Measuring Waste Prevention in New York City

[With Foreword to the Waste Prevention Report Series]

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Spring 2000

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Foreword to Report Series

Background and Objectives

This Foreword accompanies a series of reports issued by the NYC Department of Sanitation (DOS), Bureau of Waste Prevention, Reuse and Recycling (BWPRR), at the conclusion of its sponsorship of two substantial waste prevention and recycling research consultant projects.

These are the Waste Prevention and Recycled Product Research Project (the "Research Project") and the Business Waste Prevention Assessment and Waste Prevention Programs ("NYC WasteLe$$"). The Research Project was a multi-task study designed to measure the impact of ongoing and new waste prevention programs. It was also intended to develop and improve certain waste prevention programs, promote recycling and the purchase of goods containing recycled material, and examine strategies that might warrant the attention of City agencies (under the name *NYCitySen$e*). *NYC WasteLe$$* was a technical assistance program to provide waste prevention consulting services to businesses and institutions in nine economic sectors in New York City. In addition to involving some of the same parties, the two projects are related in that NYC WasteLe$$ was one of the programs that the Research Project measured.

Project Work Reports

The written reports from each project are as follows (*[B]* indicates background report):

Research Project Reports:

- *Measuring Waste Prevention in New York City*
- *Survey of Waste Prevention Programs in Major Cities, States and Countries [B]*
- *Procurement Strategies Pursued by Federal Agencies and Jurisdictions Beyond NYC for Waste Prevention and Recycled Products [B]*
- *Inter-Agency Task Force Action Plan to Encourage the Use of Recycled-Content Building Materials*
- *Characterization of NYC's Solid Waste Stream [B]*
- *Materials Exchange Research Report [B]*
- *Life Span Costing Analysis Case Studies [B]*
- *Packaging Restrictions Research: Targeting Packaging for Reduction, Reuse and Recycled Content [B]*
- *NYCitySen$e Summary Report*
- *NYC WasteLe$$ Summary Report*

The projects also resulted in other work products. The Research Project convened seminars, conducted purchasing training for relevant staff from NYC government agencies, and is developing a waste prevention and enhanced recycling guide for the agencies. Some of its participants took part in roundtables on materials exchange programs and strategies and on packaging legislation

The WasteLe$$ Project provided extensive technical assistance to the specific participating businesses and organizations and conducted outreach, distributing sector-specific information through newsletters, a video, seminars and a NYC WasteLe$$ website, accessible at http://www.nycwasteless.com. The website presents the full record of project experiences and case studies of successful initiatives. It includes cost/benefit information for particular programs and links to related sites.

Waste Prevention Defined

Waste prevention means eliminating or reducing the amount or the toxicity of waste, including recyclables. For businesses, government agencies, and other organizations, it includes processes that:

- Conserve supplies and inventory
- Eliminate, reduce, and reuse products and packaging
- Deploy waste-reducing technology and equipment
- Use more durable, reusable, repairable, and less toxic products and packaging
- Leave grass clippings on the lawn to naturally decompose, and reduce disposal of food and yard waste including through on-site composting
- And other less wasteful practices.

For residents, waste prevention also includes: buying products with the least amount of packaging; buying only the amount of a product that is needed; buying less harmful products; and reusing, donating or repairing items that might otherwise be discarded or recycled.

Waste Prevention Without Rose-Colored Glasses

In the late 1980s and early 1990s, 'waste prevention' captured the imagination. Many localities, New York City included, were looking for waste disposal options that were preferable to incineration or to dumping in old, sub-standard landfills. Recycling was beginning to grow as one way to manage waste that was produced. Imagine how much better it would be to *prevent* waste – waste prevented would not have to be managed at all! Unnecessary packaging, take-out food containers, single-use cameras, any single-service item, disposable batteries, catalogues – probably anyone could make a list of products that seemed reasonable targets for achieving measurable waste prevention. New York State adopted a goal of 8% to 10% waste prevention from 1998 levels, and the US Environmental Protection Agency put waste prevention at the top of a hierarchy of methods to handle waste. Hence the order of 'reduce, reuse, recycle.'

New York City's 1992 Solid Waste Management Plan (SWMP) estimated that programs to prevent waste might reduce the waste stream by 7% to 8% between 1990 and 2000, while warning about "...the speculative character of these estimates."[1] The estimates were based on a series of tentative assumptions about the possible impacts of four groups of policies or factors:

(1) advanced disposal fees (ADFs), which are charges at the time of purchase (wholesale or retail) to cover disposal costs of particular products, like tires or consumer electronics;

(2) quantity-based user fees (QBUFs), which are charges for waste generation;

(3) regional or national packaging protocols; and

(4) material-specific factors (such as two-sided copying of paper and changes in packaging practices).

The first, third, and part of the fourth groups require regional or national action; the rest can be local. The tentativeness of the conclusions cannot be overemphasized, and the consultants who prepared them warned, "We are especially concerned that the figures do not take on a life of their own in light of the weakeness *(sic)* of the underlying data."[2]

It was in this atmosphere that the Department of Sanitation undertook the Research and NYC WasteLe$$ projects, confronting the central questions in this field. What kind of waste prevention can be achieved in the home and the workplace? Can it be measured? If not, how can it be evaluated, and on what basis should public dollars be allocated to it? And if so, are amounts achievable significant? Furthermore, what does it mean to prevent waste in a growth- oriented market economy? What parties have an interest in preventing waste, and what parties have a responsibility to do so?

The totality of these reports have answered, for the Department, some of these questions. With respect to measurement, there is something of an Alice-in-Wonderland quality of quantifying *something that does not happen*. The consultant's discussion of methodology in ***Measuring Waste Prevention in New York City*** is a clear review of this problem and the various approaches to measurement. The many case studies in that report, and in ***Life Span Costing Analysis Case Studies*** and the ***NYC WasteLe$$ Summary Report***, apply ways of measuring waste prevented for particular processes, waste generators, or product choices. For waste prevention programs, it turns out that only some have outcomes that can be measured clearly. Others have impacts too diffuse or non-specific to track with reasonable costs. Still others showed considerable uncertainty about amounts of waste potentially saved. (See, for example, program descriptions of the Department's hotel waste prevention guide, and the NY Stuff Exchange.) Still other programs will have impacts over time, but at rates that cannot be predicted well (for example, paper saving through electronic information systems and the purchase of double-sided copiers when older copiers are replaced). Thus, aggregate measures of waste prevention become a mix of likely and uncertain measures. They provide a basis for comparing programs but are not operationally reliable enough to apply to the tangible solid waste management system as a whole.

These challenges and limitations may shed light on why the NY State Solid Waste Management Plan suggests that waste prevention initiatives focus on implementation, rather than measurement. The 1997/98 Update to that plan says,

> New York State's goal of 8-10% waste reduction by 1997 and waste reduction's position of highest priority in the State solid waste management policy have been the chief impetus for efforts to reduce dependence on disposal options. Many New York State, local government and private sector efforts have reduced the amount of waste being produced and contributed toward achieving the waste reduction goal.
>
> Progress toward the 8-10% goal has not been measured, because it is extremely difficult to quantify waste reduction achieved. This is largely due to inaccuracies and gaps in data, especially data from the base year 1987 and the years immediately following it. Much thought has been given as to how to quantify waste reduction, but all approaches have fallen short of accurately measuring aggregate waste reduction in the State.

As to amounts of waste preventable, the reports do not suggest a near-term potential to prevent a sizable portion of the waste stream. For households, the programs that could be measured with relative certainty had benefits that were relatively small. (See, for example, program descriptions of work with take-out restaurants and dry cleaners in the ***Measurement*** report.) In the public sector, product and agency reviews have contributed ideas for improvements in purchasing and contracting, and even some ideas for improved recycling (***Life Span Case Studies*** and ***NYCitySen$e Summary Report***), but do not suggest great waste stream reductions. And in the private sector, success stories are mixed with difficulties getting businesses to participate sufficiently and to spend resources on waste prevention documentation, even when offered free waste prevention technical assistance (the ***NYC WasteLe$$ Summary Report***). Under 'lessons learned,' this report states, "Solid waste planners, and business people, must not set themselves up for disappointment by thinking that massive cost savings achieved through waste prevention are realistic expectations." Rather, it suggests that working hard at waste prevention should bring incremental change.[3]

To be against waste and to advocate consumption patterns that generate less waste are roles that are intuitively appealing. And on an *a priori* basis, it might have seemed as if there would be countless ways to reduce waste and save money at the same time. But in reviewing the many waste prevention efforts the Department has supported in all sectors and documented in these studies, readers will discover that intentional wastefulness is not generally the norm. Individuals, businesses, and institutions have tended to put in place processes that reduce waste relative to some other process, and that are not more costly, although they may not be labeled waste prevention. The consultant review of this Department, for example, found anti-freeze recycling, extended preventative maintenance schedules, and tire recapping. These are established processes that prevent waste, but have not been documented as such. Operating units do not have baseline measures of what particular wastes 'used to be,' and may not wish to spend labor resources to estimate quantities of something already being done.

In the examples just described, waste-preventing considerations were part of the normal set of considerations in making purchasing and consumption decisions. This is not to say that they

are always taken into account or that they are the overriding considerations. But it is to say that costless waste prevention opportunities generally are not waiting to be seized. As an example, the same Departmental review that found some waste-preventing programs in place also found a waste prevention opportunity to purchase a concentrated soap had been passed by because it had a higher initial cost than its alternative. In this case, institutional changes in single-year budgeting are required, in turn complicating fiscal review procedures.

The corollary to the fact that processes that make sense are likely already to be enacted is that waste prevention processes *not* put in place require spending other resources – labor, money, time, and/or space – to carry out and/or to document. Consider the example of replacing disposable tableware with dishwashers; it requires buying the dishwashers, buying dishes, using staff time, water and electricity. In New York's fast-paced, complex and high overhead environment, managers of public and private entities face a host of priorities that compete for these other resources, and make their own cost evaluations about such trade-offs. Organizations and businesses are not generally irrational when it comes to waste prevention. Rather, in allocating resources; they tend to reduce waste where doing so saves money and does not impinge on their regular business or service delivery.

The Department continues to fund the programs appropriate to its mission that have the largest actual or potential waste prevention benefits accruing to the public. These are material reuse and exchange programs, and ongoing waste prevention advocacy in various forms. New York City Agencies are reviewing certain purchases and practices, as described in the ***NYCitySen$e Summary Report***, and the City is also looking at contracting and purchasing adjustments that could be made to allow for fuller consideration of waste prevention considerations.

Other initiatives are beyond the scope of any sanitation department acting on its own, even one the size of the New York City Department of Sanitation. Whether at the local, state, or federal level, broad public expression of support for the cost, resource, and product trade-offs that can contribute to preventing waste would be necessary, through support for the kinds of policies mentioned above. These include ADFs, QBUFs, and such requirements as grass bans and manufacturer take-backs. QBUFs (charging waste generators based on the amount of trash they discard) and grass bans are really major changes in service. To be successfully administered in a democratic system, they require broad public support; but to date there has been only limited public enthusiasm for charging City institutions for waste generation and banning the collection of grass. ADFs must be at least regional, and preferably national; take-backs require national legislation that would make manufacturers bear a greater responsibility for reducing product and packaging waste.

Finally, in a consumer-oriented market economy, the Sanitation Department, charged with moving thousands of tons of material off the streets each day, is obliged to question how likely it is that waste prevention in one sphere will mean reduced amounts of waste overall. If waste prevention does indeed save money, what will businesses, organizations, and individuals do with their added resources? Isn't additional spending likely to generate additional waste? These are not questions to be answered here, but to be kept in mind as these reports are read.

Acknowledgments: Contractor and Project Partners

The contractor, Science Applications International Corporation (SAIC), was separately awarded each contract as a result of a competitive proposal process conducted in accordance with New York City's Procurement Policy Board Rules. Funding for some portions of the work on these projects was awarded by the U.S. EPA Region 2, NY State Department of Environmental Conservation, and NY State Energy Research and Development Authority.

To perform the contracted work, SAIC utilized experienced staff from its Newport, Rhode Island and Albany, New York offices. SAIC also subcontracted work to local consultants, consultants who have worked extensively in New York City, and others who possessed substantial knowledge and experience appropriate to perform or assist portions of the project work. These include Cornell Waste Management Institute (CWMI), Council on the Environment of New York City (CENYC), Franklin Associates, Hammer Environmental Consulting, INFORM, Konheim & Ketcham, Tellus Institute, The Writing Company, and Waste Tech. CWMI was particularly helpful in planning the Research Project roundtables.

The involvement of the Mayor's Office of Operations was an important component in developing and implementing the NYCitySen$e project that was launched through the Research Project. Various agencies and organizations, within and beyond New York City, also were helpful.

The NYC Solid Waste Advisory Board's Waste Prevention Committee assisted in the selection of items focused on in the product-specific waste composition study conducted under the Research Project. SWAB representatives were invited to participate in the interactive roundtables facilitated by Cornell Waste Management Institute. The Recycled Content Building Material Action Plan reflects the input of agency reviewers.

In implementing the NYC WasteLe$$ research and demonstration project, in addition to utilizing subcontractors, DOS leveraged voluntary partnerships with government agencies and private organizations, including trade associations, business assistance organizations, and utilities. These partnerships were central to all phases of the project. Organizations that provided invaluable assistance include Bell Atlantic, Con Edison, Food Industry Alliance of New York, Grand Central Partnership, Long Island City Business Development Corporation, NYC Department of Business Services, New York State Restaurant Association, NYC Trade Waste Commission, and many others. The NYC WasteLe$$ Summary Report and other work products highlight the contribution of these and other partners.

Timing for Issuing Reports and Action Plans

DOS is issuing the reports and action plans now because the two consultant contracts are in the final stages of completion. Some of these reports were provided by the consultant and utilized further during the course of the contract. However, issuing reports intermittently as stand alone documents would have slowed down a lengthy process and taken them out of context of

the entire project work performed pursuant to the two contracts. Issuing the case study reports concurrently with ***Measuring Waste Prevention in New York City*** enhances the overall impact. The case studies explain program detail, shed light on waste prevention measurement difficulties, and highlight the importance of legislative and voluntary industry action to achieving substantial levels of waste prevention beyond what can be achieved by DOS programs.

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[1] [SWMP, Appendix Volume 4.1 (August 1992), *Waste Management Components*; Appendix 4-A, *Waste Prevention*, p. 22 and Table 3.]

[2] Memo to Ben Miller and Jim Meyer from Reid Lifset and Marian Chertow, CalREcovery Systems Inc., 7/9/91.

[3] To achieve incremental change, appendices to the ***NYC WasteLe$$ Summary Report*** include worksheets that can be used directly, or as models, for how to assess particular product choices. Worksheets included allow for calculating whether a particular business would achieve savings for such things as reusable shipping containers, or duplex (double-sided) copy machines.

BWPRR Overview

This report is one of a number of waste prevention reports prepared under a long-term contract by consultant Science Applications International Corporation, and issued at contract conclusion. The New York City Department of Sanitation (DOS, or the Department), Bureau of Waste Prevention, Reuse and Recycling (BWPRR), the sponsor, has issued a Foreword to the studies; it acknowledges the many contributors and frames a position based on its considerable efforts to review, practice, and measure waste prevention. The Foreword precedes the Overview to this report, the first of the series. Interested readers are strongly encouraged to access the material through the Department's web site at www.ci.nyc.ny.us/strongest. Print or electronic versions are available through BWPRR. (The list of reports is included in the Foreword that precedes this Overview.) Release of these reports is not an endorsement of recommendations made by the consultant.

Over the last decade, BWPRR has undertaken a number of waste prevention programs — that is, programs designed to eliminate or reduce the amount and/or toxicity of solid waste — in the residential, institutional/government, and commercial sectors. In light of waste prevention planning goals, this study was commissioned to determine whether satisfactory methods could be developed to measure reductions in waste achieved through its waste prevention programs, and through other programs and processes. It has resulted in the longest of the reports issued. In the process of reporting on measuring program impacts, it summarizes many of the Department's programs, including programs undertaken with other City Agencies. Their participation also is not an endorsement of recommendations.

The Framework for Measuring Waste Prevention

This report confronts the difficulties in measuring something that did not happen – waste that was prevented. There are, first, conceptual problems of measuring residential and commercial waste prevention in an era of growth. Suppose an office goes from singe-sided to double-sided photo copying. That seems like waste prevention. But if it happened because business expansion required a new copy machine that allowed for duplex copying, and now the business uses more paper, is it still waste prevention? If so, what is the methodology to quantify "how much paper would otherwise have been used"? What assumptions need to be made? What costs and benefits should be included? Is it worth the resources required to do it?

Equally problematic is calculating a "waste prevention" measure for programs or behavior that pre-dated current waste prevention notions. Are donations of furniture and clothes to charities "waste prevention?" If so, should all contributions be counted, or only those contributions made as a result of new initiatives undertaken now to encourage people to donate more? And again, even assuming a conceptual definition is applicable in this case, is it feasible to isolate and measure program impacts?

Other complications further compound the difficulty of measuring. For example, do electronic forms of communication create more or less use of paper? If it seems to be less, is it appropriate to deconstruct a fundamental change in technology and process and try to measure a part of it as 'waste prevention'? Finally, if this is appropriate, who should undertake the cost of such a measurement? If benefits are shared and diffuse and cannot be charged for — economists call these externalities — how much public support should there be, given competing needs for public dollars? If direct beneficiaries cannot be identified but they are private businesses, should the public sector initiate support? If so, for how long?

In the first chapter of the report, SAIC raises the kinds of questions suggested here, discusses waste prevention measurement efforts in other jurisdictions, and sets forth a number of limitations of waste prevention measurement efforts. These include:

- the absence of any conclusive work on evaluating waste prevention;
- the impossibility, in some cases, of linking actual effects to waste prevention actions;
- the difficulty and cost of getting reliable measures for programs where participants or potential participants are many and dispersed;
- the reliance on self-reporting; and,
- the presence of indirect costs and benefits.

The NYC Study

In carrying out its charge, SAIC reviewed fifteen different Department waste prevention programs. Some, by nature, could be fairly easily quantified; others were more problematic. However, for the most part, assumptions, estimates, and data limitations are stated clearly throughout.

SAIC presents four key findings from its review:

1. **Measuring waste prevention is still a "work in progress," to which the Department has contributed through this study;**
2. **Waste prevention is worth undertaking, but limited resources require public agencies to carefully weigh program effectiveness and, where possible, to encourage the beneficiaries of waste prevention to undertake these programs themselves;**
3. **Significant achievements in waste prevention will require State and federal initiatives, not just initiatives at the local level; and**
4. **Waste prevention activities that make good common sense, such as general education and reminders, should be supported even if they cannot be measured.**

SAIC presents its core findings in the second chapter. Here it provides descriptions of each of the Department's waste prevention programs, as well as descriptions and evaluations of the

measurement tools the Department has employed in attempting to determine the amount of waste prevented by these programs. In some cases, these programs are in pilot phases, so that an evaluation of measurement tools is not feasible, as there is little or no program effect to measure. A general caveat to the reader is that in the case of the NYC WasteLe$$ and NYCitySen$e programs, SAIC itself worked with the Department on program implementation, and therefore these evaluations lack some of the objectivity of the others.

Because of the variety of programs and the range of measurement issues, different readers will draw different conclusions from this report. Overall, the Department finds that while many waste prevention programs might effectively serve public education functions, they often do not provide cost effective means of actually *preventing waste*. Even in cases where accurate measurement of waste prevention is possible *and* cost effective, on careful consideration, the waste prevented is a mere drop in the total bucket of waste.

Another important finding this report highlights is the problematic relationship between public agencies and private industry when it comes to reevaluating the way the latter does business. By definition, a public agency, through its consultants, does not have the inside perspective on business operations; nor is it likely to make recommendations that will *fundamentally* affect the way a business handles its waste. The consultants can sort business waste and work backwards to suggest what might be reconsidered or reused. But this is unlikely to translate into the significant tonnages of waste prevented when companies, motivated by increased profitability and competitiveness, re-evaluate the way they do business, including what they are currently calling waste. These systematic, process-oriented changes are occasioned by internal, company-wide re-examinations, generally in response to changing markets, not by the proddings of public agency consultants.

Of the waste prevention programs sufficiently developed to be quantified (waste prevention impacts are summarized in Table 1 and detailed in Chapter 2):

- Five programs have small waste prevention impacts and show relatively small costs only by excluding human resource costs (staff time). These are the Unwanted Direct Mail Reduction Campaign, Outreach to Chinese Restaurants, Dry Cleaners Outreach, Grocery Store Outreach, and the CENYC Waste Assessments. ***The waste prevented by each of these programs is estimated to range from about 120 to 1,500 tons per year***, relative to a citywide residential and institutional waste stream of about 13,000 tons *per day*, or just over 4,000,000 tons *per year*. Including the commercial waste stream brings the total to more than 8,000,000 tons per year.

- Two programs, NY Wa$teMatch and Materials for the Arts, have relatively small waste prevention impacts with rather substantial positive costs to DOS and positive benefits to the private sectors.

- The only program that shows both potentially large waste prevention impacts for DOS and savings for NYC residents as consumers, NYC Stuff Exchange, relies on a highly uncertain small-sample survey, whose results "did not appear to be reliable" (pp. 40-41) according to the survey takers. That survey used people's self-reports of likely future donations as the basis for estimates of amount of donations of clothes and furniture people will make, beyond what they are making already. The Department's emerging experience in beginning the Stuff Exchange roll-out also suggests a lower level of donations than estimated here.

A Note on Waste Management Costs

This study was undertaken over a period of changing waste management costs. In estimating net impacts of waste prevention for the final version of this report, disposal costs ranged from $41.50/ton to $70/ton (Tables 2-1 and 2-2). The latter is close to the average export cost projection of approximately $75 derived subsequently by the Department for its *Comprehensive Solid Waste Management Plan Draft Modification, May 2000* (Table 4.3-2).

Table of Contents

Executive Summary

I. Introduction

The New York City Solid Waste Management Plan of 1992 (SWMP) set a goal of a nine percent reduction in the City's waste stream through waste prevention by the year 2,000. Preventing the generation of solid waste assumed even greater importance in New York City in 1996 when New York City Mayor Rudolph Giuliani and New York State Governor George Pataki announced the decision to close the Fresh Kills Landfill in *A Plan to Phase Out the Fresh Kills Landfill*. Subsequently, the City established an export strategy and a time line for increasing the diversion of waste from Fresh Kills each year until its final closure on December 31, 2001.

Waste prevention, in this report, means eliminating or reducing the amount and/or toxicity of solid waste. It includes policy and process modifications, as well as procurement of products and materials that are more durable, reusable and/or repairable, or diverting such items for beneficial reuse. In addition, it includes using items that have less packaging and/or are less toxic than alternative products and packaging. It includes composting at the site of generation, as well as the source reduction of yard waste through backyard composting and grasscycling. Waste prevention does not refer to using items that are recyclable or contain recycled material, nor to the diversion and collection of recyclables for processing.

The New York City Department of Sanitation (DOS) has undertaken a wide range of ambitious waste prevention initiatives through its Bureau of Waste Prevention, Reuse and Recycling (BWPRR). These programs target reductions in waste generation in the commercial/industrial sector, as well as the residential, institutional and government sectors. To measure the effectiveness of programs implemented to date, and to suggest methodologies for determining and evaluating the impacts of future initiatives, DOS contracted with Science Applications International Corporation (SAIC). The primary objective of SAIC's evaluation of New York City's Waste Prevention Programs is identification of satisfactory methods for measuring reductions in waste generation achieved as a result of the implementation of waste prevention requirements and programs in New York City. While the focus of this report is on the development of evaluation procedures, not all waste prevention initiatives warrant the effort and expense of developing statistically valid measurements of resulting waste prevention and other impacts. In some cases, the cost of measuring the impact of a waste prevention program may actually exceed the cost savings and other benefits of the waste prevention effort.

SAIC's efforts focused on:

- Developing and applying methods for evaluating all DOS waste prevention programs for which data are available. SAIC sought both to measure directly quantifiable impacts and to project future impacts on the waste management system, as well as to determine the "other impacts" of these programs on such factors as energy consumption, material use, the environment, and the economy.

- Developing and applying methods for evaluating reductions in the City's waste stream resulting from non-DOS City-sponsored programs as well as programs sponsored by non-profit and private sector organizations, for which data are available. Based on these evaluations of all relevant programs, SAIC sought to determine the cumulative impacts of these efforts on New York City's waste management system, energy consumption, material use, the environment, and the economy.

Specific tasks included:

1. Measuring the waste prevention impacts of ongoing and completed DOS- sponsored waste prevention programs for which data are available;

2. Recommending enhancements to the evaluation and measurement methodologies for ongoing, planned or proposed DOS waste prevention programs;

3. Recommending evaluation and measurement methodologies for the waste impacts of waste prevention initiatives undertaken or sponsored by other entities in the City, including the Department of Citywide Administrative Services (DCAS) for which data currently are not available;

4. Identifying obstacles to and limitations of practical waste prevention measurement methodologies; and

5. Evaluating the energy, economic and general environmental effects of waste prevention initiatives.

II. Structure of the report

This report consists of three chapters:

Chapter 1 provides an introduction, a review of potential techniques to measure waste prevention, a discussion of waste prevention measurement efforts in other jurisdictions, a discussion of the limitations of waste prevention measurement efforts, and a conceptual framework for the development of the DOS waste prevention program evaluation.

Chapter 2 provides program evaluation plans for 14 New York City waste prevention programs, including 12 on-going or completed DOS programs, one DOS pilot program, and one Department of Citywide Administrative Services (DCAS) program. The first two sections of Chapter 2 provide details on the development and content of the program evaluation plans. These sections are followed by the 14 program evaluation plans. Some of the projects evaluated are ongoing and current evaluation plans should be viewed as preliminary.

Chapter 3 explains and quantifies the potential aggregate impact of City-wide waste prevention programs. Aggregate impact refers to the total annual quantity of waste prevented and includes the impacts of DOS-sponsored waste prevention programs. The report

describes two basic methods for evaluating aggregate impacts, top-down and bottom-up, and evaluates the pros and cons associated with the use of each method. The report provides an analysis of aggregate impacts based on the bottom-up approach.

III. Program Evaluation

The evaluation plans for 14 of the City's waste prevention programs include program descriptions to provide a context for the waste prevention effort. They further provide comments on the approaches used by DOS to evaluate and quantify the waste prevention and cost savings achieved through the programs, as well as recommendations to enhance the evaluation process. Current programs, estimates of waste prevented and other impacts are evaluated as data allows. Based on available data, the report presents projections of the potential waste prevention impacts of each program through the year 2002. Specifically, each evaluation plan includes the following elements:

1. **Program Summary.** This section provides a brief overview of the program.

2. **Comments on DOS Approach.** Describes measurement procedures undertaken or anticipated by DOS and provides a qualitative evaluation of those measurement procedures.

3. **Program Evaluation Recommendations.** If applicable, recommended, potentially cost-effective strategies for enhancing DOS's evaluation methods are discussed in this section.

