The net cost per household equals the net costs per year divided by total households served.

Net cost per ton is the best common denominator for comparing the current costs of solid waste management activities within or across local government jurisdictions.

Operating costs are regularly recurring costs of resources that are used over a relatively short period of time (i.e., less than 1 year) in order to support ongoing municipal solid waste operations.

Outlay is an expenditure of cash. See capital outlay for more details.

Overhead costs are the management and support costs of running a solid waste program. Overhead costs might include legal services, administration, data processing, billing, and purchasing.

Routine cash outlays for solid waste management activities are the same as the operating costs of those activities.

Service revenues are derived from fees charged for the amount of municipal solid waste services used, such as unit pricing for solid waste collection and tipping fees for waste disposal.

Unit pricing charges solid waste generators (e.g., primarily households) based on how much they throw away. Also called variable rate pricing and pay as you throw.

Up-front costs reflect the initial investments and expenses necessary to start a municipal solid waste activity. Up-front costs could include permitting, education, and initial capital outlays for capital equipment and facilities.

Variable costs are regularly recurring operating expenditures for MSW operations that can be reduced quickly in response to changes in service levels.

Waste management hierarchy emphasizes a preferred order of management approaches: source reduction (including reuse), recycling (including composting), and waste combustion with energy recovery and landfilling.

For More Information on the Case Studies

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For More Information on Full Cost Accounting

EPA published several other documents about FCA for solid waste managers. Free copies of the following documents are available from the RCRA Hotline. To order, call 800 424-9346 or TDD 800 553-7672. In the Washington, DC, area, call 703 412-9810 or TDD 703 412-3323.

- *Full Cost Accounting for Municipal Solid Waste: A Handbook (EPA530-R-95-041).* This document describes the key concepts and benefits of FCA. It explains many of the financial terms used in FCA and the specific costs that are considered. While the handbook is not a step-by-step "how-to" document, it does describe the steps involved with implementing FCA for solid waste management. It is a comprehensive overview and a valuable resource for local governments.
- *Making Solid (Waste) Decisions With Full Cost Accounting (EPA530-K-96-001).* This document is a short primer that explains the basic concepts of FCA. It provides a summary of the benefits, challenges, and uses of FCA, as well as five short case examples about agencies that have used FCA successfully.
- *Questions and Answers About Full Cost Accounting (EPA530-F-98-003).* This 15-page booklet features some of the questions and answers discussed during the 1996 nationwide, interactive satellite forum on FCA, "Planning, Pricing, and Performance: The Business of Solid Waste Management." The forum featured a panel of four local government solid waste managers and one policy analyst who spoke about their experiences using FCA.

In addition, check EPA's Web site for more FCA information: <www.epa.gov/fullcost>.

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