4. **Waste Prevention Impacts.** For programs completed or in progress, this section provides estimates of the quantity of waste prevented. For programs under development, similar estimates, based on anticipated performance, are provided where possible.

5. **Other Impacts.** This section addresses impacts other than tons of waste prevented. A table presenting solid waste system impacts, economic and environmental impacts and financial indicators is included with each evaluation plan. Other Impacts reflect the program's current waste prevention impacts.

6. **Waste Prevention in 2002.** Estimated tonnage to be prevented by the program in 2002 is discussed in this section and, to the extent possible, quantified. In some cases, options for enhancing program effectiveness also are noted and discussed .

Evaluation plans for the following New York City waste prevention programs are included in this report:

- *NY Wa$teMatch*, a citywide reusable materials exchange;

- *NYC Stuff Exchange*, a menu-driven, automated, toll-free telephone system that will contain listings for various types of reuse outlets available in New York City;

- *NYC WasteLe$$*, a program that promotes waste prevention in nine business and institutional sectors including: hospitals; airlines and airports; schools; food retailers/

producers; non-food retail; restaurants; wholesalers; manufacturers; and stadiums, arenas, and convention centers;

- *Unwanted Direct Mail Reduction Campaign* a program during which DOS sent information to every New York City household on why and how to register with the Mail Preference Service (MPS) to be excluded from direct mailings;

- *Materials for the Arts*, a City-sponsored program that facilitates the reuse of items donated to the program by businesses, organizations and individuals;

- *Outreach to Chinese Restaurants*, a DOS effort to mail surveys and posters promoting waste prevention to the nearly 600 members of the Chinese American Restaurant Association (CARA);

- *Dry Cleaning Outreach*, a DOS effort targeting City dry cleaners, conducted in cooperation with the Neighborhood Cleaners Association (NCA);

- *Grocery Store Outreach*, a program in which DOS mailed surveys on grocery store waste prevention activities and posters to 350 grocery store chain headquarters and individual stores, with the assistance of the Food Industry Alliance of New York State;

- *CENYC Waste Assessments*, an effort during which The Council on the Environment of New York City (CENYC) assisted organizations in New York City to develop waste prevention programs, with funding and other assistance provided by DOS and Empire State Development;

- *Department of Citywide Administrative Services* (DCAS), operations conducted through the DCAS Office of Surplus Activities (OSA), for the purpose of managing the reallocation or marketing and sale of a variety of equipment, materials and products that are no longer needed by the agencies that purchased them;

- *NYCitySen$e*, a program through which DOS worked cooperatively with ten Mayoral Agencies, to initiate waste prevention and enhanced recycling programs;

- *Botanical Gardens Compost Projects*, a program to promote backyard and small-scale composting to NY City residents, institutions and businesses through outreach, education and technical assistance;

- *DOS Outreach and Education Initiatives*, efforts which targeted residents, businesses, not- for-profit organizations and government agencies with outreach and educational materials about how to prevent waste; and

- *Training for Local Development Corporations*, a training program for New York City-based Local Development Corporations (LDCs) and local academic institutions concerning practical strategies for providing waste prevention technical assistance services to businesses in their service area.

Table 1 summarizes the waste prevention findings relevant to these New York City Waste Prevention Programs.

Table 1: Estimated Waste Prevention

Program	Status	Tons of Waste		Comments
		Prevented FY 97	Projected 2002	
NY Wa$teMatch	Initiated April 8, 1997	0	1,448	Program impact in year two (4/98 – 3/99) was 1376.54 tons diverted from disposal.
NYC Stuff Exchange	DOS will launch a pilot on Staten Island in 1999	0	12,485	Assumes the program is expanded citywide and 10% of callers make a donation
NYC WasteLe$$	Initiated October, 1996	0	79,704	A participation rate of 10% was assumed; sector-wide outreach activities began in Spring, 1999.
Unwanted Direct MailReduction Campaign	Mailing to every NYC household, 1993; displays to libraries and public officials, 1996-97.	186	0	MPS registrations expired in 1998. If DOS does not conduct a follow-up program before the end of 2000, it should be assumed that the program will prevent no waste in 2002.
Materials for the Arts Program	Warehouse space to double in fall, 1999	434	578	MFA will double its warehouse space, increase service to City public schools and expand advertising for an anticipated additional 12 tons of waste diverted per month.
Outreach to Chinese Restaurants	Summer 1993 to May 1994	120	120	Based on 1993 estimate. Significantly more waste prevention could be achieved if all take-out restaurants were targeted.
Dry Cleaning Outreach	Summer 1993 to May 1994	305	311	Based on 1993 estimate, accounting for .51% population increase.
Grocery Store Outreach	Summer 1993 to May 1994	1,027	1,043	Estimate refers to grocery bag use prevention.
CENYC Waste Assessments	July, 1993 to June, 1995	1,334	1,334	Based on 1997 CENYC data assuming institutionalizaton of these programs, but no further growth.
Department of Citywide Administrative	Program includes sealed bid sales of surplus materials and equipment; vehicle auctions; City Agency property reallocation; and the Surplus Warehouse.	NA	NA	Data are not currently available to support projections.
NYCitySen$e Program	Initiated summer, 1998	NA	NA	Data currently are not available to support projections.
Botanical Gardens Compost Projects	Initiated 1993	NA	NA	Data currently are not available to support projections.
DOS Outreach and Education Initiatives	Initiated 1991	NA	NA	Data currently are not available to support projections.
Local Development Corporations Training	Training conducted 1997	NA	NA	Data currently are not available to support projections.

To supplement the discussions of waste prevention, this report addresses the program impacts beyond reductions in disposal tonnage. To the extent possible, the evaluation plans included in this report analyze the following general categories of Other Impacts:

Solid Waste System Impacts. These impacts include effects on solid waste management system costs (e.g. avoided collection, processing, or disposal activities and costs).

Prevention Program Financial Indicators. These impacts include waste prevention program costs, payback periods, and net annual amortized savings.

The methods used for the analyses and the results obtained are described in Chapter 2.

IV. Issues and Challenges

Measuring waste prevention is a complex undertaking. Part of the difficulty is intrinsic to the nature of prevention. Some of the challenges of measuring waste prevention and proposed strategies to address them are presented below.

- No conclusive work on the evaluation of waste prevention has been developed. The literature on the subject is limited. As a result, this project draws upon methods and findings from the energy conservation field, when applicable, and develops new approaches to analyze waste prevention measurement, as needed.

- Obtaining reliable and complete data on which to base waste prevention measurement is often difficult. Therefore, the "bottom up" approach was selected as the only practical and defensible way to address this task.

- Establishing a cause and effect relationship between waste prevention programs and their impacts is not always possible. As a result, this report includes assumptions about the contribution of underlying economic trends to the "cumulative" reduction of waste. These trends are described in Chapter 3. In addition, the report addresses other trends in waste prevention, independent of DOS sponsored programs. At this time, however, a full analysis of the cumulative effects of all contributing factors to waste prevention is limited by the availability of data.

- Sample size may affect the reliability of measurements of waste prevention impacts. The larger the number of program participants and the greater their dispersal, the more difficult it is to estimate the amount of waste prevented. The effort to measure waste prevention can be as costly or more costly than the implementation of the waste prevention program measured. Thus, the cost of data collection may make some data unavailable under any circumstances. These issues are raised in Chapter 1 and elsewhere in the report.

- The costs and benefits of DOS programs are not always accurately portrayed or captured by looking solely at the direct costs and benefits of DOS programs to DOS. For this reason, an "All Participants" analysis was provided to offer perspective on the costs and benefits of programs initiated by DOS.

Despite these constraints and issues, this report presents an evaluation of DOS programs by considering waste prevention measurement and impacts through a combination of approaches. These approaches include, "bottom up" analysis; all Participants" benefits; and the "cumulative impacts" of waste prevention programs.

Based on the analysis conducted to date, approximately 78,663 tons of waste are anticipated to be prevented in 2002 by New York City programs evaluated in Chapter 2. An additional 456,126 tons are expected to be prevented in 2002 through other means, including non-NYC programs and trends in packaging and reuse. A total of 534,789 tons is expected to be prevented in 2002. Based on a sensitivity analysis for the data for each program or trend, New York City waste prevention in 2002 could be as low as 413,684 tons and as high as 928,050 tons. These estimates are subject to revision in subsequent years as additional programs are examined, new programs are planned and implemented and developing waste prevention programs mature, providing additional data.

Furthermore, a bottom-up analysis of waste prevention will inevitably be unable to identify and quantify every waste prevention activity. Indeed, some waste prevention activities are inherently impractical or not feasible to quantify, as discussed earlier. *As a result, the City of New York is probably further toward its goal of 9 percent waste prevention by 2000 than this analysis indicates.*

V. Conclusions

1. The process of municipal solid waste prevention measurement is still under development, nationwide. This study contributes ideas and strategies to enhance subsequent efforts.

Waste prevention remains at the top of the U.S. Environmental Protection Agency's hierarchy for addressing municipal solid waste management concerns, but there has been little national progress to date on the establishment of definitive strategies for measuring waste prevention.

Many cities, states, and the U.S. EPA have sought, and to varying degrees succeeded, in measuring waste prevention on the micro-level — focusing, for example, on achievements of individual programs or individual businesses. DOS and its consultants, however, are not aware of any government effort that has successfully demonstrated how to practically and cost-effectively calculate waste prevention on the macro-level — that is, waste prevention actually achieved within an entire municipality, state, or country. As discussed in Section 1 of this report, the U.S. EPA developed a methodology

that projects waste generation through its correlation to consumer spending, and then determines whether reductions are attributable to recycling or source reduction. This methodology is limited to national analyses since local consumer spending data are not available. Also, as presented in Section 1, the State of Connecticut and Franklin Associates developed a method to estimate source reduction within the State. This approach can be used to ground truth findings from the bottom up analysis of New York City programs.

This study seeks to develop, test, and refine methods to measure waste prevention in New York City by examining waste prevention achieved and projected citywide. Further progress is expected as this study continues to advance DOS's measurement efforts.

2. Waste prevention measurement is a worthwhile undertaking.

Despite the stated obstacles to and limited experience in measuring waste prevention, DOS recognizes a number of factors reinforcing the push to develop and refine measurement approaches. These considerations include the need to:

- Determine which programs are most or least effective to enable DOS to target its limited resources most appropriately;
- Document the savings to businesses, taxpayers, and potential co-sponsors of municipal waste prevention efforts to generate support for worthy waste prevention initiatives;
- Justify any budgetary appropriations and expenditures on waste prevention program research, development, and implementation;
- Substantiate the level of, need for, and potential benefits to be derived from federal, state, or local legislation intended to promote waste prevention; and
- Motivate New York City businesses, and other non-governmental entities, to devote appropriate time, energy, and resources to preventing waste.

3. Results from this waste prevention study indicate that significant waste prevention achievements will require state, national and industry initiative.

New York City's Department of Sanitation has devoted substantial resources to development and implementation of a comprehensive and coordinated waste prevention effort. Additional initiatives that may be pursued by the Department of Sanitation during the coming years may lead to waste prevention achievements beyond the levels currently projected in this report. DOS's current and projected programs are comparable to, or more advanced than, those undertaken in other jurisdictions. Above all, the City must lead by example and publicize its own efforts and achievements. The City may wish to seek funding, preferably from outside the NYC government, and encourage voluntary national industry actions that complement the City's programmatic efforts.

DOS's programs are ambitious and comprehensive, targeting both residential and commercial waste. However, programs operated by DOS are expected to contribute only a small portion of the anticipated reductions in waste generation. Non-city programs, as well as general trends in waste generation, account for a substantial portion of the expected reductions. To achieve the level of industry and consumer behavior change necessary for substantial reductions in the New York City solid waste stream, Federal and state legislation and programs, voluntary industry initiatives, and politically challenging initiatives, such as quantity-based user fees, are needed.

4. **Obstacles to waste prevention measurement should not justify abandoning waste prevention initiatives.**

The findings of this study indicate that it may not always be practical or cost-effective to quantify the impacts of a waste prevention initiative. Nevertheless, there may be inherent value to undertaking a waste prevention project for which measurement is problematic, such as conducting citywide public education. In these instances, a more qualitative approach, perhaps facilitated by the use of focus groups, surveys, and other types of market/behavioral research, can be a worthwhile approach for demonstrating the value of those waste prevention impacts that may not be directly measurable.

1. INTRODUCTION

This report describes work undertaken to evaluate the impacts of New York City waste prevention programs. The work is sponsored by the New York City Department of Sanitation (DOS), Bureau of Waste Prevention, Reuse and Recycling (BWPRR).

BWPRR oversees development, administration, and evaluation of DOS waste prevention programs. Throughout this report, these waste prevention programs are referred to as "DOS" programs. Waste prevention, as defined in this report, means eliminating or reducing the amount or toxicity of waste, including recyclables. It also includes using items that are more durable, reusable, and/or repairable, or diverting such items for beneficial reuse. In addition, it includes using items that have less packaging and/or are less toxic than alternative products and packaging. It includes composting at the site of generation, as well as the source reduction of yard waste through backyard composting and grasscycling. Waste prevention does not refer to using items that are recyclable or contain recycled material, nor to the diversion and collection of recyclables for processing. In this document, the terms waste prevention and source reduction are used interchangeably.

Table 1-1 presents data on the amount of municipal solid waste generated, both in tons and per capita, for the U.S. and New York City over two years. The goal of waste prevention is to further reduce the total amount of waste generated, as well as the *per capita* amount of waste generated.

Table 1-1. Municipal Solid Waste (MSW) Generation in the U.S. and New York City

	1995	1996
U.S. MSW Generation (in thousands of tons)	211,360	209,190
New York City MSW Generation (in thousands of tons)	4,802	4,717
U.S. Population (in thousands)	262,890	265,284
New York City Population (in thousands)	7,373	7,380
U.S. MSW Generation Per Capita, Per Day (in pounds)	4.40	4.32
New York City MSW Generation Per Capita, Per Day (in pounds)	3.57	3.50

Sources: Population figures from U.S. Bureau of Census, MA-96-5, December 1997. U.S. MSW generation and per capita quantities from *Characterization of Municipal Solid Waste in the United States: the 1998 Update*. U.S. EPA, May 1999. New York City generation rates from DOS, calculated based on average daily tonnage x 365 days/year. Per capita = (generation / population) x 2000 lbs/ton) /365 day/year. EPA data include residential, commercial and institutional MSW; New York City data do not include commercial waste collected by private carters.

Evaluating waste prevention accomplished by City-sponsored programs and private initiatives requires a deliberate and carefully designed approach, as tracking waste prevented by these

programs presents unique challenges. DOS is interested in developing and applying evaluation procedures that will:

1. Measure the impacts of on-going and completed DOS-sponsored waste prevention programs.
2. Improve the evaluation and measurement methodologies of planned DOS waste prevention programs.
3. Evaluate the solid waste impacts of waste prevention initiatives undertaken or sponsored by other entities in the City, including the Department of Citywide Administrative Services (DCAS).
4. Identify obstacles and limitations to implementing practical waste prevention measurement methodologies.
5. Evaluate and measure the environmental, energy, and economic impacts of waste prevention initiatives.

The information in this report has been developed with these objectives in mind.

While the focus of this report is on the development of evaluation procedures, not all waste prevention initiatives warrant the effort and expense of developing statistically valid measurements of resulting waste prevention and other impacts. In some cases, the cost of measuring the impact of a waste prevention program may actually exceed the cost savings and other benefits of the waste prevention effort.

Franklin Associates, a service of McLaren/Hart, reviewed the content of this report for accuracy. Franklin Associates is recognized for its work in Life Cycle Assessment for processes, products and packaging, market analyses, and studies addressing policy issues for private industry and government agencies. Franklin Associates provided updated information on national waste composition for this report. Their staff reviewed and commented on the presentation of the relevance of the EPA characterization report and their work with the Connecticut Resources Recovery Authority and provided an analysis of the potential for newspaper source reduction in New York City. Franklin Associates also provided a peer review of the entire SAIC study.

1.1 Structure of this Report

This report consists of three major chapters. Chapter 1 provides an introduction, a review of potential measurement techniques, a discussion of factors affecting waste prevention measurement, and a conceptual framework for development of DOS waste prevention program evaluation.

Chapter 2 provides program evaluation plans for 13 of DOS's on-going, completed, or planned programs and one Department of Citywide Administrative Services (DCAS) program. The first two sections of Chapter 2 provide details on the development and content of the program evaluation plans. These sections are followed by the 14 evaluation plans developed to date. Some of the projects evaluated are relatively new, thus, current evaluation plans should be viewed as preliminary.

Chapter 3 explains and quantifies the aggregate impact of citywide waste prevention. Aggregate impact refers to the total annual quantity of waste prevented and includes the impacts of DOS-sponsored waste prevention programs. This chapter describes two basic methods for evaluating aggregate impacts—top-down and bottom-up—and discusses the pros and cons associated with the use of each method. An analysis of aggregate impacts based on the bottom-up approach also is provided.

1.2 Measuring Waste Prevention: The Conceptual Framework

Measuring waste prevention is a complex and difficult undertaking. Unlike recycling, where the amount of material transferred from the "garbage can" to a "recycling bin" can be quantified, waste prevention often results in the elimination of the material. In those cases, there is nothing to weigh or evaluate. Attempts to measure waste prevention are further confounded by the difficulty in properly attributing reductions to waste prevention, rather than other factors, such as recycling, declining populations, or economic contractions. A conceptual framework for measurement that allows for measurement of the specific reductions attributable to waste prevention must be defined. This section examines potential measurement techniques that can be applied to efforts to eliminate or prevent waste, measurement techniques tested in other jurisdictions, and the limitations of existing measurement techniques.

1.2.1 Techniques to Measure Waste Prevention

A number of sources were reviewed to identify potential techniques for measuring source reduction program effectiveness. A primary source, *Profiting From Source Reduction: Measuring the Hidden Benefits*[1] was prepared in 1997 for the Alameda County, California Source Reduction and Recycling Board. This section draws upon the work of this report, as well as other sources, as noted, to describe five primary types of source reduction measurement techniques:

- Direct Quantification of Source Reduction,
- Source Reduction Cost Analysis,
- Economic, Resource, and Waste Indicators,
- Source Reduction Program Potential Estimates,
- Demand Side Management.

Each of these techniques is discussed below along with additional research conducted since the publication of the Alameda County report.

Direct Quantification of Source Reduction

Quantifying source reduction relies on reported measurements of changes in waste stream quantities, either by volume or weight. The California Integrated Waste Management Board

suggested three specific methods, all aimed at obtaining direct measurement data. The methods included: direct program monitoring through case studies, audits, and reporting requirements; conducting surveys and field work; and waste sorting studies.[2]

The Alameda County report does not provide extensive detail on the means of direct measurement but, implicitly, such measures would need to be taken as close to the source of the reduction as possible, to eliminate the effects of changes in waste generation rates due to recycling or other non-waste prevention efforts. Such measures could include self-reported reductions by firms, waste audits or case studies conducted by the responsible state or federal agent, or measures obtained through a sample of firms participating in waste prevention programs.

As wastes are aggregated and move further along the management stream, screening out the effects of non-waste prevention efforts becomes more difficult. For example, if Firm A began to require that all photocopies be double-sided, it would realize a reduction in its rate of waste paper generation. However, Firm A's paper recycler also collects from Firm B, which is experiencing a business slowdown. After aggregation of Firm A's and Firm B's waste paper, reductions in the weight of paper recycled could not be attributed directly to successful source reduction. Firm B's poor economic times could result in lower rates of paper generation that are not due to waste prevention efforts. A direct measure such as this would overestimate the success of a paper waste reduction effort.

The U.S. EPA WasteWi$e Program made recommendations on how to develop facility-specific and corporate-wide waste reduction measurement programs that include using hauler records, purchasing records, sales records, employee surveys, facility walk-throughs, and waste sorts to collect direct information.[3] Such techniques are useful at the site-specific level, but are difficult to aggregate at the local level, due to measurement differences and spotty participation by businesses.

In Connecticut, the Resources Recovery Authority commissioned a study of the impact of recycling and source reduction in the state.[4] The study uses a methodology recommended by the U.S. EPA to calculate the state's recycling rate and a methodology devised by Franklin Associates and the State of Connecticut to calculate source reduction. Where data on recycled materials are available, these data generally were used as is. In some instances, the data were adjusted to make them consistent with definitions used at the national level. Where no data exist for recycling of materials, national recycling rates were used. The quantities of waste recycled were then added. Next, the quantity of waste generated for the state, absent recycling and source reduction activities, was projected based on a linear regression model, using historical per capita waste generation data. Then, the actual municipal solid waste generation quantity and the actual recycling quantity were subtracted to yield the projected source reduction quantity. Additional analyses were conducted to ensure the integrity of data used, bring state and national definitions into alignment, and account for programs just entering the implementation phase, such as a ban on yard waste disposal.

Source Reduction Cost Analysis

Basic cost analyses generally incorporate two financial factors—the cost of undertaking the source reduction effort and the savings in purchasing and disposal costs—to calculate the realized total costs of the effort. In *Rethinking Resources*,[5] INFORM, a New York based environmental research firm, considered cost-based measurements, including savings from avoided disposal and from reduced purchasing, operating and maintenance costs. Other measures, identified through a survey of municipalities, include increased sales of waste preventing products and the creation of new jobs and businesses. Drawing on the Alameda County report, as well as general corporate finance principles, the basic steps in analyzing source reduction costs may include:

- Identifying the source reduction effort to be analyzed.
- Identifying the direct cost of implementing the source reduction effort (capital and operating/maintenance costs).
- Identifying the costs to be measured (such as purchasing, disposal, labor, and other relevant factors) before and after implementation of the source reduction effort.
- Identifying any additional indirect benefits that accrue from implementing the source reduction effort, such as additional storage space for raw materials or products and, if necessary, determining their financial value.[6]
- Determining the net cost of the source reduction effort using a process that considers the time-value of money, such as net present value, to account for savings that will continue into the future.
- Monitoring the source reduction effort over time and making improvements as needed.

Waste prevention projects may be implemented today, but the savings effects of the program generally will continue over time. As a result, the savings realized in the future must be "discounted" so that the future dollars have the same value as the current dollars spent on starting the program. A basic principle of finance is that a dollar today is worth more than a dollar tomorrow. As a simple example, imagine putting $0.91 in a bank account today that earns 10% interest, compounded annually. One year from now, $0.09 interest is posted and there is $1.00 in the bank account. Thus, one of the important aspects of cost analysis is to consider the time frame in which the project is undertaken and savings accrue, and adjust future cash flows to today's present value. Once the initial investment and the savings are all expressed in current dollars, their values can be added. The methodology for discounting cash flows to determine net present value is discussed in Chapter 2.

Economic, Resource, and Waste Indicators

A potential measurement technique is the use of indicators—determined on either an economic, resource, or waste basis—to establish both baseline potential for waste prevention programs and to measure effectiveness of the program after implementation. Economic indicators, frequently used by economists, can be used to determine the consumer price index (CPI) of waste prevention programs. In calculating the CPI, the price of a "market basket" of consumer items

is determined and the value of the market basket is divided by the value of the same basket during a base year. To apply this approach to waste prevention, a fixed list of waste prevention efforts is measured for the period being examined, and then is divided by their value in a base year. Resource productivity and waste indices measure waste prevention effectiveness using inputs and reductions in waste outputs, respectively.

In 1993, the Minnesota Office of Waste Management published a report[7] that suggested using ***economic indicators***, such as population and employment data readily available from government sources, in conjunction with locally developed source reduction data. Such indicators could include per capita waste generation, per employee waste generation, or tons of waste per wage dollars.

The U.S. EPA recently released a paper outlining such an approach.[8] EPA reported that statistical analyses show that waste generation correlates closely to Personal Consumption Expenditures (or consumer spending) rather than population trends. To determine projected waste generation quantities, the authors suggest the following equations:

$$\frac{\text{Actual 1990 Waste Generation}}{\text{1990 Consumer Spending}} = \frac{\text{Projected 1996 Waste Generation}}{\text{1996 Consumer Spending}}$$

$$\text{Projected 1996 Waste Generation} = \frac{\text{Actual 1990 Waste Generation}}{\text{1990 Consumer Spending}} \times \text{1996 Consumer Spending}$$

$$\text{Source Reduction in 1996} = \text{Projected 1996 Waste Generation} - \text{Actual 1996 Waste Generation}$$

The U.S. EPA authors indicate that the methodology is robust enough to allow estimation of source reduction within specific subcategories of recyclable materials, based on historical data regarding the composition of the national municipal solid waste stream. EPA will use this methodology in all future MSW Characterization reports to analyze source reduction in addition to the traditionally reported categories of generation, recycling, and disposal.

The government of Sweden is utilizing ***environmental measures in tandem with national economic statistics.***[9] Sweden maintains an environmental accounting system that includes waste statistics for extraction and manufacturing industries. Efforts have focused on greenhouse gas emissions; data on wastes are limited. To date, the data collected include only one year of waste generation information from industry, households, hazardous, and "other" sources. The disposition of these wastes is reported as percent landfilled, incinerated, recovered, and handled by other treatment techniques. The data can then be manipulated to develop indicators of per capita waste generation or waste management costs per industry. Future work anticipated by Sweden's statistical agency includes the development of indicators, such as key ratios and profiles.

The U.S. EPA also reported[10] the use of a ***waste intensity index*** developed by Tellus Institute. The index is the ratio of waste generated divided by the unit of product or service provided by a company. Because of its simplicity, the waste index approach lends itself to community-level

use. The index presents the waste generation in terms of the factor driving the waste generation. The data required for calculation are straightforward—for example, the quantity of waste generated by a Chinese restaurant is divided by the number of patrons served. Decreases in the ratio indicate that less waste is generated per unit (assuming no change in the number of patrons), and increases in the ratio indicate that more waste is generated per unit (again, assuming no change in the number of patrons). Fast food restaurants and top flight gourmet restaurants may have a different ratios of waste per patron, allowing comparison of the relative waste per unit driving the waste generation by industry. It also is possible to make the waste intensity index more specific by limiting the waste generated to a specific type, such as paper, plastic, glass, or aluminum. For example, one could measure the quantities of glass and aluminum generated by a bar and divide by the number of drinks served to determine the waste intensity index for glass and/or aluminum per drink served. In measuring waste quantities, however, it is important to eliminate from consideration the amount of waste recycled. In addition, changes in the product mix or packaging mix cannot easily be distinguished with the waste intensity index. The underlying data must be collected by the business, which may introduce economic or labor burdens that the establishment may be unwilling to undertake. Further, data would not be consistently collected or reported by these firms, raising uncertainty in the quality of data collected through this process.

Resource productivity ratios are simple measurements of a product or service divided by the resources required to produce the product or service. Each ratio is a measure of the efficiency with which resources are used. For example, product sales divided by raw material costs provides a measure of whether improvements in raw material use are effective. If raw materials are conserved, the ratio of sales to raw materials will increase.[11] The numerator can be measured as items sold, sales, accounts receivable, budget, products manufactured, finished parts and components, or customers served. The denominator can be supplies, raw materials, labor, energy, water, capital expenditure, or plant square footage. The numerator and denominator selected must be sensible for the measurement to be meaningful. Resource productivity ratios do present some shortfalls, however. The ratios are useful only to the extent that the composition of the product remains unchanged. If lighter weight materials are substituted, material costs could increase and the ratio decrease, even though the amount of waste prevented would decrease.

Source Reduction Program Potential Estimates

In the *Source Reduction Program Potential Manual*[12], the U.S. Environmental Protection Agency suggests a methodology for determining, before a source reduction program is implemented, the potential portion of the waste stream that can be reduced. The methodology relies on existing data regarding the amount of waste generated, detailed information on the waste stream and potential participants, and technological limitations to calculate program potential expressed in tons of waste per year. The formula is shown below.

The quantity of a specific material is entered for the General Waste Category, such as 30.6 million tons of yard waste generated annually. The applicability factor allows for an estimate of the total waste stream generated by a certain sector. For example, 45% of yard waste may come from residential sources. The feasibility factor identifies the percent of the waste stream that could be reduced through source reduction. For example, 66% of homes could compost yard waste but do not. The technology factor would account for any technological limitations. There are no technological limitations to composting, so the technology factor in the example is 100%. The calculation yields a program potential figure, expressed as the portion of the waste stream that potentially could be prevented. For the Yard Waste Source Reduction Program Potential example, the calculation yields 30.6 million tons x 81% x 74% x 100 % or 9.1 million tons per year of yard waste that **could** be prevented.

Demand-Side Management

In designing approaches to evaluate waste prevention, reliance on existing methods and approaches to the evaluation of waste prevention, as well as the results and costs of evaluations undertaken elsewhere would seem logical. A wealth of information is available in a closely-related area: the evaluation of energy conservation programs known in the electric utility field as Demand-Side Management (DSM) programs. DSM programs seek to reduce electricity usage either directly by consumers or by substituting energy efficient equipment for older equipment. DSM programs confront the same basic type of measurement problem as solid waste prevention programs: they need to evaluate and, to the extent possible, quantify something that is no longer generated, in this case, electricity use that is avoided. Experience in the DSM area, particularly with respect to use of surveys and public education, can inform and help guide evaluation efforts for waste prevention programs.

The use of DSM in the utility industry is declining, primarily due to the significant changes in the industry following deregulation. These changes are driving supply side management over demand side management; however, the techniques and methodologies underlying DSM remain valid. The transfer of these approaches to waste prevention is appropriate. This report will use DSM methods and findings where such strategies strengthen the analysis of waste prevention.

1.2.2 Waste Prevention Measurement Activities in Other Jurisdictions

In a study conducted for the Department of Sanitation entitled *Survey of Waste Prevention Programs in Major U.S. Cities*,[13] the waste prevention programs of 14 cities, two counties, and two States were examined to explore efforts undertaken in other jurisdictions. Several of these jurisdictions reported that they measured the impact of waste prevention programs.

- Alameda County, California completed a study on measuring the benefits of source reduction in 1997. The county developed measures for its waste prevention programs and recommends that measurement tools be refined over time to direct end-use research and to broaden their application to additional sectors.

- As previously noted, Connecticut measured source reduction and recycling using a methodology that estimates waste generation, absent any initiatives to reduce it, then subtracts actual waste generation quantities and recycled quantities to arrive at the quantity of waste reduced at the source.

- Denver, Colorado was developing a mechanism to track waste prevention program impacts in city-owned facilities.

- Milwaukee, Wisconsin measured the success of the city's waste prevention program by comparing the amount of waste generated historically to both average and present tonnage. Milwaukee also is performing waste stream composition studies to determine the quantity and components of the waste stream. Staff described the process of quantifying the benefits of waste prevention as "arduous."

- Philadelphia, Pennsylvania reported that, although it does not have a waste prevention program, the city tried to quantify program benefits by instituting a grassroots campaign that sent representatives door-to-door to teach waste reduction techniques to inner-city residents. The city performed pre- and post-education waste audits and found that the grassroots approach was effective in the inner city.

- San Diego, California reported difficulty in obtaining waste prevention program funding because quantifying benefits was problematic. The City plans to measure the success of its composting program by the number of participants, the number of telephone inquiries, and the use of surveys.

- San Jose, California residents were surveyed to determine the potential waste reduction participation rate. The City conducted focus groups concerning residents' perceptions of waste prevention. As a result, the City of San Jose altered its program name to "waste reduction" based on this term's higher appeal to focus group participants.

- Seattle, Washington reported that almost every waste prevention program it operates includes an evaluation component that measures participation in sponsored events, notes participants' self-reported behavioral changes in response to the event, and evaluates whether participants actually changed behaviors. Seattle also reported the limited use of surveys to collect measurement data.

- Tompkins County, New York, through a NYSERDA grant, conducted waste assessments at five demonstration sites within three commercial sectors. Some of the demonstration sites did not measure waste reductions, while others did. Some sites already had measurement in place. The measurement results of this effort were mixed, and the project was terminated when funding expired.

The number of successful waste prevention measurement programs that have been implemented is somewhat limited. A California state law requires every city and county to divert 50% of its solid waste from landfills by 2000, measured against a 1990 baseline. Cities and counties were required to report baseline waste generation data for 1990 and quantities of waste disposed

annually thereafter. Baseline 1990 data are adjusted for economic and population changes to ensure that equivalent measures are used. However, the disposal-based focus of this measurement program constrained its utility for measuring waste prevention program impacts. As a result, three California jurisdictions instituted the independent measures discussed above.

1.2.3 Limitations of Existing Measurement Methodologies

Limitations inherent in the existing measurement methodologies affect the reliability of the results they may yield. The reliability of the results of a measurement technique depends on the quality of the data inputs. As discussed in this section, data accuracy and completeness directly affect the accuracy of the results.

Direct Measurement

In this report, waste prevention connotes all identifiable activities or developments which reduce municipal solid waste generation. The difficulty of direct measurement of waste prevention complicates its evaluation. For example, the tendency to confuse observed changes in waste generation with the effects of waste prevention activities can lead analysts to spurious conclusions. In fact, the two activities may not be directly related. This point is illustrated in the example presented in Table 1-2.

Table 1-2. Waste Generation and Prevention in Two Communities

Community	Waste Generation		Population		Waste Generation Per Capita		1990 Generation Absent Prevention		Waste Prevented	Meets 10% Goal?
	1980	1990	1980	1990	1980	1990	Total	Per Capita		
A	1,000	1,050	250	300	4.0	3.5	1,200	4.0	150	Yes
B	1,000	900	250	200	4.0	4.5	950	4.8	50	No

Table 1-2 is based on two fictional communities, A and B, which have equal populations of 250 individuals. Community A experienced growth in waste generation between 1980 and 1990. However, Community A also undertook extensive and effective waste prevention initiatives, avoiding the generation of 150 tons of waste in 1990, and so met a goal of preventing tonnage equal to at least 10 percent of 1980 generation. Community B undertook less extensive or effective waste prevention initiatives and so, despite declining waste generation, did not meet the 10 percent goal.

The information presented for Community A is typical of the experience of the U.S. as a whole. Between 1980 and 1990, municipal solid waste generation in the U.S. grew substantially, both in total quantity generated (from 151.8 million tons to 205.3 million tons) and on a per-capita basis (from 3.66 lb/person/day to 4.51 lb/person/day). At the same time, many communities made substantial progress in waste prevention. Both of these points are well-documented in the U.S. EPA's *Characterization of Municipal Solid Waste in the United States: the 1998 Update*. The data for Community B are typical of what one finds in areas with population declines,

reinforcing the concept that there is not necessarily a direct correlation between changes in waste generation and the extent of waste prevention.

The example demonstrates that waste prevention cannot be evaluated simply by looking at changes in the total waste generation. Rather, measuring the amount of waste prevented requires separating actual waste prevention results from external forces that can affect waste production rates, such as declining populations or reduced industrial productivity. Developing such data and measurement techniques is the focus of the work presented in this report.

Direct measurement also is difficult due to the reluctance of private collection services to share data on waste quantities hauled due to concerns regarding release of competition-sensitive information. As a result, jurisdictions in which private haulers operate often have difficulty measuring the total quantity of waste generated.

Cost Analysis

One of the difficulties in using cost analysis for measuring private sector source reduction is that such measures are specific to a firm, and may be proprietary. Moreover, those firms willing to provide data may choose not to use discounting or may use a discounting methodology other than net present value, such as payback period or internal rate of return. Financial data presented in such varying formats do not allow for easy calculation of aggregate discounted source reduction costs. However, the cost analysis method does allow actual or estimated aggregate costs across a community to be evaluated using discounted cash flows. The accuracy of the net present value approach for community-level analysis will depend on the quality of the financial estimates used.

Indices

While clearly applicable to individual business locations or plants, the resource productivity measure is difficult to apply on a community level. Detailed information on the costs of individual products are difficult to track through published financial statements, particularly if the firm produces more than one product. To produce accurate, aggregate, community-level resource productivity measures would require data from individual firms.

Program Potential

The U.S. EPA Source Reduction Program Potential estimates provide a planning tool that is convenient and relatively easy to use, but it only allows for measurement of potential reductions as opposed to actual reductions. It does, however, provide a benchmarking methodology that could be useful in initial program planning stages.

Demand-Side Management

DSM measurement techniques used in the utility industry have more abundant and more reliable direct measurement data available because of the commodity nature of electricity. Applying

DSM principles and practices to the measurement of waste prevention raises the same issues that affect direct measurement.

Beyond the practical problems associated with the collection of data, experience in the evaluation of DSM programs reveals important methodological issues that affect the development of impact estimates and the presentation of program results. The same issues are important for waste prevention. The approach taken for each group of issues in this report is discussed briefly below:

- **Excluding "Free Riders."** Waste prevention programs target specific activities. Ideally, program evaluations should *exclude* the portion of the activity that would have taken place in the absence of the program ("free riders"). Otherwise, the amount of waste prevented by the program may be overstated.[14]

- **Including "Repeaters" and "Free Drivers."** Once influenced by a program, some participants will continue the activity without further program contact ("repeaters"). In addition, others will be influenced by the program without making direct contact with the program sponsor ("free drivers"). The waste prevented by these two groups should be *included* in the estimate of waste prevented through the program, if possible, since had the program not existed, these groups would not be preventing waste. Otherwise, the amount of waste prevented by the program may be understated.

The terms "free rider," "repeater," and "free driver" are used, above, following standard usage in the area of DSM program analysis.[15] Experience with DSM program evaluation illustrates the difficulty of identifying free riders, repeaters, and free drivers, and quantifying the impacts of their waste prevention actions. Accounting for these factors can complicate evaluation plan development and implementation.[16]

Furthermore, many of the DOS programs create what economists refer to as "beneficial externalities." The following example illustrates this concept:

> A backyard composting education program may be paid for by the Department of Sanitation because it reduces costs for the agency, since residents who compost at home reduce the amount of yard waste set out for collection and management by DOS. However, the program also benefits producers, distributors, and retailers who sell backyard composting equipment in New York City.

In this example, the primary DOS objective is to reduce its costs and enhance its waste management efficiency by minimizing the amount of yard waste that must be collected and managed for recycling or disposal. However, in doing this, DOS provides a service (promotion of an activity that may result in New Yorkers purchasing composting equipment), which benefits businesses. These businesses are beneficiaries ("free riders" in the environmental economics sense), although this is a rather different use of the term free rider than was introduced previously. To avoid confusion, the term "free rider" will not be used in the environmental economics sense. The costs and benefits of DOS waste prevention programs associated with these beneficiaries will, however, be discussed in this report.

1.3 Framework for Measuring the Success of New York City's Programs

To evaluate the impact of waste prevention, the sources of waste prevention must be identified. The question is, what qualifies as waste prevention? Clearly, the impacts of waste prevention programs sponsored by the City and others must be included. However, other non-programmatic sources contribute to waste prevention as well.

Two possible approaches for quantifying cumulative impacts were considered in the preparation of this report. The first, bottom-up estimation, involves adding up the total quantity of waste prevented by individual waste prevention activities and developments. The second approach, top-down estimation, derives aggregate impacts based on an estimate of the anticipated quantity of waste that would have been collected, in the absence of waste prevention. A review of the relative merits of the two approaches, in the context of the availability of data needed for applying each approach, resulted in selection of the bottom-up estimation approach as the only viable, defensible, and practical method for quantifying the cumulative impacts that are presented in this report. The rationale for selecting this approach is presented in Chapter 3.

The first step in applying the bottom-up approach is identification of the individual waste prevention activities and developments to include in measuring aggregate impacts. This process relies heavily on the data available to characterize the waste prevention programs. The waste prevention activities addressed in this report are the following:

- **City Programs and Related Activities.** This category includes 13 DOS programs and one DCAS program for which evaluation plans have been prepared, as well as additional waste prevention impacts attributable to independent activities related or similar to those programs.

- **Non-City Programs.** This category refers to waste prevention programs and activities with sponsors other than the City.

- **Underlying Trends.** This category includes changes in the economy, such as materials substitution, which may not necessarily be intended to reduce waste generation but, nevertheless, have that effect.

1.4 Limitations on the Evaluation of City Waste Prevention Programs

New York City has undertaken a wide range of ambitious waste prevention programs and initiatives. For individual programs, this report provides program evaluation plans based on initial estimates of the tonnage of waste prevented, and projections into the year 2002. In quantifying the impact of the City's waste prevention programs, the project team recognizes some key limits.

In general, the larger the number of program participants and the more dispersed they are, the more difficult it is to estimate the amount of waste prevention achieved. If a single business

implements a waste prevention program, it may be relatively simple to estimate the waste prevention achieved from procurement records, waste audits, and employee surveys. In contrast, when DOS conducts a large-scale business or residential waste prevention awareness and education campaign, contact with participants is often fleeting. The contact may occur during a brief site visit, at a city-sponsored seminar, through the mail, via a newspaper article, or through other methods for which cause and effect are difficult to observe, evaluate, and quantify. Further, to the extent that DOS projects affect multiple businesses, extrapolation of results from a small set to the larger universe may result in mis-estimation of impacts.

DOS has developed several waste prevention publications, including, but not limited to: 1) *Safeguard Your Home from Harmful Products*; 2) *It Makes Business Cents to Prevent Waste*; and 3) *Make Waste an Unwelcome Guest: The New York City Hotel Guide to Waste Prevention*. These publications were mailed to thousands of recipients throughout the City. The City does not know how many recipients implemented waste prevention activities in response to information presented in these materials. Contacting recipients is possible, but is time-consuming and costly. Designing and implementing a scientific, statistically significant survey to determine how, and to what extent, the documents were used would be even more expensive. For some waste prevention programs or activities, making the effort required to quantify the waste prevention achieved may not be cost justified, practical or even feasible. The cost of data collection makes some data unavailable under any circumstances.

The following three sections of this chapter explore the limitations to the evaluation of waste prevention in some detail.

- Section 1.4.1 discusses DOS's experience in attempting to evaluate the waste prevention impacts of its hotel waste prevention guide, *Make Waste an Unwelcome Guest: The New York City Hotel Guide to Waste Prevention*.

- Section 1.4.2 discusses the costs of surveys, a method often proposed for the evaluation of the impacts of educational (and other) waste prevention efforts.

- Section 1.4.3 discusses educational efforts and their relationship to waste prevention. Efforts such as the hotel waste prevention guide do lead to waste prevention.

The discussion of the limitations inherent in the evaluation of waste prevention is included in this report to reinforce the importance of accounting for these limitations when deciding whether, and to what extent, to fund evaluation.

1.4.1 DOS Evaluation of the Hotel Waste Prevention Guide

DOS's efforts to evaluate the waste prevention impacts of the distribution of its hotel waste prevention guide highlight the difficulties of measuring results attributable to a small-scale public education initiative. On March 18, 1996, the Hotel Association of New York City, Inc. mailed a copy of the DOS guide, *Make Waste an Unwelcome Guest: The NYC Guide to Hotel Waste*

Prevention, to the general managers of 115 hotels on its membership roster. DOS staff called each of the 115 hotel managers. Response rates for the survey were as follows:

- In the initial telephone survey conducted from June 13 to 19, 1996, 67 hotel managers spoke to DOS staff, and 13 indicated that they forwarded the guide to other individuals, including assistant general managers, housekeeping directors, building engineers, and food and beverage directors.

- In August 1996, DOS sent a follow-up survey via facsimile to the 48 hotel managers whom DOS staff did not reach in the first round of calls. Ten of the hotels responded; nine of the ten replied that the guide was useful and that they planned to implement practices described within the guide. Of these nine, three did not provide any response to the request for information on the waste prevention practices they intend to implement; one listed only recycling practices that they plan to implement; two responded that they were still discussing which practices they may implement or did not indicate which practices they planned to implement; and one responded by listing practices that they already are implementing (implying that they actually are not planning to implement any additional waste prevention practices).

DOS contacted 77 of 115 hotels (67 percent of the target audience). However, DOS reported that of the 115 hotels surveyed, only two hotels provided information on the specific waste prevention practices they intend to implement as a result of receiving the guide. The results of this survey effort illustrate various limitations to measuring the impact of an educational initiative, and using surveys to facilitate the evaluation. These include:

- Although the universe of hotels targeted for waste prevention was only 115, more than 50 hours of staff time was required to conduct limited follow-up intended to evaluate the waste prevention impact of the guide. A broader campaign targeting more generators would require expenditure of significantly more hours of staff time.

- The evaluation approach used involved conducting a qualitative analysis. For those hotels that indicated they planned to institute waste prevention practices as a result of receiving the guide, quantifying the impact would require extensive, subsequent follow-up by DOS.

- Although DOS reported that only two of the surveyed hotels listed the waste prevention practices they intended to implement as a result of receiving the guide, additional hotels may have implemented waste prevention practices that they chose not to report to DOS, or hotels may not yet have decided whether and/or which practices they would implement at the time of the survey. It is possible that the public education impact of the guide planted a "seed" in the mind of hotel managers or staff who ultimately will pursue waste prevention strategies.

- The evaluation relied on self-reporting by surveyed hotels and such data should be verified independently. However, verification would require permission from the surveyed hotels to examine their operations and records and additional DOS staff time

to ascertain whether or not hotels actually implemented reported waste prevention practices.

These findings highlight the difficulties of measuring waste prevention that may be achieved from a waste prevention education initiative. The production and distribution of the hotel waste prevention guide may result in waste prevention by New York City hotels. However, the limited resources that DOS could devote to the effort were insufficient for a thorough and exhaustive evaluation. The extensive staff time and resources that would have been necessary to fully evaluate and verify the waste prevention impact of this initiative in a statistically valid manner do not appear to be justifiable. The publication cost less than $10,000 to produce and distribute.

DOS is appropriately trusting the results of its qualitative research. Furthermore, DOS's survey indicates that the guide was deemed useful by all ten of the hotels that responded to the written survey. Prior to publication, a peer review process involving review and comment on the guide by the NYC Hotel Association and several member hotels was followed to reinforce the suitability of the format and content of the Guide. Presumably, many other hotels may have deemed the Guide useful, but did not take the time to complete and submit the written survey.

1.4.2 Use and Cost of Surveys in Waste Prevention Program Evaluations

At various points in the discussion of evaluation plans for waste prevention programs, the question of conducting surveys arises. While DOS utilized surveys in the past, this report keeps recommendations for their use to the minimum. The main reason is cost. Obtaining statistically valid estimates of the impact of a particular program often involves sample sizes in the hundreds, or even in the thousands. In general, sampling on this scale is simply not justifiable as part of the evaluation of waste prevention programs. Rather than being governed by the need to achieve specific levels of confidence and accuracy, the scope of sampling in the program evaluation process should be determined by the importance of the topic to be sampled, the cost of the sample, and the quality of the information likely to be produced by a survey.

The recommendations concerning survey use presented in this report are based on information on sample sizes and survey costs drawn from survey research and DSM program evaluation literature. This information is presented in summary form in the remainder of this section.

The procedure for developing statistically-valid data based on surveys rests on the use of random samples. Surveys are administered to a random sample of the population under study. Statistics provide a wealth of information concerning the sample size required to estimate a particular quantity, such as the fraction of NYC households who currently donate or sell reusable items. Depending on the particular item to be quantified, sampling procedures and formulas governing sample sizes can vary greatly.[17] However, in all cases, to meet accepted standards of statistical accuracy, relatively large samples are required. For example, to obtain an estimate of a simple quantity, such as the fraction of households donating or purchasing reusable items with an accuracy of plus or minus 5 percent, a random sample of about 400 households would be needed.[18] Complex surveys, involving the use of control groups or division of the sample into subgroups, can often require much larger sample sizes.

There are three basic types of surveys: mail, telephone, and in-person interviews. All have been used extensively in DSM program evaluation. Based on the DSM experience, in general, the costs for a professional firm's services per completed survey response are $15 to $40 for mail, $25 to $60 for telephone, and $150 to $300 for interviews.[19] Using mid-range values of the cost per completed survey, the cost of obtaining data from a sample of 400 respondents would be $11,000 for mail, $17,000 for telephone, and $90,000 for interviews. These estimates represent the cost a market research or similar professional firm might charge the program sponsor for conducting such surveys. These estimates do not include the in-kind costs to the program sponsor for contract oversight and other time spent on the survey.

In considering the value of survey information to DOS, it is useful to relate the survey cost to the magnitude of DOS savings produced by waste prevention programs. In principle, waste prevention could lower DOS costs for recycling as well as trash collection and disposal. However, as a practical matter, waste prevention programs are very unlikely to affect recycling or waste collection costs. This is because savings in collection costs would occur only if waste prevention was so significant as to enable DOS to reduce the number of its collection routes, or otherwise reduce resources dedicated to make changes in its collection infrastructure, as a result of a particular waste prevention program. No single waste prevention program is anticipated to offer this potential level of impact. In combination, the projected reduction in waste generation is expected to be roughly 2.5 percent of the 1992 waste stream when only programs evaluated in Chapter 2 of this report are included. As discussed in Chapter 3, other factors, including reductions attributable to packaging and reuse trends, as well as non-New York City operated programs, will increase the projected reduction in waste generation to six percent of the 1992 waste stream.

The principal benefit of waste prevention programs to DOS is the avoidance of disposal costs, reflected, for example, in the City's export disposal costs of approximately $70 per ton in 1999. This cost per ton is significantly higher than the $41.50 current per ton cost of disposal at the City's one remaining landfill, Fresh Kills. The City and the State of New York have committed to closing Fresh Kills at the end of 2001. Based on the $70 figure, a DOS waste prevention program would have to prevent the generation of about 157 tons of waste simply to pay for the review and analysis of 400 completed mail surveys. To cover the costs of 400 completed interviews, the waste prevention figure rises to 1,286 tons of solid waste, and these figures do not include the cost of designing and implementing a program that achieves this waste prevention. Substantially higher levels of waste prevention would likely need to be achieved to cover these additional costs.

When considering how much to spend on surveys, it also is important to take into account the quality of the information likely to be produced. Experience in DSM program evaluation using surveys to obtain information on consumers' electricity consumption and types of electrical appliance used provides a cautionary note:

> "Mail surveys often have low response rates and high error rates. Response rates for mail surveys can be 5 to 10 percent in commercial surveys and 20 to 40 percent for residential surveys. High error rates result from a lack of incentive to complete the survey, carelessness, ambiguity, and lack of supervision of the respondent. Telephone

surveys generally have higher response rates and lower error rates than mail surveys. However, with the increased use of telemarketing by businesses, the public is becoming increasingly wary of unsolicited calls, and researchers are reporting difficulties in getting an adequate sample. Respondents to a telephone survey . . . often can provide only a very general indication of the types of appliances they have."[20]

The experience of DSM program sponsors is consistent with the DOS experience using surveys:

- The DOS survey of hotels concerning receipt and use of the hotel waste prevention guide produced a 67 percent response rate, but the qualitative information collected did not lend itself to a thorough evaluation of the success of the brochure. Respondents reported finding the brochure useful, but provided limited information on programs that would be implemented.

- DOS commissioned a professional survey that focused on New Yorkers' donations of second-hand goods. The market research firm that conducted the survey stated that, for its question on the weight or volume of donations made in the previous year, "New Yorkers had great difficulty in quantifying their donations . . . the data from this question seems (sic) very unreliable and possibly misleading."[21]

These two examples do not reflect problems with the survey efforts. Rather, the results of these two surveys point to real limits on the usefulness of data produced by mail and telephone surveys.

The preceding discussion is not meant to suggest that the use of surveys for DOS program evaluation should be avoided. In some cases, surveys can be a useful tool to collect information. However, when surveys are conducted, the size of the survey cannot be determined through the application of strict statistical methods.[22] Rather, the survey must be designed in light of the costs involved as well as the quality of information likely to be produced. These constraints often result in the decision to forgo large, random samples or professionally-conducted surveys designed to achieve statistical validity.

1.4.3 Educational Efforts and their Relationship to Waste Prevention

The effects of educational efforts on waste prevention activities are mixed. Market research conducted by New York City in the spring and summer of 1996[23] evaluated public awareness of, and attitudes toward, waste prevention. The City conducted eight focus groups of 8-10 participants and a telephone study of 800 participants. The research indicated that, without education, most City residents could not distinguish between recycling and waste prevention. After the differences between the terms were explained, market research participants continued to confuse the terms waste prevention and recycling, often using them interchangeably. Participants in both the focus groups and the telephone survey recognized the importance of waste prevention, and indicated that they needed to be better informed about ways to prevent waste.

Participants in the New York City focus groups also expressed the need for manufacturer participation in waste prevention initiatives. They noted that consumers had limited opportunities to purchase products with minimal packaging. Conversely, however, participants

did not express a willingness to change brands to reduce packaging. This is consistent with findings in market research undertaken by the California Integrated Waste Management Board.[24] California focus group participants noted that consumers evaluate multiple factors when purchasing products, but only a subgroup of consumers consider the amount of waste a product will generate.

Evaluations of some educational efforts indicate that they can be effective in promoting waste prevention. As detailed in the evaluation plan on the DOS Unwanted Direct Mail Reduction Campaign in Section 2.2 of this report, DOS evaluated efforts to educate residents about the waste prevention associated with removing their names from direct mail lists. The effort was shown to be successful. New Yorkers' requests to stop receiving direct mail increased significantly in the time frame directly following the DOS's campaign.

The City of Blaine, Minnesota conducted a targeted public education campaign that included three mailings of informational publications, hand-delivery of a fourth informational packet by local Boy Scouts, and follow up, voluntary in-home waste prevention workshops. The effort was evaluated by comparing changes in the tons of waste generated and recycled per person in the targeted neighborhood against four non-participating control-group neighborhoods over a one-year period. Waste generation in the target zone decreased by 4.75 percent, after adjusting for reductions due to recycling.[25] It is not known whether or not waste preventing behaviors continued after completion of the intensive education campaign. Larger urban areas, such as New York City, are not likely to have the staff or financial resources to replicate the extensive educational outreach campaign conducted in Blaine. Therefore, the results from the Blaine study should be viewed as a high-end estimate of the reductions that could occur due to extensive educational outreach efforts.

Experience in the DSM area confirms the difficulties in measuring the impact of broad educational programs. In a comprehensive survey of DSM activities, utilities reported that they conducted hundreds of informational and educational DSM programs. However, rarely is any direct evaluation of these program results undertaken.[26] The issue here is not cost. Electric utilities routinely spend $30,000 to $160,000 to evaluate individual DSM programs.[27] Rather, the issue is the feasibility of performing any evaluation at all. One evaluator stated:

> "Various organizations, ranging from the federal government to individual utilities to private businesses, have, over the past 18 years, educated consumers about energy choices. These activities have generally been considered difficult, if not impossible, to evaluate . . ."[28]

While the difficulty of evaluation is acknowledged, educational programs were, and continue to be, offered by a wide range of sponsors over the last 22 years. The reason that these programs continue is simple: despite the difficulty in quantifying their effects, the sponsors are convinced that the programs do indeed reduce electricity usage. Where utilities expended effort and expense to evaluate the programs, the results confirm that: "Overall, programs that provided the public with information on how to conserve energy resulted in a measurable 4 percent reduction in use during the period studied."[29]

It is unlikely that the reductions attributable to energy conservation public education can be duplicated in the waste prevention arena. Consumers understand the costs of energy use and the savings that can result from conservation. Waste prevention education also can result in positive impacts, including heightened awareness of solid waste issues, greater participation in waste prevention and recycling efforts, and possibly a greater awareness of how a consumer's consumption pattern adds to or subtracts from the local waste generation rate. However, the larger the target audience and the broader the waste prevention message, the more difficult and expensive the waste prevention measurement effort is anticipated to be. For many waste prevention education campaigns, it may not be practical for a municipality to seek to measure the impacts of its waste prevention effort. Publications, such as those produced by DOS, can be an effective means of heightening public awareness of the benefits of waste prevention, and can serve as building blocks or tools for more targeted, measurable programs. However, it may not be practical or feasible to quantify the impacts of specific DOS publications.

For educational programs, some level of qualitative analysis can be useful. Public opinion polls, market research, and other methods can be used to solicit input from the targeted audience prior to instituting a waste prevention education campaign to maximize the likelihood that the campaign will be motivational and useful to the target audience. Focus groups and other peer review processes can help ensure that the waste prevention public education information and marketing approach is as effective as possible.

Publications can encourage readers to provide feedback on the usefulness of the information presented. This can be extremely valuable for developing large-scale effective waste prevention awareness and promotional campaigns, even if it is not feasible or cost-effective to measure the subsequent results. The qualitative approach generally is pursued by DOS for large-scale waste prevention education and consciousness-raising efforts, as well as other waste prevention initiatives, for which measurement may not be feasible or cost-effective. Unfortunately, qualitative waste prevention evaluation provides little or no guidance on how much money to spend on a waste prevention campaign; in particular, it does not show at what point diminishing returns may result in the costs of education (and evaluation of the education) exceeding the benefits. This may explain why government agencies are likely to have more difficulty justifying investments in waste prevention public awareness and education campaigns and, instead, may much more readily invest in solid waste programs for which impacts are more readily measurable.

1.5 Costs and Benefits of Waste Prevention

The evaluation plans presented in this report address the costs and benefits associated with DOS waste prevention programs. The costs and benefits of waste prevention programs will often be perceived quite differently depending on whether they are viewed solely from the perspective of the program provider, in this case DOS, or more broadly. This report will address issues related to costs and benefits from the perspective of DOS and from the perspective of "All Participants." Following the DSM model for program evaluation, "All Participants" is defined as both the service provider (usually DOS in this report), those whose waste is reduced, and those who derive other financial costs or benefits as a result of the waste prevention programs.

DSM analysts developed standard procedures for the development of costs and benefits.[30] The National Association of Regulatory Utility Commissioners' handbook, which describes these procedures, notes that the "All Participants" approach should capture a wide range of direct and indirect impacts. However, except in those cases where indirect impacts are readily apparent and quantifiable, the handbook limits "All Participants"-based calculations to an analysis of the costs and benefits incurred directly by the program provider and participants benefitting from the implementation of the program. The benefits generated by DOS programs for various segments of the population provide justification for seeking investments from program beneficiaries. This may explain DOS's success in establishing partnerships with numerous business assistance organizations and trade associations through its NYC WasteLe$$ Program and for other waste prevention initiatives.

In its 1996 report, *Local Lessons in Source Reduction: A Look at Six Planning Units in New York State,* INFORM echoes the DOS's views on the importance of recognizing All Participants' Benefits. INFORM, while discussing the difficulties of quantifying source reduction, reports that "even where source reduction can be documented, the beneficiary may not be the solid waste authority running the program. For example, procurement savings for a business as a result of implementing a source reduction measure may not result in a reduced cost per ton for the municipality." The report continues with the statement that this ". . . may place an undue burden on the solid waste authority to achieve those benefits—unless the authority takes steps to leverage resources and capitalize on the benefits generated by government-sponsored source reduction programs."

Focusing on the All Participants perspective for DOS programs provides evidence of the benefits that participants in DOS waste prevention programs receive. This evidence can be used by DOS to pursue co-funding arrangements for its programs which may, in turn, enable DOS to stretch its limited resources. It also allows DOS to share the costs of program implementation as equitably as possible, by re-distributing at least a portion of its costs from the general tax revenue fund to the primary beneficiaries.

The inclusion of information on costs and benefits from the All Participants perspective is squarely in the mainstream of program evaluation methodology. Among the vast numbers of cost-benefit analyses performed on DSM programs, by far the most common approach is the All Participants perspective.[31] Additional discussion of the usefulness of All Participants data on costs and benefits will be provided after the impacts of the DOS programs are presented.

2. WASTE PREVENTION PROGRAM EVALUATION PLANS

The City has undertaken a wide range of waste prevention programs; however, this report focuses particular attention on the programs undertaken by DOS[32] and the Department of Citywide Administrative Services (DCAS). For individual waste prevention programs, this report provides program evaluation plans. Measurement of the tonnage of waste prevented currently, and in the year 2002, is addressed. Every reasonable effort has been and will be made to quantify the impacts of the City's waste prevention programs. However, as discussed in Chapter 1, there are important limitations to this effort. This chapter provides program evaluation plans for thirteen DOS programs, including:

- *NY Wa$te Match;*
- *NYC Stuff Exchange;*
- *NYC WasteLe$$;*
- Unwanted Direct Mail Reduction Campaign;
- Materials for the Arts (co-sponsored by NYC Department of Cultural Affairs);
- Outreach to Chinese Restaurants;
- Outreach to Dry Cleaners;
- Outreach to Grocery Stores;
- CENYC Waste Prevention Assessments (performed by The Council on the Environment of NYC and co-sponsored by the NY State Department of Economic Development);
- *NYCitySen$e;*
- Botanical Gardens Composting Projects;
- DOS Outreach and Education Programs; and
- Training for Local Development Corporations.

This chapter also addresses the waste prevention efforts of the New York City Department of Citywide Administrative Services (DCAS), Division of Municipal Supply Services (DMSS), Office of Surplus Activities.

Section 2.1 discusses the design and content of the program evaluation plans. Section 2.2 contains the fourteen evaluation plans examined to date. These plans and the results provided should be viewed as preliminary.

2.1 The Structure of the Program Evaluation Plans

Chapter 1 presents the conceptual framework for the program evaluation plans in this chapter. Evaluation plans for the City's waste prevention programs are designed to summarize and present relevant data on each program's focus and approach, current and anticipated impact

on waste generation, and other impacts. As noted in Chapter 1, each evaluation plan has six sections:

1. **Program Summary.** This section provides a brief overview of the program.

2. **Comments on DOS Approach.** Describes measurement procedures undertaken or anticipated by DOS and provides a qualitative evaluation of those measurement procedures.

3. **Program Evaluation Recommendations.** If applicable, recommended, potentially cost-effective strategies for enhancing DOS evaluation methods are discussed in this section.

4. **Waste Prevention Impacts.** For programs completed or in progress, this section provides estimates of the quantity of waste prevented. For programs anticipated or under development, similar estimates, based on anticipated performance, are provided where possible.

5. **Other Impacts.** This section addresses impacts other than tons of waste prevented. A table presenting solid waste system impacts, economic and environmental impacts and financial indicators is included with each evaluation plan. Other Impacts reflect the program's current waste prevention impacts.[33] The approach used is described below.

6. **Waste Prevention in 2002.** Estimated tonnage to be prevented by the program in 2002 is discussed in this section and, to the extent possible, quantified. In some cases, options for increasing program impact also are noted and discussed .

The evaluation plans included in this chapter analyze Other Impacts in addition to waste prevention tonnage. The methods used for that analysis and the results obtained are described in Table 2-1. Table 2-1 provides both a description of the methodology used to analyze Other Impacts, and a set of sample calculations illustrating the application of the methodology. Table 2-2 presents a description of additional data elements used in association with the Other Impacts analysis, the value of the data element, variations in the value of the number, and a brief description of the source of the data.

In Table 2-1, the Other Impacts evaluated for each program are listed in the first column. For those impacts for which estimation is reasonable and practical, the procedures used rely on "multipliers" and "factors." For example, reduction in solid waste volume is estimated by applying standard material density factors to program-specific estimates of tonnage reductions. The multipliers and factors are identified, and their use is illustrated in columns 2 and 3. The "sample calculations" presented are based on an office paper reduction program that prevents 500 tons of office paper use per year for five years at a total cost of $700,000. This example provides a simple illustration of the general approach to the analysis of Other Impacts, to avoid problems associated with incomplete data and other difficulties confronted in the analysis of actual programs.

The final portion of Table 2-1 presents analysis of costs and benefits and a discussion of payback periods. In addition to reducing waste, DOS waste prevention programs have financial costs and benefits that can look quite different, depending on whether the focus is on the DOS perspective alone, or on All Participants in a program (see also Section 1.5 of Chapter 1).

When estimating Other Impacts, even the simplest and most apparently straightforward calculations can raise significant issues. Consider, for example, the "reductions in recycling" as it might relate to a simple office paper program. There are two impacts that a waste prevention program could have on the amount of paper collected for recycling: it could prevent tonnage that otherwise would have been recycled (thereby lowering the annual tons recycled and diminishing the Department's expectations of achieving its annual tonnage mandates); and/or it could lead to "increased awareness" of waste, thereby contributing to increased recycling of the paper that previously would have been disposed. To fully account for these impacts, it would be necessary to determine the recycling behaviors of those involved in the waste prevention effort. This is not feasible. Instead, the calculations presented here assume that, absent waste prevention, paper diverted from disposal would have been recycled at the average recycling rate. In general, the procedures used make the best use of available data. Where program-specific data are available, that information is incorporated into the analysis.

Table 2-1 Assumptions and Methodologies Used to Calculate Impacts of Waste Prevention Programs Other Than Reductions in Tonnage

Impacts	Methodology Description	Sample Calculation
Solid Waste System Impacts		
Waste Prevention (in tons)	Calculated in Section 4 of Program evaluation plans.	500 tons of paper
Waste prevention (in cubic yards)	Divide Waste Prevention (in tons) by a density factor. The 1992 New York City Solid Waste Master Plan includes standard sets of density factors for many materials.[34] For programs that reduce several materials, use an average density factor of 0.14175 tons/cubic yard (loose), per 3/92 draft of NYC SWMP, Appendix Volume 1.2, Appendix 1-K, Exhibits 5-1, 5-2.	Office paper has a density of 0.1125 tons per cubic yard 500/0.1125 = 4,444 cubic yards
Reductions in Recycling (in tons)	Estimate percentage of Waste Prevention (in tons) that would have been recycled and multiply it by Waste Prevention (in tons). Use City recycling data for residential and institutional waste, and private carter recycling data for commercial establishments.	According to the 1996 NYC SWMP,[35] 21% of private carter collected MSW is recycled. 500 x 0.21 = 105 tons

Table 2-1 (continued) Assumptions and Methodologies Used to Calculate Impacts of Waste Prevention Programs Other Than Reductions in Tonnage

Impacts	Methodology Description	Sample Calculation
Reductions in Recycling Collection Costs	Multiply Reductions in Recycling (in tons) by the cost of recyclables collection. If DOS collects the material, use DOS costs. Reductions in Recycling Collection Revenues are not calculated because markets are too volatile to estimate impacts.	$0/ton. No collection cost savings are assumed since marginal effects of waste prevention on recycling programs are likely to be too small to result in significant savings; fixed costs of the program will not be affected. In fact, to the extent that generation of recyclables is prevented, the cost per ton for collection may rise due to the existing underutilized recyclable collection capacity of the NYC collection fleet. $0/ton x 105 tons = $0.
Reductions in Garbage Collection and Disposal Costs	Subtract Reductions in Recycling (in tons) from Waste Prevention (in tons), yielding Reductions in Disposal (in tons). Because an enormous quantity of waste would have to be prevented to affect DOS collection services, this report assumes there will be no change in collection costs. Multiply Reductions in Disposal (in tons) by the cost of garbage disposal. If DOS collects the waste, use the City's cost of disposal at Fresh Kills ($41.50/ton) or export ($70.00/ton). For DOS collected waste, assume 100% disposal in Fresh Kills in 1998 ($41.50/ton), 50% disposal at Fresh Kills and 50% exported in 1999 ($55.75/ton composite rate), 25% disposal at Fresh Kills and 75% exported in 2000 ($62.88/ton composite rate), and all exported for 2001 and beyond. If a private carter collects the waste and the cost of disposal at private landfills is available, it should be used. If it is not available, the City's cost of disposal at Fresh Kills, which is lower than the expected cost of disposal at private landfills, should be used. For commercial generators who reduce a substantial portion of their waste stream, use savings resulting from recycling as reported on p. 2-3 of the 1996 NYC SWMP Final Update (p. 2-31) as a proxy for Reductions in Garbage Collection and Disposal Costs. The NYC SWMP indicates that commercial establishments pay an average of $7 per cubic yard recycled, as opposed to the maximum legal limit of $12.20 per cubic yard hauling/disposal fee for non-compacted waste removed by private haulers, a savings of $5.20 per cubic yard. The actual avoided cost will depend on the density of the material and whether or not the material is compacted by the generator (the maximum legal limit is currently $30.19/compacted cubic yard). For commercial programs which target a mix of material, use $54.32/ton as the avoided disposal cost.[36]	500 - 105 = 395 tons Assuming density of 0.1125 tons/cu. yd: 1 Ton/0.1125 tons/cu. yd. = 8.89 cu. yd./ton 8.89 cu. yd./ton x $5.20/cu. yd. = $46.23/ton, savings in commercial garbage collection costs for this office paper program would be $46.23/ton. 395 tons x $46.23/ton = $18,260.85

Table 2-1 (continued) Assumptions and Methodologies Used to Calculate Impacts of Waste Prevention Programs Other Than Reductions in Tonnage

Impacts	Methodology Description	Sample Calculation
Reductions in Landfill Capacity Required (in cubic yards)	Divide Reductions in Disposal (in tons) by an in-landfill density factor. Use the City's in-landfill density if available. Otherwise, use default conversion factor of 0.60 tons per cubic yard.[37]	395 / 0.60 = 658 cubic yards
Reductions in Landfill Capacity Required (in cubic yards): Local Region	Multiply Reductions in Landfill Capacity Required (in cubic yards) by the percentage of the material disposed in the local region. Use the City's information, if available.	The 1996 NYC SWMP (p. 5-8) indicates that 2% of commercial garbage was sent to Fresh Kills. 658 x 0.02 = 13 cubic yards
Reductions in Landfill Capacity Required (in cubic yards): Export	Subtract Reductions in Landfill Capacity Required: Local Region from Reductions in Landfill Capacity Required.	658 - 13 = 645 cubic yards
Prevention Program Financial Indicators		
Reductions in Procurement Costs	Multiply Waste Prevention (in tons) by the estimated procurement cost per ton. For programs which reduce a small number of materials, use the average purchase costs for all items in the waste category. Otherwise, use the procurement cost of the primary material as an estimate of the average procurement cost per ton of materials in the waste stream.	Current retail prices for office paper are approximately $1,340 per ton. $1,340 x 500 = $670,000
Cost of Implementing Waste Prevention Program	Use information on the costs of implementing the program collected from both DOS or other program sponsors and the program participants. If unavailable, use generic estimates based on case studies. Costs are for lifetime of program, not just one year. Program costs include costs such as labor, printing, and mailing costs.	Assume DOS costs to be $200,000 and the program participants' costs to be $500,000. $200,000 + $500,000 = $700,000
All Participants Payback Period	All Participants Payback Period is equal to the Cost of Implementing Waste Prevention Program divided by the sum of one year's Reductions in Recycling Collection Costs, Reductions in Garbage Collection and Disposal Costs, and Reductions in Procurement Costs.	$700,000 / ($0 + $26,860 + $670,000) = 1.00 years
DOS Payback Period	DOS Payback Period is equal to the DOS cost of implementing the waste prevention program divided by DOS annual savings from the program. Although there is no direct financial payback, other benefits include reduced demand for regional disposal capacity, education of employees who may sensitize others, and related indirect benefits.	DOS does not collect commercial waste, therefore, for programs that do not affect the DOS collected waste stream, the DOS investment is never repaid.

Table 2-1 (continued) Assumptions and Methodologies Used to Calculate Impacts of Waste Prevention Programs Other Than Reductions in Tonnage

Impacts	Methodology Description	Sample Calculation
Net Annual Amortized Savings of Waste Prevention to All Participants	Sum each year's Total All Participants Savings (including Reductions in Recycling Collection Costs, Reductions in Garbage Collection and Disposal Costs, and Reductions in Procurement Costs) and subtract the total Cost of Implementing the Waste Prevention Program. Then divide by the lifetime of the program and subtract. If no information is available on lifetime of program impacts, assume 5 years.	[5 x ($0 + $26,860 + $670,000) – $700,000]/5 = $556,860
Net Annual Amortized Savings of Waste Prevention to DOS	Calculate the DOS savings (reductions in garbage disposal costs from DOS- collected sites plus reductions in procurement costs to DOS, if any). Divide the DOS cost of implementing waste prevention measures by the lifetime of the program and subtract.	Because DOS does not collect from commercial sites, its direct savings are $0 and indirect savings are not measurable. ($0 - $200,000) / 5 = -$40,000

Table 2-2 Additional Data Used in Calculations of Waste Prevention Programs Other Than Reductions in Tonnage

Data Element	Value(s) Used	Program Analysis	Basis	Source
Density Factor (tons/cubic yard)	0.14175 tons/cubic yard	All analyses except Dry Cleaners	Loose density of mixed institutional waste	NYC SWMP compaction tests
	0.08601 tons/cubic yard	Dry Cleaners	Loose density assuming 94.3% steel (hangers) and 5.7% polyethylene (dry cleaner bags)	
% of Waste Recycled	21%	All analyses except those below	Average private carrier rate	FY 95 SWMP
	1.1%	Dry Cleaners	December 1993 Survey and Letter	DOS
	0.95%	Grocery Stores	Weighted average percent of plastic and paper bags recycled	NYC Composition Analysis research
In-Landfill Density Factor	0.6	All	Default data developed for NY state	Tellus Institute, *New York State Waste Plan Default Data Report*, 1994

Table 2-2 (continued) Additional Data Used in Calculations of Waste Prevention Programs Other Than Reductions in Tonnage

Data Element	Value(s) Used	Program Analysis	Basis	Source
% of Waste – Commercial	100%	NY Wa$teMatch NYC WasteLe$$ CENYC	Programs do not include households	DOS
	70%	Materials for the Arts	Materials accepted from both commercial and residential sources	
	0%	NYC Stuff Exchange Unwanted Direct Mail Chinese Restaurants Dry Cleaners Grocery Stores	Programs only include households and facilities where DOS collects waste	
% of Waste – Residential	0%	NY Wa$teMatch NYC WasteLe$$ CENYC	Programs do not include households	DOS
	30%	Materials for the Arts	Materials accepted from both commercial and residential sources	
	100%	NYC Stuff Exchange Unwanted Direct Mail Chinese Restaurants Dry Cleaners Grocery Stores	Programs only include households and facilities where DOS collects waste	
Waste Disposal Cost ($/ton)	$54.32 commercial $41.50 DOS 1998 $55.75 DOS 1999 $62.88 DOS 2000 $70.00 DOS 2001 and beyond	All analyses	Commercial cost used where % of waste-commercial is 70% or 100%. DOS cost used where % of waste-residential is 100% or 30%. DOS cost reflects progressive increase in disposal cost per ton due to closure of Fresh Kills landfill and subsequent routing of waste to commercial landfills.	DOS

Table 2-2 (continued) Additional Data Used in Calculations of Waste Prevention Programs Other Than Reductions in Tonnage

Data Element	Value(s) Used	Program Analysis	Basis	Source
Procurement Cost ($/ton)	$100/ton	All analyses except as noted below	Based on estimates that waste prevention saves businesses approximately $100 per ton	Long Island City Business Development Corporation
	$10,000/ton	NYC Stuff Exchange	$5/lb. estimate assumes used clothes sell for $1/lb. and new clothes sell for $6/lb. The new clothes price is very conservative and is based on a sales price of $3 for a shirt and $6 for a skirt or pants.	Tellus estimate
	$574/ton	NY Wa$teMatch	Savings of $168,239 reported by users divided by 293 tons of waste prevented	DOS
	$5,339/ton	Materials for the Arts	FY 98 Donation Value of $2,264,455 ÷ 424.12 tons of donations	Materials for the Arts FY 98 Annual Report
	$1,189/ton	Chinese Restaurants	(Average on-food container single use procurement cost of $2,378 x 600 participating restaurants)/1200 tons of waste potentially prevented	SAIC estimate based on DOS data
	$1,740/ton	Dry Cleaners	$30 per case of 500 hangers x (1 ÷ case weight of 0.017 tons/case). Bag costs not included.	SAIC estimate
	$2,297/ton	Grocery Stores	(133,333 plastic bags/ton x purchase cost of $0.02/plastic bag x 75% of bags used by groceries) + 16,949 paper bags/ton x purchase cost of $0.07/paper bag x 25% of bags used by groceries)	NYC WasteLe$$ research data. Groceries indicated that 75% of bags used were plastic and 25% were paper.
DOS Implementation Costs	Varies by program			

There are two features of the sample calculations of Other Impacts that deserve particular attention:

1. The office paper program provides substantial annual savings for the program participants while costing DOS $40,000 per year. This can be seen by comparing the DOS Net Annual Discounted Savings with the net savings for all participants. In programs with this pattern of costs and benefits, DOS should seek assistance from program participants to help defray program costs.

2. The program produces substantial environmental benefits. These benefits accrue to society as a whole, not just to DOS or the program participants. Since the analysis of financial indicators focuses on DOS and all participants, these benefits are not included in the calculation of discounted savings. This approach is consistent with standard procedures for DSM program analysis.

$$NPV = C + \sum_{t=1}^{n} \frac{CF}{(1+r)^t}$$

Finally, the sample calculations presented in Table 2-1 cover a one year period. In evaluating specific programs, it is recognized that savings (and potentially the program costs) will be realized over a multi-year period. In the program-specific evaluation plans, future costs and savings are discounted to current dollar values. The cash flows, both expenditures and savings, are discounted because the value of a dollar today is more than the value of a dollar tomorrow. In this report, discounting is achieved through calculation of the Net Present Value (NPV), which discounts future expenditures and savings by the rate at which these cash flows would have earned interest had they been invested in a risk-free investment. The equation for calculating NPV is shown above.

$$NPV = -\$1{,}000 + \frac{(\$500-\$100)}{(1+0.1)^1} + \frac{(\$500-\$100)}{(1+0.1)^2} + \frac{(\$500-\$100)}{(1+0.1)^3} + \frac{(\$500-\$100)}{(1+0.1)^4} + \frac{(\$500-\$100)}{(1+0.1)^5} = \$516.31$$

The equation means that you subtract the initial program cost (C), which is not discounted because it is in current year dollars, and add to it the sum (Σ) of the discounted cash flows (CF) for each year from the first year to a year (t) in the future. The cash flows equal savings less any additional expenditure. For example, if a program has a startup cost of $1,000 and subsequent annual costs of $100, and the program yields a cost savings of $500 per year beginning the second year, the NPV over five years at a 10 percent interest rate would be: $516.31.

A general rule of thumb is that projects showing a NPV greater than zero yield positive returns and should be undertaken. In this report, the interest rate (r) used is the yield on long-term debt issued by the New York Metropolitan Transportation Authority. As of June 18, 1999, this rate was 5.42%.

2.2 Evaluation Plans for DOS Waste Prevention Programs

This section includes a discussion of each of the waste prevention programs targeted for examination. The program summary provides a brief overview of the structure and goals of the program. Subsequent sections describe and discuss mechanisms for evaluation of the waste prevention impacts of each program and anticipated waste prevention through 2002.

2.2.1 Evaluation Plan for *NY Wa$teMatch*

1. Program Summary

NY Wa$teMatch is a reusable materials exchange funded by DOS through a five year Inter-Agency Agreement with the City University of New York (CUNY). The program facilitates exchange transactions for non-hazardous solid wastes for which there currently are not well-established reuse or recycling options. *NY Wa$teMatch* is intended to promote industry-to-industry transactions, although it also facilitates commercial and institutional waste exchanges on a small scale and is facilitating transactions among industry, non-profit organizations and government agencies. The project began on April 8, 1997; the budget for the first year was approximately $220,000; the budget increased to $222,000 in the second year. A reduction in the DOS contribution is expected in the third year, with additional funding to come from a $29,500 U.S. EPA grant for web site development. The Industrial Technology Assistance Corporation (ITAC) is under contract with CUNY to manage the *NY Wa$teMatch* program. Long Island City Business Development Corporation (LICBDC) is a subcontractor to ITAC, providing technical assistance, marketing, and materials exchange matchmaking assistance. These contractors are performing the following tasks:

- Refining the database developed earlier in the project. The database lists firms generating reusable solid waste materials ("generators") and firms seeking reusable solid waste materials ("recipients"), and tracks transactions. Where possible, *NY Wa$teMatch* invoices generators and users for a small percentage of their realized revenues and disposal and purchasing cost savings.

- Identifying industries, institutions, and commercial establishments interested in listing or receiving discarded solid waste materials through *NY Wa$teMatch*. The primary focus of this effort is the manufacturing sector of the City's economy.

- Facilitating transactions between recipients and generators.

- Promoting and advertising *NY Wa$teMatch*.

- Evaluating *NY Wa$teMatch*'s effectiveness in preventing waste, saving money for businesses, and otherwise meeting the objectives of the Department of Sanitation and the needs of the targeted businesses and organizations.

NY Wa$teMatch is designed to help businesses save money by promoting reuse of materials that otherwise would be discarded. *NY Wa$teMatch* also assists businesses by providing brokering

services between generators and potential reusers of industrial scrap, packaging, and other commercial wastes. Although reuse is the focus, some transactions may include recycling, if a reuse option is not available. The program is similar to other waste exchanges operating throughout the country, and builds on locally successful programs in Long Island City and East Williamsburg.

2. Comments On DOS Approach

NY Wa$teMatch is structured so that DOS can evaluate its performance by examining the cost per ton of waste diverted for reuse and recycling by the program, based on reports submitted by the contractors. DOS evaluates the performance of *NY Wa$teMatch* by examining the avoided disposal cost per ton of waste diverted for reuse by the program and other criteria. The tonnage associated with transactions that occurred or would have occurred without *NY Wa$teMatch* are excluded, if possible. Further, the tonnage associated with transactions made initially through *NY Wa$teMatch* that continue without the aid of the Service (continuing transactions) is included. To the extent that continuing transactions can be confirmed, the tonnage figures are incorporated into the annual total tonnage of waste prevented. In addition, DOS examines program achievements by reviewing:

- The number of completed transactions.
- Estimated revenues realized by the generator of the transacted material.
- Estimated decreases in the disposal costs of the generator of the transacted material.
- Estimated decreases in the purchasing costs of recipients of materials.
- Users' estimated total savings from participating in *NY Wa$teMatch*.
- Other qualitative factors such as the ease of arranging transactions.
- Results of publicity and outreach efforts.

3. Program Evaluation Recommendations

It is recommended that the tonnage of waste prevented by *NY Wa$teMatch* be estimated as the annual tonnage of waste reused, subject to three adjustments not previously considered by DOS:

1. *NY Wa$teMatch* promotes transactions between New York City businesses and others throughout the state and the country.[38] If the materials exchanged are not generated in New York City, then no New York City waste will be prevented as a result of the trade. Thus, materials originating from outside the City should be excluded from the estimate of City waste prevented. The recipient companies' cost savings, however, should be included in the total cost savings reported by the contractors to DOS.

2. For each completed transaction, to the extent feasible, the contractors should determine whether any of the material would have been reused or recycled in the absence of *NY Wa$teMatch* (for example, if the generator used *NY Wa$teMatch* to find a better price or a more convenient source).

3. To the extent feasible, it is important to document recipients and generators who make further transactions of the same or additional materials privately, after *NY Wa$teMatch* brings them together, to avoid underestimating the total amount of waste prevented by the program. A Texas waste exchange reports that 90 percent of the materials tracked are diverted through ongoing transactions.[39] While it is costly to identify, update and verify the status of spin-off relationships between generators and recipients, whenever possible, the quantities of materials reused through these continuing relationships between successful recipients and generators should be determined, in addition to the number of ongoing transactions.[40] Current data from the *NY Wa$teMatch* consultant team provide the number of ongoing and new transactions and the total quantity of waste diverted.

4. Estimated Waste Prevention Impacts

NY Wa$teMatch was launched in April, 1997 and two years of data are available. Table 2-3 below presents data for the first two years of the program.

Table 2-3. Results of Transactions Conducted Through NY Wa$teMatch

Category	Year 1: April 1997 - March 1998	Year 2: April 1998 - March 1999
Number of Transactions	153	266
Number of New Listings*	434	482
Amount of Waste Diverted	292.80 tons	1,376.54 tons
Savings/Revenues Realized by Businesses	$105,776	$142,666
Program Cost for DOS per Ton Diverted	$751.36	$161.27

* *NY Wa$teMatch started operations with 802 listings collected previously through LICBDC and a study done with Cooper Union.*

The Michigan Office of Waste Reduction set up a trial exchange program very similar to *NY Wa$teMatch* and found that, even after six months of operation, no transactions had been made.[41] In comparison, *NY Wa$teMatch* resulted in the diversion of 292.8 tons of waste in the first year and 1376.54 tons in its second year. It should be noted, however, that *NY Wa$teMatch* had the benefit of building upon the pre-existing Long Island City Business Development Corporation's Materials Exchange Program (MEP), operated by their Industrial Waste Recycling and Prevention (INWRAP) program staff.

In Year 2, *NY Wa$teMatch* experienced a dramatic increase in tonnage diverted, without a similar, proportional increase in the number of transactions and the savings/revenues for

participating businesses. This may be a function of the fact that the first year constituted the start-up phase of the program. Contractors were engaged in organizational efforts including development of the database and marketing materials. The fair market value of the materials may fluctuate dramatically from material to material and transaction to transaction.

5. Estimated Other Impacts

The primary focus of *NY Wa$teMatch* is industrial waste. Therefore, to the extent that *NY Wa$teMatch* leads to a reduction in commercial, institutional, government and not-for-profit organization waste, there will be reductions in the waste management costs for commercial entities, which may be calculated based on the methodology presented in Tables 2-1 and 2-2. This benefit can assist the efforts of DOS's contractors to seek additional, outside funding to support the program. In particular, reductions in business waste disposal and raw materials costs are among the Other Impacts that can support seeking funding from the businesses that benefit directly from program services.

The program generates fees for services paid by the businesses that benefit directly from the reduced disposal or purchasing costs attained through waste exchanges. User fees provided approximately $15,000 in revenues during the first two years. In addition, those who have a mandate or vested interest in serving the business community and promoting business sustainability and competitiveness in New York City, such as business assistance agencies, trade groups, and other non-governmental organizations, are potential funders and future program sponsors. Additional funding sources included grants from The New York Community Trust of $30,000 over two years and $7,500 from ConEdison in 1999.

6. Waste Prevention Projections In 2002

Based on estimates by the contractors for *NY Wa$teMatch*, DOS expects that in 2002 a total of 260 transactions will divert 1,448 tons of waste and result in savings to All Participants of $213,855. The projected figures conservatively anticipate that the *NY Wa$teMatch* program will enter a steady state in 2000, with the anticipated number of transactions, tons diverted, and savings realized running at or near these levels through 2002. This estimation is reasonable, in that it recognizes that all of Fiscal Year 1998 and the first Quarter of 1999 represent the start up period for the program. Since no significant expansion of the program is planned, 2001 and 2002 are projected to continue operations at the same steady state. However, establishing the web site, refinement of contractors' roles and expanded publicity anticipated to begin during 1999 should enable the program to exceed its goals.

It should be noted that despite a significant decline in the program cost per ton from $750.85 to $151.94, current calculations still indicate a negative return on its investment for DOS. This program benefits the commercial sector, which is projected to realize savings with a net present value of over $890,000. DOS, however, will realize no savings, since it does not manage the prevented waste. Annual savings to All Participants may be more significant than the total dollar amount indicates since *NY Wa$teMatch* serves a niche market of smaller companies who generate limited quantities of low value-added materials for reuse or recycling. The average of $574 savings in procurement costs per ton may be significant in the context of the small business

community. Also, *NY Wa$teMatch* contractors believe that their dollar savings and tonnage amounts are highly accurate, unlike other exchanges where open listings allow transactions to be completed without direct assistance of the program. For open listing programs, data are based on surveys that, in some cases, reportedly represent less than 20 percent of listings.

A successfully implemented alternative funding plan, required of the contractors, should reduce DOS expenditures each year. The contractors must seek to raise funds from participating businesses and elsewhere within the business community. Depending on the response from outside sources, DOS net annual costs may be reduced, while All Participants' savings may increase (since DOS costs are subtracted from their savings). The program also is designed to enable other materials exchanges in NYC, such as the East Williamsburg Valley Industrial Development Corporation's Waste Assessment and Reduction Program (WARP), to tap into the DOS-sponsored data base. This could expand the impact of *NY Wa$teMatch* to businesses and institutions beyond those in the initial industrial sector at little or no cost to DOS.

The calculations in Table 2-4 [next page] present the actual second year impacts using data obtained from DOS. Also included are estimates of the discounted five-year cost impacts of the program. As noted above, the projected number of transactions, tons of waste diverted, and anticipated savings from *NY Wa$teMatch* do not account for the growth of the program. The impact of growth, accompanied by success of the contractors' fundraising efforts, and a decrease in the projected program costs can result in a positive net present value from this program. Such change also could generate long-term economic benefits and enhance the economic sustainability of the City's business sector.

2.2.2 Evaluation Plan for *NYC Stuff Exchange*

1. Program Summary

The *NYC Stuff Exchange* is a menu-driven, automated, toll-free telephone system that contains listings for various types of reuse outlets available in New York City. The *NYC Stuff Exchange* provides information to residents on businesses and organizations that accept donations and buy, sell, rent, or repair second-hand goods, in an effort to promote the reuse of durable and non-durable goods. DOS launched a pilot test of the *NYC Stuff Exchange* in Staten Island during the fall of 1999. DOS plans to expand the service beyond Staten Island after evaluating the results from the pilot program.

The *NYC Stuff Exchange* telephone system allows insertion of 25-word messages in which participating businesses or organizations can describe their mission, hours of operation, availability of pick-up service, or other relevant information.

To determine whether this type of service might be an effective waste prevention tool, DOS commissioned two surveys: 1) a survey of reuse outlets and 2) a survey of consumers. These surveys, conducted by Blum & Weprin Associates, a market research firm, in January 1995, showed widespread interest among both residents and reuse outlets in the information and

Table 2-4. Estimated Impact of NY Wa$teMatch, 1998-2002

	1998	1999	2000	2001	2002	Notes
WASTE PREVENTION QUANTITY CHANGES						
Waste Prevention (tons/year)	293	1,377	1,448	1,448	1,448	Actual data year 1&2, Projected Year 3-5
Density Factor (tons/cubic yard/year)	0.14175	0.14175	0.14175	0.14175	0.14175	Loose density of mixed institutional waste from NYC SWMP compaction tests
% of Waste Recycled (per year)	21%	21%	21%	21%	21%	Avg. private carter rate FY 95 SWMP
In-Landfill Density Factor (tons/cubic yard/year)	0.6	0.6	0.6	0.6	0.6	
% of Waste Residential (per year)	0%	0%	0%	0%	0%	
% of Waste Commercial (per year)	100%	100%	100%	100%	100%	Commercial waste all exported
Waste Prevented (cubic yards/year)	42	195	205	205	205	Waste prevented x Density Factor
Reductions in Recycling (tons/year)	62	289	304	304	304	Waste prevented x % of Waste Recycled
Reductions in Landfill Capacity	176	826	869	869	869	Waste prevented x In-Landfill Density Factor
Reduction in Local Landfill Capacity Required (cubic yd/year)	0	0	0	0	0	Reductions in Landfill Capacity Required x % of Waste Disposed in NYC
Reductions in Export Landfill Capacity Required (cubic yd/year)	176	826	869	869	869	Reductions in Landfill Capacity Required x % of Waste Disposed/Exported
COSTS						
Waste Disposal Cost ($/ton/year)	$54.32	$54.32	$54.32	$54.32	$54.32	Commercial disposal cost
Procurement Cost Savings ($/ton/year)	$574	$574	$574	$574	$574	Based on savings reported by participants divided by tons of waste prevented
DOS Implementation Costs (per year)	$97,500	$92,500	$122,000	$122,000	$122,000	Year 1 & 2 are actual costs, Year 3-5 estimated
Other Participant Costs (per year)	$122,500	$129,500	$100,000	$100,000	$100,000	Co-funding from NY Dept. of Conservation in 9/98 to cover 5 years
Total All Participants Cost of Implementing (per year)	$220,000	$222,000	$222,000	$222,000	$222,000	DOS Implementation Cost + Other Participant Costs

AGGREGATE NET PRESENT VALUES OF COSTS AND SAVINGS		
Interest Rate	5.42%	Yield on New York Metropolitan Transportation Authority Bonds
NPV Cost of Implementing for All Participants	$948,189	
NPV Cost of Implementing to DOS	$472,335	
NPV Savings for All Participants	$890,304	
NPV Savings to DOS	$0	
NPV of Program to All Participants (NPV Savings to All Participants – NPV Cost to Implement for All Participants)	($57,885)	
NPV of Program to DOS (NPV Savings to DOS – NPV Cost to Implement to DOS)	($472,335)	
All Participants Payback Period	5.33	
DOS Payback Period	N/A	
Net Annual Amortized Savings to All Participants	($12,963)	
Net Annual Amortized Savings to DOS	($45,864)	

services that would be offered. A focus group, funded and contracted by Bell Atlantic, was convened in May 1996 to test a prototype of the menu system, developed for DOS by a Bell Atlantic consultant, and to solicit feedback on its design.

DOS convened a second series of focus groups in the summer of 1998. Focus group participants included: (1) thrift store owners/managers or businesses that sold used merchandise; (2) repair or rental store owners; (3) residents that shop at thrift stores or buy used items at least once a year; and (4) residents that make non-monetary donations to thrift stores or charities at least once a year. Most participants thought that the proposed service was a good idea. Focus group participants noted that references to "Department of Sanitation" or the word "reuse" sometimes left a negative impression about the quality of goods being offered and resulted in confused perceptions regarding the service. As a result, the program was renamed from the DOS Reuse Hotline to the *NYC Stuff Exchange*, and references to DOS, "throwing items away," and "reuse" were deleted from the telephone scripts. A grant of $315,050 from the NY DEC is anticipated to help underwrite start-up costs.

DOS has incorporated an "on-line" survey of callers into the *NYC Stuff Exchange*, to assist in program evaluation and measurement. Callers are asked to provide verbal responses to five questions, including:

- How did you learn about the *NYC Stuff Exchange*?
- What type or types of items and services did you inquire about during this phone call?
- Did the *NYC Stuff Exchange* help you find the information you needed?
- As a result of your use of the *NYC Stuff Exchange*, have you or do you intend to buy, sell, donate, repair, or rent any type of reusable second hand goods?
- Please try to provide an estimate of the weight of the goods you plan to buy, rent, donate, sell, or repair as a result of your calling the *NYC Stuff Exchange*.

While responding to the on-line survey is optional for callers, results from the focus group suggest that callers will participate. The survey will collect information on those seeking to donate or sell goods to reuse outlets, as well as those seeking to make purchases from the outlets.

2. Comments On DOS Approach

DOS included reasonable and practical evaluation activities—on-line surveys and focus groups—in its development of the *NYC Stuff Exchange*. However, DOS may be able to refine its approach to enhance the accuracy of its calculations, particularly with respect to determining incremental users who make donations, sales, or purchases as a direct result of the Exchange, as well as improving the qualitative estimates of the weight of goods users plan to buy, rent, donate, sell or repair. In addition, to the extent that staffing can be made available to complement this approach, DOS should be able to enhance its ability to evaluate and measure the waste prevention impact of the Hotline by conducting an on-site or telephone survey of reuse outlet patrons. These enhancements are discussed in the following section.

The surveys and focus groups sponsored by DOS provide a starting point for substantiating the merit and design of the phone service and estimating the quantities of materials that may be reused and diverted from disposal as a direct result of implementing the *NYC Stuff Exchange* ("the tonnage prevented"). The results from the surveys conducted by Blum & Weprin indicate that many people who currently do not donate or sell reusable materials to reuse outlets or purchase from them would call the Hotline. However, the Blum & Weprin survey results alone will not allow projection of the number of new donors, sellers, and buyers resulting from the Hotline, because the surveys occurred before the Hotline existed. While the on-line survey may add all the additional information required for an evaluation, it may still be useful to include a survey of customers that actually visit reuse outlets. The role for such a survey is discussed below.

3. Program Evaluation Recommendations

To evaluate the effectiveness of the *NYC Stuff Exchange*, two components should be targeted:

1) the effectiveness of outreach programs in publicizing the availability of the Exchange; and 2) the effectiveness of the Exchange in diverting waste for reuse. The tonnage of waste prevented as a result of the operation of the Hotline will depend on the number of callers who buy, sell, or donate to outlets *only* because they received information from the Exchange ("Incremental Users") and the average weight of a transaction (i.e., a purchase, sale or donation at a reuse outlet). Roughly speaking, the waste prevention impact of the Exchange program is equal to the number of Incremental Users multiplied by the average weight per transaction. Methods for estimating the number of Incremental Users and the average weight of a transaction are described below. Estimating the number of Incremental Users is the most difficult aspect of the analysis of waste prevention due to the *NYC Stuff Exchange*.

Estimating Exchange Callers and Incremental Users

DOS designed the Exchange to be able to calculate the number of residents who call, hereafter referred to as the Exchange Callers. Incremental Users represent the portion of Exchange Callers who actually make donations, sales or purchases as a direct result of the Exchange. The number of Incremental Users cannot be measured directly. The only group for which an accurate number can be obtained is the Exchange Callers. Some Exchange Callers may not make transactions at reuse outlets. In addition, some repeat customers may call the Exchange more than once.

Determining the number of Exchange Callers provides a gauge of the effectiveness of the education and outreach concerning the Exchange. This information may assist DOS in refining Exchange outreach efforts and in designing outreach for future waste prevention programs. Determining the percentage of Exchange Callers who actually make donations, based on their Exchange call, will provide quantitative evidence of the effectiveness of the Exchange and the Exchange's potential as a waste prevention tool.

To identify the Incremental Users among all Exchange Callers, the survey could be expanded to query whether the caller would have made this donation without the assistance of the *NYC Stuff Exchange*. The number of callers responding "no" to this question can be divided by the

total number responding to the on-line survey to provide an estimate of the percentage of Incremental Users.

If DOS convenes focus groups and/or conducts evaluative surveys in the future, participants who have called the Exchange can be asked whether they made donations, sales, or purchases at reuse outlets after calling the Exchange and whether they would have participated in these activities without the assistance of the Exchange. Assuming that participants in the focus group and/or survey(s) are typical of all Exchange Users, the percentage who answer "no" to this question will confirm the estimate of the percentage of Exchange Callers who are Incremental Users. In addition to, or in conjunction with, the focus group and telephone survey evaluation approach, DOS may initiate an on-site survey to calculate Incremental Users. Depending on the extent to which the focus group or survey results are deemed valid, alternatively, DOS may decide that it is appropriate simply to assume that those who go to the trouble of calling the Exchange will, in fact, donate, sell, or make a purchase.

The answers to the survey question could be used to estimate two additional factors.

A. The percent of callers who engage in continuing transactions.

B. The average number of continuing transactions per Incremental User.

These factors can be used to adjust the estimated number of Incremental Users for the effects of continuing transactions. To make this adjustment, the number of Incremental Users would be multiplied by the product of the percent of continuing transactions times the average number of continuing transactions per Incremental User.

The second refinement addresses what will be referred to as "repeaters." Repeaters are residents who may initially call the Exchange and then, without calling the Exchange again, conduct additional transactions at a later date. These "continuing transactions" are attributable to the services provided by the Exchange. They may not, however, be captured in the methodology recommended above, because the estimate of Incremental Users is based upon the number of calls made to the Exchange. Rather than relying on what callers say, an estimate can be developed based on a survey of reuse outlet patrons. Reuse outlets could be recruited to participate in, for example, a one-month survey of reuse outlet patrons after the Exchange is implemented. Ideally, participating outlets should be dispersed throughout the City and represent the various categories of reuse outlets. Surveys could be designed as postcard-sized forms and distributed to reuse outlets for use in conducting the donor survey. Outlet staff would ask patrons to complete the survey questions on-site and leave the survey card with store staff.

The number of questions included in the survey should be kept to a minimum to encourage participation in the survey. Answers to three questions are needed to estimate the number of Incremental Users:

1. Did you call the *NYC Stuff Exchange* before coming her?
2. Did you come to this outlet specifically because of information you received from that call to the *NYC Stuff Exchange*?
3. Would you have made this donation if you had not contacted the *NYC Stuff Exchange*?

The survey procedure discussed above—soliciting responses to a short survey from patrons at a number of reuse outlets—could provide information from hundreds or even thousands of reuse outlet patrons. However, because the number of outlets sampled is likely to be small, the sample will not necessarily be representative of all reuse outlets in the City. Using a statistically significant sample of outlets would likely be very expensive. As explained in Chapter 1, even the simplest random sampling approach would require 400 outlets to obtain a 90 percent confidence level. An alternative approach to the on-site survey would be a follow-up telephone survey.

Estimating the Average Weight of a Transaction

There are two ways to estimate the average weight of a transaction: obtain estimates from the customers of reuse outlets or obtain estimates from the reuse outlets.

In the Blum & Weprin consumer survey, respondents were asked to estimate the average weight of their purchases, donations, and sales of second-hand goods. Although the information provided by consumers provides some indication of the weight of a transaction, Blum & Weprin commented that these estimates did not appear to be reliable.[42] Therefore, the consumer survey should not be used as the source for the weight of an average transaction, if better data can be developed.

Some of the outlets included in the Blum & Weprin survey provided estimates of the weight of materials received monthly. The Blum & Weprin survey did not request corresponding information on the number of transactions. Therefore, average weight per transaction should not be estimated based on the Blum & Weprin reuse outlet survey data. However, the results of the outlet survey conducted by Blum & Weprin suggest that outlets may be able to provide data on the weight of materials associated with transactions conducted over a specified time period.

As part of the DOS effort to recruit outlets for a post-implementation consumer survey related to the use of the Exchange, DOS could ask participating outlets to keep track of the number of donations during the one-month survey period, and the total weight of the materials donated. If an outlet is unable to estimate the number of donations, the number of consumer surveys returned could be used to estimate the number of donations per month. The total weight of materials donated in all transactions at each outlet can be divided by the estimated number of Incremental Users, based on survey responses, to estimate the average weight of donations that can be attributed to the Exchange.

Qualitative Evaluation

DOS already incorporated the use of focus groups for evaluating program performance into the scope of the *NYC Stuff Exchange* program. Future focus groups and/or surveys may be used to provide a qualitative evaluation of the program's effectiveness. DOS anticipates soliciting qualitative feedback via the Exchange menu system. Another way to obtain a qualitative evaluation of program effectiveness is to add questions to the on-site survey that would be distributed to consumers at reuse outlets. However, this would make the on-site survey more complex; therefore, this approach is not recommended. Qualitative feedback will be obtained

from residents who leave a message on the Exchange. This will be an option on the Exchange menu for callers who would like to provide comments on their level of satisfaction with the Exchange services, including any suggestions for changing the Exchange design.

4. Estimated Waste Prevention Impacts

The specific methodology proposed above for evaluating the impact of the Exchange on the tonnage of waste prevented depends on the results of a number of data collection activities which are yet to be conducted. However, based on the available information, a preliminary estimate of the number of Incremental Users and the weight of materials involved in each transaction can be made; this will allow for a rough estimation of the potential tonnage of waste to be prevented by the Exchange and the anticipated costs and savings attributable to the program.

The initial estimate of the tonnage of waste prevented by the *NYC Stuff Exchange* is based on the Blum & Weprin survey of 206 City households and applies only to donations. The Blum & Weprin survey asked whether households would call the Exchange; it did not ask consumers whether they would actually make transactions involving reusable materials. To avoid over-estimating the Exchange's potential, it is assumed that of the households that said they would call the Exchange, only ten percent will actually make transactions as a result of those calls. This estimate recognizes that all callers would not complete transactions and addresses potential variance in the survey results due to selective positive perceptions among focus group participants.

Based on the Blum & Weprin survey, 82 percent of New York City households currently donate items for reuse. In addition, among City households that currently donate reusable materials to reuse outlets, 32 percent said that they would call the Exchange at least twice a year. Of the 18 percent of City households who do not currently donate, 62 percent said they would call the Exchange.[43] Assuming callers from these households behave similarly to those in households already donating, then 32 percent of the callers may call the Exchange twice a year. It is anticipated that remaining residents will not call the Exchange and will either continue donating through channels currently used or continue not to donate. Table 2-5 presents an analysis of the potential number of callers and wastes prevented for the 1999 pilot program in Staten Island and for subsequent years for the entire City.

Table 2-5 [next page] presents the quantity of waste prevented, in tons, at a ten percent rate for donation transactions based on calls to the Exchange. At the 10 percent rate of transactions resulting from calls to the Exchange, approximately 9.5 percent of the population base will make transactions at reuse outlets due to the Exchange. Based on consumer responses to the Blum & Weprin survey, it is estimated that the average weight of the materials involved in a single transaction is approximately 30 pounds. As noted earlier, Blum & Weprin is not confident of the validity of the data used to derive this estimate, but it is used in this report because it is the best available estimate.

Table 2-5. Analysis of Potential Calls to and Donation Transactions from NYC Stuff Exchange

	Staten Island		New York City	
No. of households	171,750		3,500,000	
No. currently donating (82% of total)	140,835		2,870,000	
- expected to call once (34% of current donors)	47,884		975,800	
- expected to call twice (32% of current donors)	45,067		918,400	
- expected not to call (34% of current donors)	47,884		975,800	
No. currently not donating (18% of total)	30,915		630,000	
- expected to call once (42% of non donors)	12,984		264,600	
- expected to call twice (20% of non donors)	6,183		126,000	
- expected not to call (38% of non donors)	11,748		239,400	
Total Households - One Call	60,868		1,240,400	
Total Households - Two Calls	51,250		1,044,400	
Total Calls (One Call + (2 x Two Calls)	163,369		3,329,200	
Potential Transaction Rate From Total Calls	# of Trans-actions	Tons of Waste Prevented	# of Trans-actions	Tons of Waste Prevented
10 Percent	16,337	245	332,920	4,994

The Blum & Weprin survey data provide sufficient information to conclude that additional transactions (*i.e.*, rental, repair and sale of second-hand goods) will very likely occur due to the Exchange. Because of data limitations, the impact on waste prevention has not been estimated. However, as discussed above, the impact can be included when actual data become available.

5. Estimated Other Impacts

For the *NYC Stuff Exchange*, the program sponsors (DOS and others, including non-profit organizations and a state agency) are included in All Participants Costs. These Other Impacts are important, in part because they include All Participants benefits anticipated to be generated by the program. The calculation of these Other Impacts supports DOS anticipated efforts to seek funds to support the program from beyond Sanitation's taxpayer-funded budget. In particular, expected benefits to reuse outlets that gain from increased donations, sales and/or purchases as a result of the Exchange is justification for seeking user fees from reuse outlets who want to be listed on the Exchange. Likewise, the Exchange is expected to benefit callers, as follows: (1) those who receive tax deductions as a result of donating second-hand goods; (2) those who save money by buying second-hand goods instead of new items or renting instead of purchasing; and (3) those who profit from selling second hand goods to reuse outlets.

Calculating Other Impacts can help DOS in seeking funding from business assistance organizations whose mission is to serve the business community, from foundations and other organizations that serve not-for-profit reuse outlets, and from potential advertisers who might wish to be credited as co-sponsors of the Exchange and otherwise benefit from their association with the Exchange. Quantifying every type of impact associated with the Exchange is not possible, however. For example, an estimate of the cost savings to purchasers of second-hand goods is included in the table on Other Impacts which follows, but the savings to those who donate or sell second-hand items is not quantified. Sellers do, of course, receive cash for selling their reusable items, while donors may receive a tax deduction for the value of the donation. Although it was not possible to quantify these benefits, they do represent real benefits for sellers and donors participating in the Exchange program.

6. Waste Prevention Projections In 2003

For the base year, 1999, the number of calls is limited to the estimate derived for the Staten Island pilot program. In 2000, the program is slated to expand to all of New York City. The New York City estimates shown in Table 2-5 include Staten Island. It is expected that the Exchange will continue to receive approximately the same number of calls per year from 2000 to 2003. This expectation is based on an assumption that the Exchange will have a three-year impact on transactions at reuse outlets and that diminishing returns from Incremental Users will be seen in each of the three years. Thus, two-thirds of Year 1 callers will continue participating in Year 2, and one-third of Year 1 callers will continue participating in Year 3. The diminishing returns will be offset by new callers in each year.

To avoid overestimating the potential waste prevention impacts of the *NYC Stuff Exchange*, analyses for the five-year impacts of the program, presented in Table 2-6, reflect the potential tons of waste prevented, based on a 10% transaction rate resulting from calls to the Exchange. In addition, procurement savings at this juncture are estimated only for clothing, rather than the full panoply of materials that may be donated, such as furniture, white goods, books etc., due to a lack of data on procurement savings for non-textile donations.[44] In conjunction, these two factors result in the most conservative basis for estimation. The program is projected to yield a negative net present value to DOS of $250,312 between 1999 and 2003 when costs of implementing the program are subtracted from savings. Projected saving to consumers will be over $49 million by 2002.

If higher transaction rates occur, or if large, non-textile donations are frequent, all categories of savings will increase, but the program investment costs will remain relatively unchanged. Therefore, increases in these factors would increase the total net present savings of the program to a positive return. In addition, DOS anticipates taking steps to reduce its annual operating costs by potentially charging reuse outlets to list on the Exchange and by soliciting advertisers as Exchange co-sponsors. Together, these measures would increase DOS's annual amortized savings and the net annual amortized savings of All Participants.

Table 2-6. Estimated Impacts of NYC Stuff Exchange, 1999-2003

	1999	2000	2001	2002	2003	Notes
WASTE PREVENTION QUANTITY CHANGES						
Waste Prevention (tons/year)	613	4,994	4,994	4,994	4,994	Actual data year 1&2, Projected Year 3-5
Density Factor (tons/cubic yard/year)	0.14175	0.14175	0.14175	0.14175	0.14175	Loose density of mixed institutional waste from NYC SWMP compaction tests
% of Waste Recycled (per year)	21%	21%	21%	21%	21%	Avg. private carter rate FY 95 SWMP
In-Landfill Density Factor (tons/cubic yard/year)	0.6	0.6	0.6	0.6	0.6	
% of Waste Residential (per year)	100%	100%	100%	100%	100%	All residential waste
% of Waste Commercial (per year)	0%	0%	0%	0%	0%	
Waste Prevented (cubic yards/year)	87	708	708	708	708	Waste prevented x Density Factor
Reductions in Recycling (tons/year)	129	1,049	1,049	1,049	1,049	Waste prevented x % of Waste Recycled
Reductions in Landfill Capacity Required (cubic yd/year)	368	2,996	2,996	2,996	2,996	Waste prevented x In-Landfill Density Factor
Reductions in Local Landfill Capacity Required (cubic yd/year)	368	2,996	2,996	2,996	2,996	Reductions in Landfill Capacity Required x % of Waste Disposed in NYC
Reductions in Export Landfill Capacity Required (cubic yd/year)	0	0	0	0	0	Reductions in Landfill Capacity Required x % of Waste Disposed/Exported
COSTS AND SAVINGS						
Waste Disposal Cost ($/ton/year)	$55.75	$62.88	$70.00	$70.00	$70.00	DOS disposal costs
Consumer Procurement Cost Savings ($/ton/year)	$10,000	$10,000	$10,000	$10,000	$10,000	Based on estimated $5/lb. savings to consumers over purchase of new textiles, furniture, and white goods
DOS Implementation Costs (per year)	$227,931	$432,931	$332,931	$332,931	$332,931	DOS, August 1999, See Note 1
Other Participant Costs (per year)	$0	$0	$0	$0	$0	Unable to estimate
Total All Participants Cost of Implementing (per year)	$227,931	$432,931	$332,931	$332,931	$332,931	
Garbage Disposal Cost Savings (per year)	$34,175	$314,023	$349,580	$349,580	$349,580	Waste Prevented x Waste Disposal Cost
Procurement Cost Savings (per year)	$6,130,000	$49,940,000	$49,940,000	$49,940,000	$49,940,000	Waste Prevented x Procurement Cost Savings to consumers
Total All Participants Savings (per year)	$6,164,175	$50,254,023	$50,289,580	$50,289,580	$50,289,580	

Table 2-6. (continued) Estimated Impacts of NYC Stuff Exchange, 1999-2003

AGGREGATE NET PRESENT VALUES OF COSTS AND SAVINGS		
Interest Rate	5.42%	Yield on New York Metropolitan Transportation Authority Bonds
NPV Cost of Implementing for All Participants	$1,415,214	
NPC Cost of Implementing to DOS	$1,415,214	Note 1. DOS costs are actuals for 1999. Estimate for 2000 assumes increase in advertising budget of $200,000 and maintenance budget of $5,000. Estimates for 2001-2003 assume no new equipment purchases and no change in maintenance and advertising expenditures.
NPV Savings for All Participants	$173,333,986	
NPV Savings to DOS	$1,164,902	
NPV of Program to All Participants (NPV Savings to All Participants – NPV Cost to Implement for All Participants)	$171,918,771	
NPV of Program to DOS (NPV Savings to DOS – NPV Cost to Implement to DOS)	($250,312)	
All Participants Payback Period	0.04	
DOS Payback Period	6.07	
Net Annual Amortized Savings to All Participants	$41,125,456	
Net Annual Amortized Savings to DOS	($52,544)	

2.2.3 Evaluation Plan for the NYC WasteLe$$ Program

1. Program Summary

The *NYC WasteLe$$* program promotes waste prevention in nine business and institutional sectors including: hospitals; airlines and airports; schools; food retail/producers; non-food retail; restaurants; wholesalers; manufacturers; and stadiums, arenas, and convention centers. The program is sponsored and primarily funded by DOS. Additional funding support and assistance is provided by the U.S. Environmental Protection Agency (EPA) Region II and the New York State Energy Research and Development Authority (NYSERDA). DOS contracted with Science Applications International Corporation (SAIC) to develop pilot waste prevention programs for businesses in each sector, to research model waste prevention efforts by other industry leaders, and to use the results of the pilot programs and industry leader research, both to estimate the potential for waste prevention in each sector, and to develop success stories for use in outreach efforts.

The *NYC WasteLe$$* program researched the waste generation patterns and the number of businesses in each sector in New York City to estimate the quantity of waste generated in each sector. DOS and the contractor then recruited cooperative businesses in each sector to serve as partners in the program. The *NYC WasteLe$$* program provided technical assistance to the partner facilities, conducted on-site waste assessments, identified potential waste prevention opportunities, and prepared waste prevention measurement tools. Based upon information obtained during the assessments, SAIC identified the most promising waste prevention measures and offered to assist with implementation and measurement. Many of the partner businesses adopted waste prevention strategies that significantly reduced their waste generation. Very few elected to measure the level of waste prevented using the tools developed for this purpose by the *NYC WasteLe$$* program.

For each sector, the *NYC WasteLe$$* program developed sector-specific outreach materials for DOS, including waste prevention guidance delivered through a series of sector-specific seminars; a series of issue-specific newsletters; a web site presenting background information, waste prevention guidance, success stories and on-line interactive measurement tools; and a promotional video. SAIC also is working with DOS staff to design an institutionalization plan, to ensure dissemination of these materials via trade groups and business assistance organizations. This plan is part of an overall effort to institutionalize the results of the *NYC WasteLe$$* program and to achieve citywide waste reduction throughout each sector.

2. Comments On DOS Approach

The *NYC WasteLe$$* program includes two measurement-related activities:

1. quantifying the impacts of waste prevention initiatives in participating and other model businesses; and
2. estimating the potential for waste prevention in each sector.

In addition, *NYC WasteLe$$* includes an extensive outreach campaign through which the project team provides guidance and success stories that serve as models for businesses seeking to implement waste prevention efforts. The outreach is conveyed through a series of newsletters, a web site (**www.nycwasteless.com**), a seminar series and a video. As part of the outreach program, the *NYC WasteLe$$* team aggressively solicits feedback, of both a qualitative and a quantitative nature, which serves a critical evaluation and measurement function for the project's outreach effectiveness. This outreach and feedback loop is key to the institutionalization of *NYC WasteLe$$*.

Waste Prevention Achieved by Participating Businesses

To measure the effects of the waste prevention activities introduced by *NYC WasteLe$$*, participating businesses were expected to use a facility-specific tracking system, consisting of spreadsheets and a series of data entry forms. Businesses were asked to track changes in the volume and characterization of their waste streams, as well as any associated energy and economic impacts of each waste prevention activity implemented. The project conclusively demonstrated that businesses in New York City consider waste prevention measurement to be too time-consuming a venture. In the vast majority of cases, businesses chose not to complete the measurement aspects of the program. They did, however, in some cases, develop estimates of the waste prevention effects of their implementation efforts. Table 2-7 illustrates the waste prevention successes of some of the partner businesses.

Potential for Waste Prevention in Each Sector

For each sector, the *NYC WasteLe$$* program is identifying the most effective waste prevention measures implemented, either by *NYC WasteLe$$* partner businesses or by industry leaders, and estimating the potential waste prevention and cost savings that could be achieved if the entire sector in New York City implemented similar waste prevention programs.

This approach to measuring the effects of the business participants' waste prevention programs and for estimating the potential sector-wide impact of waste prevention application is reasonable, appropriate and practical, in that it focusses on those measures that are successfully implemented and documented. These lessons learned are promoted through a diverse and extensive outreach campaign including the newsletter guidance, the web site, the seminars and the promotional video. The effectiveness of the outreach materials is determined through extensive feedback provided by members of the specific industry sectors through a series of interactions that guide expansions and enhancements to the outreach effort.

Table 2-7. Results of Specific Business Waste Prevention Initiatives

Sector	Business	Waste Prevention Initiative	Waste Prevented (per year)	Basis of Estimate
Airline/Airport	US Airways	Pallet reuse	200,000 lbs. of wood	40 lbs./pallet x 80–100 pallets/month
Restaurant	Jamaica Market	Compost food preparation wastes	52,000 lbs. of food	average weight of bucket of food x buckets generated by participating restaurants
Stadium/Arena	Jacob Javits Convention Center	Donate carpet, carpet padding and chairs from trade shows	8,000 lbs. of reusable goods	average weight of carpet roll or chair x number of items donated
Manufacturing	Eagle Electric Mfg. Co.	Sell scrap plastic as feedstock for manufacture of blasting medium	460,000 pounds of urea plastic	$0.15 revenues per pound
Retail food	ShopRite	Bag reuse*	81,180 lbs. plastic bags 328,984 lbs. paper bags	8.2 million bags reused per cash register records of rebate paid to customers. Estimate 2/3 plastic. 118 lbs. per 1000 paper bags; 15 lbs. per 1000 plastic bags.

* This initiative was implemented prior to The *NYC WasteLe$$* program.

In the case of the seminars, feedback was provided by business participants in real time as well as through participants' responses to a written evaluation form distributed at the commencement of the seminar program. A sample of this evaluation form is included as Appendix A. In addition, web site demonstrations were conducted at many seminars to capitalize on opportunities to gather constructive input. Suggestions for additional or enhanced guidance

are continuously integrated into web site features and future newsletters. To develop further information concerning business representatives perspectives on the web site, the project team distributed approximately 30 detailed feedback forms and questionnaires to businesses and trade association representatives within the industry sectors of concern to ensure that the format and content presented within the web site was suitable for the target audience. Appendix B presents a copy of the survey form as it was tailored to the airline sector.

In the case of the newsletters, specific newsletter recipients provide feedback to DOS and to the team and their suggestions and requests frequently lead to broader distribution of the newsletters.

For example, representatives of the Food Industry Alliance commented that the information presented in the Retail Food newsletters was very useful for their membership, and requested additional copies for distribution to businesses who did not appear on the original distribution list. DOS had anticipated such requests and, as part of the *NYC WasteLe$$* Institutionalization effort, DOS arranged for additional copies of the newsletters to be printed beyond the number included in the original distribution. Thus, in the program's outreach to various trade associations and other partners, DOS can provide extra copies of the newsletters for their distribution, as appropriate. Such organizations also may want to announce the availability of the newsletters in their own publications. In addition, the recycling guidance issue of the newsletters developed for each specific business sector includes a request in the text of the newsletter soliciting feedback, ideas, and success stories from readers. Resulting information is then integrated into future outreach initiatives to strengthen the outreach effort.

As is evident from a review of the information presented in Table 2-8 [next page], a major strength of the *NYC WasteLe$$* project is the expansive scope of the targeted outreach program, emphasizing practical solutions to waste prevention challenges on a sector-specific basis, drawing on documented successes. This information, coupled with data concerning cost savings, developed by SAIC as part of *NYC WasteLe$$*, is delivered so as to motivate businesses to adopt waste prevention practices.

The scaled up estimates of waste prevention potential will: (1) provide DOS with an estimated projection of waste prevention attainable within each sector, citywide; (2) help DOS to establish citywide business waste prevention targets and determine where to focus waste prevention efforts in the future; and (3) help DOS encourage business assistance organizations to view business waste prevention as a means to enhance competitiveness and lead these entities to accept responsibility for promoting waste prevention within the business community.

3. Program Evaluation Recommendations

The fundamental objective of this evaluation plan is to determine if, in fact, additional waste prevention efforts actually are initiated because of the results achieved and outreach tools developed and disseminated by the *NYC WasteLe$$* program.

Although the estimates for waste prevention potential that this campaign yields are just that, estimates, they do provide a tailored blueprint for action and the fundamental yardstick for

Table 2-8. Scope of *NYC WasteLe$$* Outreach Program

Outreach Mechanism	Sector	Initial Distribution	Comments
Newsletters	Airlines/Airport	2,492	Total for three separate mailings: Energy Efficiency; Recycling; Waste Prevention/Seminar Highlights.
	Manufacturing	4,120	
	Restaurants	7,524	
	Retail	8,316	
	Retail Food	2,208	
	Schools	8,468	
	Stadium	836	
	Wholesale	5,368	
Guidance Document	Hospitals	100	
Seminar Invitations	Restaurant	1,426	1,200 additional invitations distributed by NYC Restaurant Association and Empire State Restaurant and Tavern Assoc.
	Retail Food	552	
	Airline/Airport	779	
	Schools	2,151	
	Mfg./Wholesale	1,030	
	Retail	2,079	1,500 additional invitations distributed by the 34th Street Partnership
	Stadium	650	
	Hospital	181	Invitations sent by Greater NY Hospital Association
Web Site		number of hits	TBD* may track by area of site
Video		number distributed	TBD*will be available to BIDs, LDCs, Chambers of Commerce, Trade Associations

*TBD - To be determined

gauging, and fueling, program success. Business waste prevention programs developed in other jurisdictions, such as Massachusetts WasteCap, reinforce the model of leadership by example and program expansion and popularization through outreach.

A follow-up survey of participating businesses, such as those actually engaged as *NYC WasteLe$$* Partners, as well as those attending the seminars, receiving the newsletters, and accessing the Web site could, in the context of the limitations discussed below, enhance this effort to evaluate the waste prevention potential of the *NYC WasteLe$$* program, as well as the effectiveness of the outreach effort. DOS also can work with trade associations, Local Development Corporations (LDCs), Business Improvement Districts (BIDs) or other groups, such as local educational institutions, to obtain feedback from the businesses and institutions in each sector, in addition to surveying selected businesses through electronic web site feedback, by mail, by telephone or by personal interview.

While methods may differ, the goal for each sector is the same: to estimate the fraction of businesses in each sector implementing waste prevention as a result of the outreach tools (e.g., web site, newsletters, seminars, and the video) developed by *NYC WasteLe$$*. For each sector, the maximum amount of waste anticipated to ultimately be prevented by *NYC WasteLe$$* would be estimated as that fraction times the *NYC WasteLe$$* project's estimate of the total waste prevention potential for the sector.

Four major factors complicate this estimation process:

1. Unless a costly, extensive, professional survey is conducted, the statistical validity/accuracy of a survey can be anticipated to be compromised for several reasons including: difficulty of obtaining a statistically valid response rate from a randomly selected, statistically significant sample size (e.g., see difficulties encountered by DOS in surveying recipients of the hotel waste prevention guide); and potential for survey bias.
2. The tonnage of waste prevented through *NYC WasteLe$$* sector-wide outreach efforts may not be proportional to the fraction of firms "reached" by the *NYC WasteLe$$* sector-wide outreach.
3. Businesses may not be aware that *NYC WasteLe$$* was the source of information that led them to prevent waste.
4. Businesses may not be willing to respond to survey questions, based on the *NYC WasteLe$$* experience.
5. Surveys are limited as a tool for calculating reliable estimates of waste prevented.

To overcome the first complication, DOS could engage a professional market research firm to survey a statistically significant sample of firms in a sector. However, this may not significantly improve the quality of the estimates developed, and it would be disproportionately costly.

Addressing the second complication would require DOS to contact and to interview a statistically significant sample of firms in each sector, and perhaps engage in independent waste prevention measurement for them. As noted in Section 1.5 of Chapter 1, conducting interviews, even for a very simply chosen sample, would cost upwards of $90,000; a substantial investment which might not produce truly useful data.

The third difficulty, lack of awareness of *NYC WasteLe$$* as the source of information, may result from the DOS plan to share *NYC WasteLe$$* findings with numerous business assistance organizations, trade groups, consultants, and other intermediaries. These entities may use the information to assist businesses to prevent waste without the assisted business knowing that the information originated from *NYC WasteLe$$*. Therefore, if surveyed, the businesses may not acknowledge the impact of *NYC WasteLe$$* in leading them to prevent waste.

The fourth and fifth are perhaps the most significant factors. *NYC WasteLe$$* found that businesses either lacked or were not interested in providing waste quantity data. Even if DOS were to conduct a professional survey, this approach could not verify that waste prevention measures actually are implemented, for several reasons: the approach relies on self-reporting

by businesses which may not be able to provide data on the actual impacts of waste prevention practices; it can take several years for a business to plan, implement, and evaluate the impacts of a waste prevention measure that may be undertaken as a result of information learned via the *NYC WasteLe$$* Program; and there are inherent limitations to surveys as a tool for providing credible data on the amount of waste prevented by businesses that obtain information from *NYC WasteLe$$*. The weaknesses associated with utilizing surveys as a tool for evaluating waste prevention programs, along with textbook citations for those interested in more information regarding the limitations of surveys, are discussed in Section 1.5.

To optimize the use of resources in pursuit of useful feedback, DOS may consider initiating a limited, in-house effort to collect data to address the key question presented above: "Were waste prevention efforts implemented because of the results achieved and outreach tools developed and disseminated by the *NYC WasteLe$$* program?"

If DOS determines that, in fact, the *NYC WasteLe$$* program did generate additional waste prevention efforts, depending on the opportunities for information collection in each sector and the associated costs, research efforts could be expanded to address the following sample questions:

- **Visibility** - how firms heard of *NYC WasteLe$$*, i.e., received program literature, attended a seminar, visited the web site or saw a video.
- **Influence** - what fraction of firms in each business sector had undertaken waste prevention activities due to the *NYC WasteLe$$* program.
- **Impact** - the extent to which the waste prevention activities promoted by *NYC WasteLe$$* were undertaken by firms in each sector.

DOS may wish to ask for the assistance of trade associations or other groups that are in a position to identify and contact a representative sample of businesses from a sector. These organizations can serve as efficient data collection agents. For sectors where this is not possible, consideration should be given to the use of postcard surveys. However, as noted in Section 1.4, mail surveys can have response rates as low as 5-10 percent in the commercial sector, and the responses received can have high error rates. While mail or telephone surveys might be technically superior, particularly if they are conducted by a professional marketing organization, it is not clear that the improvement in data quality, if any, would justify the cost.

Decisions regarding further efforts to determine the waste prevention impacts of the *NYC WasteLe$$* project would be based on two assumptions:

1. That DOS finds it feasible to allocate the time and funds required to perform the type of evaluation described.

2. That DOS would find estimates of tonnage prevented by the sector-wide outreach efforts useful, even if those estimates are based on undocumented assumptions.

4. Estimated Waste Prevention Impacts

Estimates of the impact of *NYC WasteLe$$* on the tonnage of waste generated by the nine business and institutional sectors can be developed based on assumptions concerning the current waste generation patterns of the businesses and institutions within these sectors, and assumptions concerning the potential for the outreach campaign to reach and affect the businesses in New York City operating within these sectors. The analysis of the potential impact of the primary outreach campaign will lead to one estimate of program effectiveness. The potential to augment the reach of the program can be developed based on an analysis of the content of the institutionalization plans for each of the nine sectors. Depending on the level of outreach, cooperation among businesses and institutions within each sector, and commitment to adoption of waste prevention mechanisms, the amount of waste diverted from disposal will vary. Starting from the total amount of waste generated by target industries, Table 2-9 presents the quantity of waste expected to be prevented first by program participants who received technical assistance from *NYC WasteLe$$* in designing their program, and then the comparable percent of waste prevented by firms undertaking waste prevention programs without assistance.

Through site assessments conducted at partner facilities and offices, the *NYC WasteLe$$* project identified waste prevention measures that could reduce solid waste generation. Of the opportunities pursued, waste prevention achievements reflected preventable wastes in the 20 to 30% range for the sectors represented in Table 2-9. For the most part, these analyses and related opportunities focused on key, large volume waste streams such as pallets, distribution packaging, food, cardboard and paper, where a limited number of changes could produce a substantial reduction in the waste generated and disposed.

Project experience and observations of the implementation patterns and efforts of *NYC WasteLe$$* clients to track waste prevention successes suggest that other factors and obstacles influence the behavior and priorities of businesses. Based on the *NYC WasteLe$$* clients' level of commitment to, investment in and persistence in pursuing project goals, the expectation that businesses will reduce waste significantly is wholly unrealistic. Projections of citywide waste prevention successes inspired by the *NYC WasteLe$$* models are more reasonably set at about 10% or less. This projection is reinforced by the fact that, although participating businesses had access to technical assistance and waste prevention support resources at no cost,

- some sectors failed to establish baseline data on total waste generation and chose not to measure progress against waste prevention goals, indicating a perception that waste prevention is not a high priority concern deserving of corporate investment and attention;

- many clients, while active in the early program phases, did not maintain program support and momentum to fully implement the proposed waste prevention measures; and

- many clients did not complete implementation within the project time frame and did not maintain visible programs to promote awareness and success through future efforts.

Thus, even when outreach and technical assistance were highly focused on specific businesses, those businesses often abandoned waste prevention efforts before program successes were fully

achieved and operational cost savings measured. Based on analysis of potential participation rates, in 2000, the first full year of the impact of *NYC WasteLe$$* sector-wide outreach activities, the program impact is optimistically expected to reach a ten percent participation rate with waste prevention estimated at 68,830 tons.

Table 2-9. Potential Waste Prevention Attributable to the NYC WasteLe$$ Program

Sector	Waste Generated by Sector (tons)[45]	Estimated Percent of Waste Preventable by NYC WasteLe$$ Participants[46]	Estimated Percent of Waste Preventable in Similar Facilities[47]	Estimated Waste Preventable per Sector (tons) at a 10% participation rate
Restaurants	765,000	20%	10%	15,300
Retail non-food	353,000	20%	10%	7,060
Wholesale	378,000	30%	10%	11,340
Manufacturing	384,000	25%	12.5%	9,600
Retail Food	433,000	30%	15%	12,990
Food Producers	117,800	30%	15%	3,534
Hospitals	257,325	35%	15%	9,006
Airport & Airlines	not available	N/A	N/A	0
Stadiums and Arenas	not available	N/A	N/A	0
Total	**2,688,125**			**68,830**

5. Estimated Other Impacts

Table 2-10 [next page] summarizes all of the impacts of this program for which quantification was possible. The specific data used to apply the methods are discussed in the table of estimated impacts. For the *NYC WasteLe$$* program, the All Participants costs refer to the contributions of DOS, the New York State Energy Research and Development Authority, and U.S. EPA Region 2 to the project budget. DOS also anticipates reimbursement for some project costs from DEC.

These Other Impacts are important in part because they can assist and substantiate the DOS's anticipated efforts to seek funds to support the program from beyond Sanitation's taxpayer-funded budget. To avoid overestimating DOS savings, the estimation of Other Impacts assumes that only a very small amount of the waste prevented would have been collected by DOS. Although *NYC WasteLe$$* is primarily a commercial-sector program, some of the waste prevented may be items, such as grocery bags, that would ultimately make their way to residents' homes and be disposed in the DOS-collected waste stream. Also, DOS collects waste and recyclables from schools.

The estimated Other Impacts does not include additional costs that participating businesses may incur to design, implement, or measure waste prevention programs. Such costs have not been measured. As a result, the net present value of the program should be viewed as a high estimate.

Table 2-10. Estimated Impacts of NYC WasteLe$$ Program

	1998	1999	2000	2001	2002	Notes
WASTE PREVENTION QUANTITY CHANGES						
Waste Prevention (tons/year)	68,830	68,830	68,830	68,830	68,830	Estimated data. Growth of program uncertain
Density Factor (tons/cubic yard/year)	0.14175	0.14175	0.14175	0.14175	0.14175	Loose density of mixed institutional waste from NYC SWMP compaction tests
% of Waste Recycled (per year)	21%	21%	21%	21%	21%	Avg. private carter rate FY 95 SWMP
In-Landfill Density Factor (tons/cubic yard/year)	0.6	0.6	0.6	0.6	0.6	
% of Waste Residential (per year)	0%	0%	0%	0%	0%	
% of Waste Commercial (per year)	100%	100%	100%	100%	100%	Commercial waste all exported
Waste Prevented (cubic yards/year)	9,757	9,757	9,757	9,757	9,757	Waste prevented x Density Factor
Reductions in Recycling (tons/year)	14,454	14,454	14,454	14,454	14,454	Waste prevented x % of Waste Recycled
Reductions in Landfill Capacity Required (cubic yd/year)	41,298	41,298	41,298	41,298	41,298	Waste prevented x % In-Landfill Density Factor
Reductions in Local Landfill Capacity Required (cubic yd/year)	0	0	0	0	0	Reductions in Landfill Capacity Required x % of Waste Disposed in NYC
Reductions in Export Landfill Capacity Required (cubic yd/year)	41,298	41,298	41,298	41,298	41,298	Reductions in Landfill Capacity Required x % of Waste Disposed/Exported
COSTS AND SAVINGS						
Waste Disposal Cost ($/ton/year)	$54.32	$54.32	$54.32	$54.32	$54.32	Commercial disposal cost
Business Procurement Cost Savings ($/ton/year)	$100	$100	$100	$100	$100	Based on LICBDC estimate for savings to business
DOS Implementation Costs (per year)	$1,680,000	$1,680,000	$1,680,000	$1,680,000	$1,680,000	Year 1 & 2 are actual costs, Year 3-5 estimated
Other Participant Costs (per year)	$220,000	$220,000	$220,000	$220,000	$220,000	Co-funding from NY DEC in 9/98 to cover 5 years and ongoing NYSERDA funding
Total All Participants Cost of Implementing (per year)	$1,900,000	$1,900,000	$1,900,000	$1,900,000	$1,900,000	
Garbage Disposal Cost Savings (per/year)	$3,738,846	$3,738,846	$3,738,846	$3,738,846	$3,738,846	Waste Prevented x Waste Disposal Cost
Business Procurement Cost Savings (per year)	$6,883,000	$6,883,000	$6,883,000	$6,883,000	$6,883,000	Waste Prevented x Procurement Cost Savings
Total All Participants Savings (per year)	$10,621,846	$10,621,846	$10,621,846	$10,621,846	$10,621,846	

Table 2-10. (continued) Estimated Impacts of NYC WasteLe$$ Program

AGGREGATE NET PRESENT VALUES OF COSTS AND SAVINGS		
Interest Rate	5.42%	Yield on New York Metropolitan Transportation Authority Bonds
NPV Cost of Implementing for All Participants	$8,131,371	
MNPV Cost of Implementing to DOS	$7,189,844	
NPV Savings for All Participants	$45,457,982	
NPV Savings to DOS	$0	
NPV of Program to All Participants (NPV Savings to All Participants – NPV Cost to Implement for All Participants)	($37,326,611)	
NPV of Program to DOS (NPV Savings to DOS – NPV Cost to Implement to DOS)	($7,189,844)	
All Participants Payback Period	0.89	
DOS Payback Period	N/A	
Net Annual Amortized Savings to All Participants	$8,721,846	
Net Annual Amortized Savings to DOS	($1,680,000)	

6. Waste Prevention Projections In 2002

As noted earlier, the first full year of the impact of sector-wide outreach activities is 2000. In estimating the five year impact of the program, a participation rate of 10 percent was used. At this level, an estimated 68,830 tons of waste would be prevented.

This program benefits the commercial sector, which is projected to realize savings with a net present value of over $45.5 million when full life-cycle costs of waste prevented are included. DOS, however, will realize no savings, since it does not manage the prevented waste.

As a result, the program has a negative net present value over the 1999-2002 period for DOS, since the cost to DOS of implementing the program is not offset by savings to DOS. When All Participants costs are subtracted from All Participant savings, the program does yield a positive net present value of over $37.3 million.

2.2.4 Evaluation Plan For DOS Unwanted Direct Mail Reduction Campaign

1. Program Summary

The Direct Marketing Association (DMA) administers the Mail Preference Service (MPS) listing of people who wish to be excluded from direct mailings and makes this information available to direct mailers. Registering with MPS can reduce the amount of unwanted third-class or "direct mail" received by New Yorkers by providing notification to mailers that receipt of such mailings is not desired. Registration with the MPS listing is valid for a five-year period and DMA states that the listing remains in force even if the resident orders goods from a direct mail catalog. During the spring and summer of 1993, DOS sent information to every New York City household on why and how to register with MPS. DOS also includes information about MPS on its

Sanitation Action Center phone hotline, and in 1996-97 distributed informational displays to libraries and public officials throughout New York City.

Between April 12 and August 30, 1993, DOS distributed 1.72 million bi-lingual (English/Spanish) postcards to all Brooklyn and Queens households and landlords. In late June, DOS mailed a bi-lingual tear-off attachment to a recycling brochure to 2.98 million households, citywide. Another 18,000 postcards were provided to the Borough Presidents offices, other public officials, and environmental organizations.[48] In mid-1996, DOS developed a new publication telling New York City residents how to get rid of the "junk mail bandit."[49]

2. Comments On DOS Approach

In evaluating the effects of the unwanted direct mail reduction program, DOS used the following four-step procedure:

1. Estimate the number of participants—new MPS registrants—in the program.
2. Estimate the reduction in the amount of direct mail received (the "tonnage prevented") per participant.
3. Calculate the tonnage prevented by the program.
4. Calculate the cost of the program and the cost per ton of waste prevented.

Step #1: Estimate the number of participants in the program

DOS used the number of new registrations with MPS to estimate the number of residents who participated in the program. DMA provided DOS with the total number of registrations as of January 1993, and a borough-by-borough breakdown of the number of new registrations received as of April, July, and October 1993. There were 28,028 new registrations between January and October, 1993. DOS assumed that all of these new registrations resulted from the program, and that no registrations received by DMA after October 1993 were a result of the program. Therefore, DOS concluded that all 28,028 residents of New York City who registered during this time frame were participants in the program.[50]

Step #2: Estimate the tonnage of waste prevented per participant

To determine the tonnage of waste prevented per participant, DOS used the U.S. Postal Service's (USPS) estimate of the number of pounds of direct mail delivered to U.S. residents each year and the percentage of that direct mail that could be prevented by registering with MPS. According to USPS, the average resident of the United States receives 31.04 pounds of direct mail per year. In the absence of New York City-specific information, DOS assumed that City residents received the average amount of direct mail.

Not all of the direct mail, however, is affected by registration with MPS. DMA estimates that 30.1 percent of direct mail is business-to-business mailings and that 21 percent is addressed to

"occupant" or "resident." Registering with MPS will not prevent either of these types of direct mail. Therefore, DOS concluded that only the remaining 48.1 percent of the direct mail—14.93 pounds per person per year—was preventable through registration with MPS.

DMA has indicated to DOS that BWPRR may have over-estimated the pounds per person of direct mail preventable by subscribing to MPS, because the average MPS registrant may not respond to direct mailings as frequently as non-registrants, and therefore receives less direct mail in the first place. However, DOS points out that the 14.93 average pounds per person includes children, most of whom probably do not receive any direct mail. Therefore, the average MPS registrant, who is likely to be an adult, is likely to receive more than 14.93 pounds of direct mail per year. For example, in a three-person household with mother, father, and child, if the average per-capita preventable waste is 14.93 pounds for each of three people, the household receives 44.79 pounds of preventable mail; if the two adults register with MPS, they would actually be expected to reduce their household mail by 22.39 pounds per registrant. In other words, DOS believes that this factor likely more than offsets any potential overestimation by DOS, and probably understates the amount of mail preventable by registration with MPS. DOS believes its own estimate is conservative and that its campaign may very well have resulted in reducing even more direct mail, at a lower cost per ton, than it has estimated.

Since DMA maintains MPS registrations for 5 years, DOS assumed that each participant would prevent 14.93 pounds for each of the 5 years of the registration, or 74.65 pounds over the life of the program.[51]

Step #3: Calculate the tonnage prevented by the program

DOS calculated the tonnage prevented by multiplying the estimated 28,028 participants (from Step #1 above) by the number of tons of direct mail prevented per participant. The amount of waste prevented per participant was estimated to be 74.65 pounds (from Step #2 above). Multiplying these two figures and converting to tons yielded a total of 1,046 tons of waste from direct mail prevented over 5 years. Since its campaign added to the amount of direct mail, DOS then subtracted the estimated weight of the 4.883 million postcards and tear-off attachments used in its outreach campaign from its estimate of the tonnage prevented. Because the postcards and attachments weighed 22 tons, DOS estimated that the program would prevent a total of 1,024 tons over its 5-year lifetime.[52]

Step #4: Calculate the costs and costs per ton of the program

DOS assumed that the cost of the program included only the costs of printing the postcards and attachments and did not include the cost of postage in this analysis. DOS estimated that printing costs were 1.9 cents per postcard, and applied that cost to all 4.883 million postcards and tear-off attachments. Therefore, the estimated cost of the program was $89,709. Dividing the total printing of $89,709 by the 1,024 tons prevented yielded a cost per ton of approximately $88. DOS believes that the program was cost-effective.

New Publication

DOS reinforced its 1993 campaign by producing, in 1996, a display called *How to Get Rid of the Junk Mail Bandit*. This display was distributed to public officials, libraries and others to build on the effectiveness of the previous DOS direct mail reduction campaign.

2. Comments on DOS Approach

DOS's general approach to measuring the tonnage of direct mail prevented is appropriate. Additional factors could, however, be included to enhance program analysis.

1. DOS assumed that all new registrations that occurred from January to October were the result of the program. However, some of these registrations occurred before the DOS mailings. It is possible to adjust the number of participants to account for the timing of the mailings.

2. DOS also did not evaluate whether the postcards or the tear-off attachments proved more effective in attracting new registrants to the MPS. However, existing information can be used to analyze the relative effectiveness of the postcards and tear-off attachment.

3. DOS did not include the cost of postage in their evaluation of program costs.

Further adjustments could be made to refine DOS's approach. However, given resource constraints and limited budgets, the refinements described below probably would not be feasible.

- DOS assumed that registration with MPS would prevent waste for All Participants for the full 5 years of the program. Since some registrants will move before the end of the 5-year period, not all participants' registrations will prevent waste for New York City for a full 5 years.

- DMA receives new MPS registrations regularly, but it is not feasible to determine the number of registrations which would have occurred even without the program.

- DOS assumed that no registrations after October 1993 resulted from the program. However, increased awareness of direct mail prevention due to the Summer 1993 campaign, the Sanitation Action Center phone announcement about MPS, and mention of MPS in other DOS literature may have led some City residents to register with MPS at a later date. MPS public awareness raising is an on-going effort of DOS. It is not feasible to account for later MPS registrants who were influenced by the program.

If DOS wishes to further refine the estimate of MPS registrants who registered because of the influence of its program, it could seek to obtain additional registration information from DMA on the pattern of MPS registrations over time. By obtaining pre-1993 data, if available, DOS could determine the average number of people who registered with MPS before the direct mail reduction program. DOS could then estimate the number of people who might have registered with MPS even if the program had not taken place. By obtaining the average number of new

quarterly MPS registrations beginning in October 1993 (the end of the program) and comparing this number to the average number of new registrants during the campaign, DOS could determine whether the program continued to influence City residents to register with MPS, all other factors being equal.[53]

3. Program Evaluation Recommendations

As discussed above, the evaluation of the direct mail program could be improved in two ways. MPS registrants who could not have been influenced by the direct mail program should not be included in the estimation of participants resulting from DOS's campaign. The relative effectiveness of the two types of mailings (postcards and attachments) could be considered.

Accounting for new MPS registrants who could not have been influenced by the direct mail program

Some portion of the new MPS registrations between January and October 1993 could not have been influenced by DOS's direct mail campaign. DMA provided DOS with the number of registrants in January 1993, and the number of new registrants as of April, July, and October 1993. Since, to its knowledge, DOS conducted the only substantial direct mail prevention campaign in New York City in 1993, it assumed that all of these new registrations resulted from its program.

DMA tracks MPS registrations on a quarterly basis. The first quarter of 1993 (the "April" registrations) included registrations between December 16, 1992, and March 15, 1993. None of the DOS mailings was sent during this period. Therefore, the first quarter or "April" registrations occurred before the program was implemented. These should not be included in the estimate of program participants. The second quarter (the "July" registrations) included registrations between March 16 and June 15. Only the postcard mailing to Brooklyn took place during this quarter. Therefore, only registrations from Brooklyn could be due to the program. All the other mailings occurred during the third quarter, June 16 to September 15. Therefore, new registrations from all boroughs may have been due to the program. MPS received 18,226 New York City registrations during the third quarter, and 6,829 Brooklyn registrations in the second quarter. Therefore, the maximum number of registrations attributable to the program is 25,055.

Effectiveness of postcards vs. attachments

Because DOS used two separate methods to reduce residential direct mail, it is useful to examine the relative effectiveness of each method. All boroughs received the tear-off attachment, but only Brooklyn and Queens residents received the postcards. When boroughs are grouped according to whether they received both the postcards and the tear-off attachments or just the attachments, significant differences are revealed. Registrations in Brooklyn and Queens increased by 90 percent during the program period. In contrast, registrations in Manhattan, Staten Island, and the Bronx increased by 7 percent.[54] New registrations from Brooklyn and Queens totaled 22,743 during the campaign while new registrations from Manhattan, Staten Island, and the Bronx totaled 2,312.[55]

Therefore, it appears that the program was much more effective in Brooklyn and Queens than in the other boroughs. The data suggest that the postcards, delivered only to Brooklyn and Queens, were responsible for the large majority of the new registrations. The pattern of registrations in Brooklyn and Queens also supports the theory that the postcards were more effective: in Brooklyn, new registrations were much higher in the second quarter (when the postcards were mailed) than in the third quarter (when the attachments were mailed). Queens was the only borough to receive both the attachments and the postcards in the third quarter; the campaign led to more than 14,000 new registrations in that period—eight times more than any other borough during the third quarter. Based on these data, postcards were more effective in encouraging residents to register with MPS. Future direct mail reduction or MPS education programs should use separate postcards instead of tear-off attachments to mailings.

4. Estimated Waste Prevention Impacts

As discussed in Section 3 above, an estimated 25,055 residents participated in the direct mail program. As shown in Step #2 of Section 1, DOS calculated that 48.1 percent of direct mail that is not business-to-business mail or mail addressed to "resident" is preventable through MPS registration. As DOS noted, however, DMA estimates that 30.1 percent of mail is business-to-business and 21 percent of mail is addressed to "resident" or "occupant," resulting in total of 51.1 percent of mail that cannot be prevented. Based on DMA estimates, the remaining 48.9 percent of direct mail should be preventable. Using the DMA estimate, MPS registration is calculated to prevent 48.9 percent of the 31.04 pounds of direct mail received per year by the average City resident, or 15.18 pounds per year. Over the 5-year lifetime of the program, it should prevent 75.90 pounds per person of direct mail, as opposed to DOS's estimate of 74.65 pounds. This means that the program is preventing approximately 186 tons of direct mail per year during the 5-year registration period, 1993-1998.

Use of DOS's procedure with the new estimates of participants and tonnage prevented per participant results in an estimated 929 tons of waste prevented over the five year period, 1993-1998.[56] The cost per ton diverted is estimated to be $96.60.

5. Estimated Other Impacts

For this program, All Participants' costs refer to DOS costs for an intern and printing and laminating posters.

6. Waste Prevention Projections In 2002

Since registrations with MPS remain in effect for 5 years, all of the MPS registrations expired in 1998. Although some residents may re-register, the number who do so because of DOS's 1993 program is not quantifiable. If DOS does not conduct a follow-up program before the end of the year 2000, it should be assumed that the program will prevent no waste in 2002. This assumption is reflected in Table 2-11 [next page].

If DOS were to mail postcards to all boroughs before 2000, the program could be expected to get a response rate similar to the response rate from residents of Brooklyn and Queens in 1993.

Table 2-11. Estimated Impacts of Unwanted Direct Mail Program, 1998-2002

	1998	1999	2000	2001	2002	Notes
WASTE PREVENTION QUANTITY CHANGES						
Waste Prevention (tons/year)	186	0	0	0	0	Actual data year 1&2, Projected Year 3-5
Density Factor (tons/cubic yard/year)	0.14175	0.14175	0.14175	0.14175	0.14175	Loose density of mixed institutional waste from NYC SWMP compaction tests.
% of Waste Recycled (per year)	21%	21%	21%	21%	21%	Avg. private carter rate FY 95 SWMP
In-Landfill Density Factor (tons/cubic yard/year)	0.6	0.6	0.6	0.6	0.6	
% of Waste Residential (per year)	100%	100%	100%	100%	100%	All residential waste
% of Waste Commercial (per year)	0%	0%	0%	0%	0%	
Waste Prevented (cubic yards/year)	26	0	0	0	0	Waste prevented x Density Factor
Reductions in Recycling (tons/year)	39	0	0	0	0	Waste prevented x % of Waste Recycled
Reductions in Landfill Capacity Required (cubic yd/year)	112	0	0	0	0	Waste prevented x In-Landfill Density Factor
Reductions in Local Landfill Capacity Required (cubic yd/year)	112	0	0	0	0	Reductions in Landfill Capacity Required x % of Waste Disposed in NYC
Reductions in Export Landfill Capacity Required (cubic yd/year)	0	0	0	0	0	Reductions in Landfill Capacity Required x % of Waste Disposed/Exported
COSTS AND SAVINGS						
Waste Disposal Cost ($/ton/year)	$41.50	$55.75	$62.88	$70.00	$70.00	DOS disposal costs
Procurement Cost Savings ($/ton/year)	$100	$100	$100	$100	$100	Based on LICBDC estimate
DOS Implementation Costs (per year)	$0	$0	$0	$0	$0	One-time costs incurred in 1993 not included here.
Other Participant Costs (per year)	$0	$0	$0	$0	$0	
Total All Participants Cost of Implementing (per year)	$0	$0	$0	$0	$0	
Garbage Disposal Cost Savings (per year)	$10,370	$0	$0	$0	$0	Waste Prevented x Waste Disposal Cost
Business Procurement Cost Savings (per year)	$18,600	$0	$0	$0	$0	Waste Prevented x Procurement Cost Savings (See Note 2)
Total All Participants Savings (per year)	$28,970	$0	$0	$0	$0	

Table 2-11. (continued) Estimated Impacts of Unwanted Direct Mail Program, 1999-2002

AGGREGATE NET PRESENT VALUES OF COSTS AND SAVINGS		
Interest Rate	5.42%	Yield on New York Metropolitan Transportation Authority Bonds
NPV Cost of Implementing for All Participants	$0	
NPV Cost of Implementing to DOS	$0	Note 2: Procurement cost savings are estimated for businesses that purchase fewer mailing materials due to reduced mailing list size.
NPV Savings for All Participants	$27,480	
NPV Savings to DOS	$9,836	
NPV of Program to All Participants (NPV Savings to All Participants – NPV Cost to Implement for All Participants)	$27,480	
NPV of Program to DOS (NPV Savings to DOS – NPV Cost to Implement to DOS)	$9,836	
All Participants Payback Period	0.00	
DOS Payback Period	0.00	
Net Annual Amortized Savings to All Participants	$5,794	
Net Annual Amortized Savings to DOS	$2,074	

Using a baseline of 58,689 MPS registrations reported for New York City, if the 90 percent average increase in Brooklyn and Queens is repeated citywide through the use of postcards and attachments, then the program will result in a citywide increase in MPS registrations of 52,820 due to a new mailing program. Using the DOS estimate of 15.18 pounds of waste preventable per person through MPS registration, a total of 801,801 pounds per year of direct mail, or 401 tons per year, could be prevented through such mailings. However, 14 tons of DOS mailings should be subtracted from the projected five-year total of 2,005 tons prevented, resulting in 1,991 tons prevented over 5 years.

Therefore, if DOS were to conduct a new campaign using only postcards, it could yield positive net savings less costs of $76,790 for DOS. Furthermore, as previously noted, DOS believes its estimates are conservative, and that its campaign may very well have resulted in reducing even more direct mail, at a lower cost per ton, than it has estimated. Thus, it is possible that DOS's direct mail reduction efforts will ultimately result in even higher net savings for the agency.

2.2.5 Evaluation Plan for the *Materials for the Arts Program*

1. Program Summary

Program Description

Materials for the Arts (MFA) is a City-sponsored program that facilitates the reuse of items donated to the program by businesses, organizations and individuals. Non-profit cultural organizations with arts programming; health, social, and community service organizations with arts programming; Schools participating in Project ARTS and City Agencies are eligible to receive reusable items, ranging from arts supplies to office equipment, from MFA. In FY 99, Materials for the Arts received and distributed more than 500 tons of annual contributions

from more than 1,000 donors. These donations are valued at more than $3 million with a replacement value of more than $5 million.

In 1977, MFA began as a desktop operation under the NYC Department of Cultural Affairs (DCA). In 1979, it became apparent that MFA's inability to provide storage was costing them donations. The Institute for Contemporary Art assisted with 3,500 square feet of warehouse space at PS 1 in Long Island City, Queens. By 1989, demand for warehouse space had increased and MFA moved to its current 10,000 square foot location in Manhattan. All materials were taken to the program's warehouse, where MFA clients came to select the items that they needed from the donations received.

Since 1990, DCA and DOS have shared support of MFA's operating budget of approximately $360,000. In 1995, DOS increased its share of the funding to cover the salary of a Direct Donations Coordinator to facilitate "direct transactions," which allow the donated items to be transported directly from the donor to the receiver.

Between 1979 and 1981, the Department of Citywide Administrative Services (DCAS) provided MFA with two vehicles and maintenance services and the NYC Department of Parks and Recreation provided fuel for the vehicles. Subsequently, MFA purchased a truck and a van through DCA. In 1997, MFA received a grant from the Manhattan Borough President's Office to purchase another truck. This alternative fuel vehicle is currently in service.

In FY 96, the inter-agency agreement between DOS and DCA was amended to require MFA to devise a long-range strategic and fundraising plan. DOS's objectives for this plan included expanding and diversifying MFA's funding, expanding services to program recipients, and diverting a larger quantity of usable material from the City's waste stream at a reduced cost per ton. DOS indicated that many organizations receive direct benefits from MFA and have a vested interest in its success, yet they do not make contributions or pay dues to offset the costs of program operation. MFA received pro bono services from Smith O'Brien, a market research firm located in Boston MA, to evaluate the social and financial impact of MFA on the citizens of New York City and the potential impact of a fee for service program. Based on this research, MFA decided not to pursue the fee for service approach.

MFA's fundraising efforts focused on raising funds for expanded warehouse space and related funds to open the warehouse to New York City public schools. The LuEsther T. Mertz Charitable Trust offered a $500,000 grant that was matched by DCA and DOS funding of $50,000 per year for ten years. Other funding sources include The New York Community Trust ($45,000), ATT Foundation ($20,000), and the Booth Ferris Foundation ($100,000). In FY 2000, the New York State Department of Environmental Conservation (NYSDEC) will provide a three year grant totaling $230,000.

2. Comments on DOS Approach

DOS's measurement and evaluation is based on monthly reports prepared by MFA, in accordance with the DOS funding agreement. MFA staff weigh all incoming donations at the warehouse and prepare daily and monthly reports on the donations received. In FY 99, the program

accepted 1,529 donations totaling 514.46 tons of reusable materials of which 50.2 tons were direct donations. It should be noted that the weight of the direct donations is determined based on a table of average weights of similar items taken into the warehouse; these donations are not weighed by MFA staff. Table 2-12 presents the estimated DOS net cost per ton for MFA.

Table 2-12: Estimating DOS's Net Cost Per Ton of MFA Program in FY 99

DOS avoided cost of disposal	$41.50
Commercial avoided cost of disposal	$70.00
Disposal savings of preventing 144.9 tons of waste from individuals, municipal agencies and non-profits at $41.50/ton	$6,013.35
Disposal savings of preventing 369.48 tons of waste from businesses at $70.00/ton	$25,863.60
FY 99 MFA funding from DOS budget	$180,000.00
DOS MFA funding FY 99 net cost per ton of preventing 144.9 tons of waste	$1,200.74
DOS MFA funding FY 99 net cost per ton of preventing 369.48 tons of waste	$417.17

DOS also calculated the cost-effectiveness of funding the direct donations program. It estimated that the cost of the program was approximately equal to the cost of the Coordinator's salary, $29,000. In FY 99, direct donations accounted for 50.2 tons of reusable materials; DOS calculated its cost per ton of the Direct Donations program to be $524.25.[57] The cost per ton to fund the Direct Donations Coordinator would be calculated to be significantly higher if the calculations assumed that the direct donations would be donated to other reuse organizations and/or if more of the goods were commercially generated and would not have been managed by DOS.

3. Program Evaluation Recommendations

While DOS's approach for calculating the cost per ton of the MFA program is reasonable, it should be noted that there are numerous benefits that accrue to the organizations, including City agencies, that receive donated goods, and the businesses that receive tax deductions from their donations.

MFA is a highly successful program for the arts community and the City, reporting benefits for the arts and City government in excess of $3 million in FY 99. In addition, MFA is recognized as a model program for other metropolitan areas interested in enhancing reuse efforts. The waste prevention education and good will generated by MFA reaches a significant audience. For example, more than 10 million people are served by nonprofit organizations associated with MFA. While these public relations benefits may accrue to DOS as a sponsor of MFA, these benefits of the program are not directly measurable. MFA's efforts in waste prevention education provide solid waste benefits to DOS, but are not reflected in the cost per ton, since these benefits are not readily quantifiable.

Nevertheless, as a solid waste management agency, DOS's primary mission is to manage the City's solid waste at the least cost per ton to the City. While subsidizing the arts is certainly a

benefit, it does not reduce the DOS cost per ton of operating the program. Benefits to the City and the arts cannot not be factored into computation of the DOS cost per ton of MFA as a reuse program.

4. Estimated Waste Prevention Impacts

In FY 99 (July 1998 to June 1999), MFA received donations weighing 514.46 tons, of which 50.2 tons were direct donations. From FY 1993 to FY 1998, MFA accepted an average of 419 tons of donated reusable goods per year. Between FY 1995 and FY 1998, the direct donations program facilitated the donation of an average of 122 tons per year.

5. Estimated Other Impacts

Other Impacts are important in part because they include All Participants' Benefits anticipated to be generated by the program. For the MFA program, All Participants' Costs refer specifically to the DCA and other funder contributions to the MFA budget. The calculation of these Other Impacts can substantiate MFA's efforts to seek funds to support the program from beyond Sanitation's taxpayer-funded budget.

As with the evaluation of any waste prevention program, it has not been possible to quantify every cost and benefit. Some of the benefits not quantified include avoided waste disposal costs for businesses and the possibility of tax deductions for businesses and individuals that donate reusable items.

6. Waste Prevention Projections In 2002

Table 2-13 presents the *maximum estimated savings* and *lowest cost per ton* to DOS resulting from the expenditure of funds from DOS's budget to support MFA in FY 1999. In reviewing the savings and cost per ton, consider that: 1) when donated goods originate in the commercial sector, these reuse transactions facilitated by MFA result in no direct cost savings to DOS; and 2) it has not been possible to estimate the portion of waste materials that would have been reused or prevented if MFA did not exist. As discussed in Chapter 1, determining the portion of waste material which would have been reused or prevented in the absence of a particular program is an issue for many waste prevention program evaluations.

MFA's Director indicated that in FY 2000, MFA will double its warehouse space and increase service to City public schools and advertising and anticipates an additional 12 tons of transactions per month. An additional 144 tons per year added to 434 tons (average for FY 96-FY 98) anticipates a total of 578 tons per year. This level of transaction is assumed to continue through the year 2002. These projections are based on personal communication with MFA Director, Susan Glass, July 21, 1999 and are reflected in Table 2-13.

The program results in a negative net present value of savings less costs to DOS. However, the savings to All Participants are substantial, and when the net present value of All Participants savings less costs are calculated, the program has an overall positive net present value.

Table 2-13. Estimated Impacts of Materials for the Arts Program, 1998-2002

	1998	1999	2000	2001	2002	Notes
WASTE PREVENTION QUANTITY CHANGES						
Waste Prevention (tons/year)	424	434	578	578	578	Actual data 1998, program average for 1999, program average plus additional capacity for 2000-2002.
Density Factor (tons/cubic yard/year)	0.14175	0.14175	0.14175	0.14175	0.14175	Loose density of mixed institutional waste from NYC SWMP compaction tests
% of Waste Recycled (per year)	21%	21%	21%	21%	21%	Avg. private carter rate FY 95 SWMP. See Note 3.
In-Landfill Density Factor (tons/cubic yard/year)	0.6	0.6	0.6	0.6	0.6	
% of Waste Residential (per year)	30%	30%	30%	30%	30%	Part residential/municipal
% of Waste Commercial (per year)	70%	70%	70%	70%	70%	Commercial waste all exported
Waste Prevented (cubic yards/year)	60	62	82	82	82	Waste prevented x Density Factor
Reductions in Recycling (tons/year)	89	91	121	121	121	Waste prevented x % of Waste Recycled
Reductions in Landfill Capacity Required (cubic yd/year)	254	260	347	347	347	Waste prevented x In-Landfill Density Factor
Reductions in Local Landfill Capacity Required (cubic yd/year)	76	78	104	104	104	Reductions in Landfill Capacity Required x % of Waste Disposed in NYC
Reductions in Export Landfill Capacity Required (cubic yd/year)	178	182	243	243	243	Reductions in Landfill Capacity Required x % of Waste Disposed/Exported
COSTS AND SAVINGS						
Waste Disposal Cost – Commercial ($/ton/year)	$54.32	$54.32	$54.32	$54.32	$54.32	Commercial disposal costs
Waste Disposal Costs – Residential ($/ton/year)	$41.50	$55.75	$62.88	$70.00	$70.00	DOS disposal costs
Procurement Cost Savings ($/ton/year)	$5,339	$5,339	$5,339	$5,339	$5,339	Based on value of goods donated per ton, MFA FY 98 Annual Report
DOS Implementation Costs (per year)	$180,000	$180,000	$180,000	$180,000	$180,000	DOS portion of MFA budget
Other Participant Costs (per year)	$180,000	$180,000	$180,000	$180,000	$180,000	Remainder of MFA budget
Total All Participants Cost of Implementing (per year)	$360,000	$360,000	$360,000	$360,000	$360,000	Total MFA Budget
Commercial Garbage Disposal Cost Savings (per year)	$16,122	$16,502	$21,978	$21,978	$21,978	Waste Prevented x % Business Waste x Business Waste Disposal Cost
Residential Garbage Disposal Cost Savings (per year)	$5,279	$7,259	$10,903	$12,138	$12,138	Waste Prevented x % Residential Waste x DOS Waste Disposal Cost
MFA Purchaser Procurement Cost Savings (per year)	$2,263,736	$2,317,126	$3,085,942	$3,085,942	$3,085,942	Used actual data on savings over purchasing new materials as reported buyers in FY 99
Total All Participants Savings (per year)	$2,285,137	$2,340,887	$3,118,823	$3,120,058	$3,120,058	

Table 2-13. (continued) Estimated Impacts of Materials for the Arts Program, 1998-2002

AGGREGATE NET PRESENT VALUES OF COSTS AND SAVINGS		
Interest Rate	5.42%	Yield on New York Metropolitan Transportation Authority Bonds
NPV Cost of Implementing for All Participants	$1,540,681	Note 3: Only available percent for recycling rate. Actual percent of waste recycled is expected to be lower due to the nature of the materials, which are more likely to be discarded than recycled. More accurate estimate of recycling rate not available.
NPV Cost of Implementing to DOS	$770,340	
NPV Savings for All Participants	$11,858,655	
NPV Savings to DOS	$39,996	
NPV of Program to All Participants (NPV Savings to All Participants – NPV Cost to Implement for All Participants)	$10,317,974	
NPV of Program to DOS (NPV Savings to DOS – NPV Cost to Implement to DOS)	($730,345)	
All Participants Payback Period	0.65	
DOS Payback Period	96.30	
Net Annual Amortized Savings to All Participants	$2,436,993	
Net Annual Amortized Savings to DOS	($170,457)	

2.2.6 Evaluation Plan for *Outreach to Chinese Restaurants*

1. Program Summary

As part of a Summer Outreach campaign of its NYC Partnership for Waste Prevention, the Department of Sanitation mailed surveys and posters promoting waste prevention to the nearly 600 members of the Chinese American Restaurant Association (CARA) in the summer of 1993. CARA restaurants represent approximately 10 percent of the 6000 Chinese restaurants in the City.[58] DOS conducted this outreach campaign to obtain information from the restaurants and to illustrate the financial benefits of waste prevention to Chinese restaurant owners and managers.

The survey was designed to gather information on the quantity and cost of the single-use products each restaurant bought monthly. The text of the poster asked take-out customers to consider whether they needed utensils, sauce packets, and other single-use products ("extras") usually included in take-out orders and to refrain from taking unneeded extras. After 19 restaurants returned surveys, DOS interns conducted in-person outreach to more than 250 restaurants. During this in-person outreach, an additional 90 restaurants completed surveys. DOS staff made use of the in-person contact with restaurant owners and managers to educate them about waste prevention and its benefits for the restaurant, its customers, and the City.

As of October, 1993, 112 restaurants had been visited by DOS interns. Six of these had waste prevention posters displayed, 68 hung posters during the visit, and 37 additional restaurants took the posters during the outreach visit, promising to hang them. This outreach effort focused on restaurants in ten neighborhoods. The following five neighborhoods were targeted because they were in Business Improvement Districts that were part of an EPA-funded waste prevention and anti-litter campaign: Thomkinsville, Staten Island; Astoria, Queens; Washington Heights, Manhattan; South Bronx; and downtown Brooklyn. In addition, two Intensive Recycling Zone

Areas—Park Slope and Starrett City, both in Brooklyn—were visited. Finally, three Manhattan neighborhoods, the West 70s, the East 20s, and Chinatown, were targeted for this outreach. In addition to the outreach conducted by interns, DOS has relied on a Chinese-speaking outreach staff person to educate restaurants about waste prevention. This outreach was conducted subsequent to the Summer 1993 Outreach Campaign. This Chinese speaker has had great success in reaching out to Chinese restaurants during door-to-door outreach in the Chinatown and Flushing neighborhoods.

2. Comments On DOS Approach

DOS staff tabulated the results of the surveys. From the survey results, DOS was able to conclude that Chinese restaurants spend a significant amount of money on disposable chopsticks; plastic spoons; plastic forks; tea bags; soy sauce packets; duck sauce packets; mustard packets; napkins; pint-size food containers; quart-size food containers; pint-size soup containers; and quart-size soup containers. DOS estimated that small Chinese restaurants (fewer than 200 take-out customers per month) spend approximately $3,000 per year on extras while large restaurants (more than 1,000 take-out customers per month) spend approximately $9,000 per year on extras.

DOS's measurement and evaluation methods for this program are appropriate. The survey data collected provide a reasonable basis for evaluating this program, although DOS should consider whether seasonal variances will apply to data collected in the summertime. The program can prevent only certain types of single-use products from being used. The food containers in which meals and soup are transported cannot be prevented by this program since take-out food must be packaged. In addition, some customers will continue to ask for chopsticks, napkins, tea bags, utensils, and condiments. The DOS analysis could be adjusted to reflect only the preventable extras.

DOS did not use the survey results to estimate the tonnage of waste prevented either before or after the outreach program because it was not deemed feasible or cost-effective. DOS did seek to measure the potential financial impacts of waste prevention (*e.g.*, the cost savings associated with buying fewer extras) in an effort to obtain information on cost savings that might motivate restaurants to institute recommended waste prevention measures. This is reasonable. However, some further analysis of the savings of implementing waste prevention activities could provide restaurant owners with greater incentives to incorporate waste prevention into their operations. The survey data provide a basis for this type of analysis.

3. Program Evaluation Recommendations

It is recommended that the analysis of potential savings due to this program be adjusted to remove the cost of single-use food containers. As shown in Table 2-14, an analysis of the survey results shows that the cost of food containers represents more than half of the total costs of all single-use products. Based on the survey, the maximum amount restaurants could save by reducing non-food container single-use products is between $1,393 for a restaurant with fewer than 200 take-out customers and $3,373 for a restaurant with more than 1,000 take-out customers per month.

It is true, of course, that hanging posters and training employees to ask take-out customers whether they would like extras will not prevent the use of all single-use products other than food containers ("preventable extras"). Therefore, restaurants that hang posters and train employees will save less than the maximum shown in Table 2-14. However, removing the single-use food containers does result in estimates which reflect only the types of extras which could be prevented as a result of this program.

Table 2-14. Cost of Single-Use Products Per Year

Item	Under 200 Take-Out Customers	200-500 Take-Out Customers	500-1,000 Take-Out Customers	1,000+ Take-Out Customers
Disposable Chopsticks	$ 215	$ 293	$ 328	$ 421
Plastic Forks and Spoons	$ 184	$ 377	$ 529	$ 954
Tea Bags	$ 213	$ 170	$ 256	$ 312
Packets of Condiments	$ 350	$ 286	$ 388	$ 404
Napkins	$ 431	$1,018	$1,100	$1,282
Subtotal: Single-Use Items other than Food Containers	$1,393	$2,145	$2,599	$3,373
Food Containers	$1,555	$2,476	$4,486	$5,776
Total	**$2,948**	**$4,621**	**$7,085**	**$9,149**

It is possible to attempt to estimate the potential maximum tonnage of waste that could be prevented if all Chinese restaurants in New York City were to take steps to eliminate the preventable waste that DOS's program sought to address through its outreach and education efforts. As shown in Section 4, if the data obtained by the survey is accurate and representative of the industry, each Chinese restaurant in New York City could prevent an average of approximately two tons per year (depending upon the number of take-out customers) if all single-use products, other than food containers, were eliminated.

4. Estimated Waste Prevention Impacts

The tonnage of waste actually prevented as a result of this program has not been measured, as noted in Section 3 above. It is possible, however, to make a rough estimate of this program's potential to prevent waste. The weights of the preventable extras were multiplied by the quantity of preventable extras purchased by the surveyed restaurants to estimate the potential tonnage of waste prevented by the program.[59] If the restaurants were to eliminate all of the preventable extras, the survey results suggest that the tonnage prevented would be between 1.05 tons per year for a restaurant with fewer than 200 take-out customers and 2.58 tons per year for each restaurant with more than 1,000 take-out customers. Assuming that the distribution by "size" (number of take-out customers per month) of the surveyed restaurants is the same as that for all 600 restaurants targeted by DOS's outreach and education program, the potential for waste prevention would be 1,200 tons per year that might otherwise be discarded in the

residential waste stream. If all of the City's approximately 6,000 Chinese restaurants could achieve these results with their patrons, it would reduce an estimated 12,000 tons per year.

Limited staff follow-up visits to Chinese restaurants indicate, however, that many restaurants have taken down the posters that they were provided, and may not be continuing to prevent waste at this level.

DOS should consider the value of renewed outreach efforts to all 6,000 Chinese restaurants. Based on the calculations described above, the program has the potential to prevent as much as 12,000 tons per year of residential wastes. If all 6,000 Chinese restaurants in the City could achieve 25 percent of the estimated waste prevention results, 3,000 tons of waste could be diverted annually from the City's residential waste stream.

The challenge in assessing the impact of a renewed outreach program would lie in identifying adequate means to measure results. Because of the costs associated with statistically valid surveys and the low commercial sector response to postcard or other mailed surveys, should DOS elect to undertake a renewed outreach effort, measurement of results could be undertaken through telephone calls or in-person visits. This approach, obviously, would be costly and labor intensive.

5. Estimated Other Impacts

For this program, All Participants Costs include DOS costs of hiring interns in 1993 to do the outreach and printing of posters. These were one-time costs incurred in 1993 and are not included in the projections for 1998-2002 shown in Table 2-15.

Procurement savings for the Chinese restaurants are an important "Other Impact" since these savings will lead businesses to implement waste prevention because of its positive effect on the "bottom line." Procurement savings were estimated by averaging the procurement costs for non-food items by the four categories of restaurants, multiplying the average by the 350 restaurants in the 1993 Outreach effort, and dividing this number by 1,200 tons of waste potentially prevented. This calculation yielded an average procurement cost of $693 per ton of waste prevented.

6. Waste Prevention Projections In 2002

Because of the passage of time since the Summer Outreach campaign, the tonnage of waste prevented due to this program is expected to be significantly lower in 2002 than in 1993. Assuming a three year impact from the program, the effects of the program ended in 1996. The amount of waste prevention that will occur in 2002 is a matter of judgment. If DOS were to assume that waste prevented in 1997 and beyond is 10 percent of the estimated initial impact, based on continued (but more limited outreach), then 120 tons of waste would be prevented by the program annually. At this rate of waste prevention, assuming no additional expenditures by DOS, the program savings less costs to DOS has a positive net present value. For the purposes of this report, it is assumed that the amount of waste prevented will keep pace with increases in the population. However, if outreach to the public is not continued, the quantity of waste prevented, and thus the savings, can be expected to diminish over time.

Table 2-15. Estimated Impacts of Outreach to Chinese Restaurants

	1998	1999	2000	2001	2002	Notes
WASTE PREVENTION QUANTITY CHANGES						
Waste Prevention (tons/year)	120	120	120	120	120	Projected based on 1993 data. Assumes effects only of minimal outreach.
Density Factor (tons/cubic yard/year)	0.14175	0.14175	0.14175	0.14175	0.14175	Loose density of mixed institutional waste from NYC SWMP compaction tests
% of Waste Recycled (per year)	21%	21%	21%	21%	21%	Avg. private carter rate FY 95 SWMP
In-Landfill Density Factor (tons/cubic yard/year)	0.6	0.6	0.6	0.6	0.6	
% of Waste Residential (per year)	100%	100%	100%	100%	100%	All residential waste
% of Waste Commercial (per year)	0%	0%	0%	0%	0%	
Waste Prevented (cubic yards/year)	17	17	17	17	17	Waste prevented x Density Factor
Reductions in Recycling (tons/year)	25	25	25	25	25	Waste prevented x % of Waste Recycled
Reductions in Landfill Capacity Required (cubic yd/year)	72	72	72	72	72	Waste prevented x In-Landfill Density Factor
Reductions in Local Landfill Capacity Required (cubic yd/year)	72	72	72	72	72	Reductions in Landfill Capacity Required x % of Waste Disposed in NYC
Reductions in Export Landfill Capacity Required (cubic yd/year)	0	0	0	0	0	Reductions in Landfill Capacity Required x % of Waste Disposed/Exported
COSTS AND SAVINGS						
Waste Disposal Cost ($/ton/year)	$41.50	$55.75	$62.88	$70.00	$70.00	DOS disposal costs
Procurement Cost Savings ($/ton/year)	$1,189	$1,189	$1,189	$1,189	$1,189	(Average of non-food container single use items procurement costs of $2378 x 600 restaurants) / 1200 tons potentially prevented
DOS Implementation Costs (per year)	$0	$0	$0	$0	$0	Based on one-time only costs in 1993; continuing costs assumed to be $0.
Other Participant Costs (per year)	$$0	$0	$0	$0	$0	No other implementation costs
Total All Participants Cost of Implementing (per year)	$0	$0	$0	$0	$0	
Garbage Disposal Cost Savings (per year)	$4,980	$6,690	$7,546	$8,400	$8,400	Waste Prevented x Waste Disposal Cost
Chinese Restaurant Procurement Cost Savings (per year)	$142,680	$142,680	$142,680	$142,680	$142,680	Waste Prevented x Procurement Cost
Total All Participants Savings (per year)	$147,660	$149,370	$150,226	$151,080	$151,080	

Table 2-15. (continued) Estimated Impacts of Outreach to Chinese Restaurants

AGGREGATE NET PRESENT VALUES OF COSTS AND SAVINGS		
Interest Rate	5.42%	Yield on New York Metropolitan Transportation Authority Bonds
NPV Cost of Implementing for All Participants	$0	
NPV Cost of Implementing to DOS	$0	
NPV Savings for All Participants	$641,060	
NPV Savings to DOS	$30,437	
NPV of Program to All Participants (NPV Savings to All Participants – NPV Cost to Implement for All Participants)	$641,060	
NPV of Program to DOS (NPV Savings to DOS – NPV Cost to Implement to DOS)	$30,437	
All Participants Payback Period	0.00	
DOS Payback Period	0.00	
Net Annual Amortized Savings to All Participants	$149,883	
Net Annual Amortized Savings to DOS	$7,203	

2.2.7 Evaluation Plan for *DOS Dry Cleaning Outreach*

1. Program Summary

During the summer of 1993, DOS conducted outreach targeting City dry cleaners. This outreach was conducted in cooperation with the Neighborhood Cleaners Association (NCA). NCA represents more than half of the 2,237 dry cleaning establishments in New York City.[60] DOS and NCA have participated cooperatively in waste reduction activities targeting the dry cleaning sector since 1991. In 1992, an article in NCA's newsletter encouraged member dry cleaners to order posters on waste prevention. DOS staff designed and distributed three posters promoting waste prevention for dry cleaners to display. The Summer 1993 outreach campaign built on the previous cooperative waste prevention activities between DOS and NCA.

DOS initiated the outreach campaign by mailing a survey to 1,700 dry cleaners who were members of NCA. The survey covered a range of waste prevention and recycling activities including use of posters promoting waste prevention and recycling, hanger return practices, recycling of polyethylene bags ("polybags") used to package and protect clothes returned to customers, and use of reusable bags instead of polybags. The purpose of the survey was not only to gather information related to waste prevention activities already established and implemented, but also to raise dry cleaners' awareness of waste prevention and of the costs associated with business practices that generate waste. More than 100 dry cleaners returned surveys. During site visits to dry cleaners later in the summer, DOS staff obtained an additional fifty responses to the survey and urged the dry cleaners to hang the posters.[61]

Since 1993, DOS has used the results of its surveys to develop case studies of dry cleaners' savings resulting from waste prevention practices. a DOS article on dry cleaner waste prevention, highlighting savings achieved by several dry cleaners, appeared in the NCA

newsletter in September 1995. This work with dry cleaners also served as a springboard for DOS's participation in evaluating applications for a National Waste Prevention Coalition award program in 1998-99.

2. Comments On DOS Approach

For this program, DOS's waste prevention measurement and evaluation efforts focused on two areas:

1. DOS estimated the tonnage of hangers and polybags used by New York City dry cleaners, based on information from Chris French Cleaners, a Manhattan dry cleaner. DOS then estimated the potential for preventing hanger and polybags waste, again using the Chris French data. DOS estimated that the dry cleaning sector as a whole could prevent 2,500 tons of waste and save $5 million per year if the wastes generated and the waste prevention achieved by all City dry cleaners, was similar to that achieved by Chris French cleaners.

2. DOS staff also tabulated the results of the surveys. From the survey results, DOS calculated that almost 90 percent of dry cleaners responding to the survey reported that they accept returned hangers and that, on average, 12 percent of hangers are returned.[62] DOS estimated from the surveys that cleaners who actively participate in outreach and waste prevention programs reuse 20-25 percent of their hangers.[63]

DOS's choice of areas for measurement and evaluation was reasonable and appropriate, although DOS should consider whether seasonal variances will apply to data collected in the summertime. DOS's analysis can be improved by making greater use of the available survey results:

- Survey data provide the basis for estimates of hanger and polybag purchases by NYC dry cleaners. The potential for waste prevention is, at most, equal to the tonnage of hangers and bags purchased. Survey results also can be used to estimate the actual waste prevention that was occurring in 1993 for both hangers and polybags.

- The comparability of Chris French Cleaners to other dry cleaners in New York City needs to be established, and variability needs to be taken into consideration. Data analyses in this section do not account for variability at this time and, thus, the analyses may be undependable.

3. Program Evaluation Recommendations

Survey-based estimates of hanger and polybag purchases and related waste prevention are provided below. Hanger and polybag waste prevention impacts are developed individually.

Hanger Purchase, Reuse, and Waste Prevention

Table 2-16 presents "Hanger Purchases and Returns" and shows that in 1993, dry cleaners who responded to the DOS survey reported data indicating the total purchase of 2,548 tons of hangers. It also shows the consultant's calculation that 279 tons of hangers were returned to NYC dry cleaners in 1993. Each hanger returned and reused represents a reduction in hanger purchases. Thus, the tonnage of hanger returns provides a value for actual hanger waste prevention, assuming returned hangers would otherwise be discarded by consumers. This assumption may overestimate the number of hangers that would be managed as trash.

In lines 1 to 5 of Table 2-16, the tonnage of hangers purchased per year is calculated. This calculation uses the number of dry cleaners in the City and the number of hangers bought by dry cleaners (from the survey). In lines 6 to 11, the tonnage of hangers used each year (including reused hangers) is calculated. This is estimated using the number of hangers bought and the hanger return rate. In line 12, the percentage of hangers returned is calculated.

Table 2-16. Estimates of Annual Hanger Purchases and Returns

1.	Number of Dry Cleaners in NYC	2,237
2.	Number of Hangers Bought by a Dry Cleaner per Month (from survey)	2,761
3.	Number of Hangers Bought per Year (line 1 x line 2 x 12)	74,116,284
4.	Weight of One Hanger (ounces)[64]	1.1
5.	Tons of Hangers Bought per Year (line 3 x line 4/32,000 ounces per ton)	2,548
6.	Percentage of Stores Accepting Hangers (from survey)	89%
7.	Number of Stores Accepting Hangers (line 1 x line 6)	1,991
8.	Average Number of Hangers Returned to an Accepting Store per Month (from survey)	340
9.	Number of Hangers Returned to All Stores per Year (line 7 x line 8 x 12 months per year)	8,123,280
10.	Tons of Hangers Returned to All NYC Dry Cleaners (line 9 x line 4/32,000 ounces per ton)	279
11.	Tons of Hangers Used by All NYC Dry Cleaners (line 5 + line 10)	2,827
12.	Percentage of Hangers Returned (line 10/line 11)	9.9%

Polybag Purchase, Replacement, and Waste Prevention

The "Estimate of Polybag Purchases and Replacement" table which follows shows that in 1993 NYC dry cleaners purchased 1,397 tons of polybags, which have a one-time use. As an alternative to polybags, some City dry cleaners have introduced reusable garment bags. Survey results show that 4 percent of dry cleaners offered their customers the option of reusable bags. Reusable dry cleaner bags are made of nylon and have been in use for five years. A life cycle of seven to ten years is not unreasonable. The cost of each reusable bag is $4-$6. As shown in Table 2-17, the use of reusable bags can result in the prevention of 17 tons of single use bags.

The survey results show that an additional eight percent of dry cleaners were considering the introduction of reusable garment bags. If these dry cleaners introduced reusable garment bags, the tonnage of polybags prevented would triple, to 51 tons.

In lines 1 to 6 of Table 2-17, the number of polybags bought by a store in a year is calculated using the average number of polybags bought by a store in a month (from the survey).

In lines 7 to 11, the tonnage of polybags prevented is estimated, using the percentage of dry cleaners offering reusable bags (from the survey).

Table 2-17. Estimate of Polybag Purchases and Replacement

1.	Number of Dry Cleaners in New York City	2,237
2.	Average Number of Polybags Bought per Store per Month (from survey)	1,851
3.	Estimated Polybags Bought per Year (line 1 x line 2 x 12)	49,688,244
4.	Estimated Weight per Polybag (ounces)[65]	0.9
5.	Estimated Tonnage of Polybags Bought per Year (line 3 x line 4 / 32,000 ounces per ton)	1,397
6.	Average Tonnage of Polybags Bought per Store per Year (line 5/line 1)	0.624
7.	Percentage of Polybags Prevented in Stores that Offer Reusable Bags[66]	30%
8.	Tonnage of Polybags Prevented in a Store that Offers Reusable Bags (line 6 x line 7)	0.187
9.	Percentage of Dry Cleaners Offering Reusable Bags (from survey)	4%
10.	Estimated Number of Dry Cleaners Offering Reusable Bags (line 1 x line 9)	89
11.	Estimated Tonnage of Polybags Prevented (line 8 x line 10)	17

4. Estimated Waste Prevention Impacts

It is estimated that NYC dry cleaners were preventing 279 tons of hangers and 17 tons of polybags, for a total of 296 tons of waste prevention in 1993. This waste prevention results from the ongoing waste prevention efforts of NCA and the DOS outreach. The accuracy of this estimate of waste prevention is limited because of the nature of the survey data from which it is drawn. a small number of dry cleaners provided data in response to the survey. If these data are not accurate or if these dry cleaners are not representative of dry cleaners overall, then the estimate of waste prevention may not be accurate. However, the cost of improving the quality of the survey may not be the most efficient use of limited resources.

Since the estimate of waste prevention for this program is related to DOS and NCA-sponsored efforts, as well as independent waste prevention efforts, dry cleaner waste prevention is expected to remain approximately flat, increasing only in proportion to population increases at a rate of 0.51 percent per year.[67] This assumption is reasonable because the quantity of clothes requiring dry cleaning per person will remain stable but the number of people will increase.

Therefore, it is estimated that 305 tons of waste would be prevented through dry cleaner waste prevention in 1998.

In order to increase the amount of waste prevented, more aggressive outreach would be required. For example, DOS could consider whether encouraging dry cleaners to institute refund schemes, such as a discount for returned hangers, accompanied by a consumer education campaign might cost-effectively increase the number of consumers returning hangers to dry cleaners.

5. Estimated Other Impacts

The specific data used are discussed in Table 2-18 [next page], which presents estimated impacts. For this program, DOS costs of paying an intern to conduct outreach were incurred in 1993 and are not included in the analysis.

6. Waste Prevention Projections In 2002

Waste prevention by NYC dry cleaners can be expected to continue due to the nature of the joint DOS/NCA effort and continued outreach activities. Assuming that (1) the number of dry cleaners and the usage of dry cleaners keeps pace with increases in the population of NYC, (2) the amount of waste prevented by the average dry cleaner remains constant, and (3) the dry cleaner self-reported waste prevention data in the survey is accurate and representative of the industry citywide, then waste prevention by City dry cleaners in 2002 is expected to be 311 tons, comprised of 293 tons of hangers and 18 tons of polybags. However, it is difficult to separate the amount of waste prevented due to DOS efforts from those attributable to NCA efforts. Because the program has no costs to DOS, it yields a positive net present value of savings less costs of $78,209 between 1998 and 2002. For the purposes of this report, it is assumed that the amount of waste prevented will keep pace with increases in the population. However, if outreach to the public is not continued, the quantity of waste prevented, and thus the savings, can be expected to diminish over time.

2.2.8 Evaluation Plan for *DOS Grocery Store Outreach*

1. Program Summary

In 1993, as part of a Summer Outreach campaign of the Partnership for Waste Prevention, DOS mailed surveys on grocery store waste prevention activities and posters to 350 grocery store chain headquarters and individual stores, with the assistance of the Food Industry Alliance of New York State. The posters were developed to encourage shoppers to refuse a grocery bag if they do not need one, or to bring their own reusable/reused grocery bags. The purpose of the outreach campaign was to inform store owners, managers and shoppers of the benefits of waste prevention and to gain an understanding of how prevalent such activities were at grocery stores located within New York City.

The survey was designed to gather information on the types of waste prevention activities conducted by grocery stores. Of the nineteen questions included on the survey, eight of the

Table 2-18. Estimated Impacts of Outreach to Dry Cleaners, 1998-2002

	1998	1999	2000	2001	2002	Notes
WASTE PREVENTION QUANTITY CHANGES						
Waste Prevention (tons/year)	305	307	308	310	311	Based on 1993 data, assuming increases proportional to 0.51% annual increase in population
Density Factor (tons/cubic yard/year)	0.08601	0.08601	0.08601	0.08601	0.08601	Loose density from NYS default data set assuming 94.3% steel and 5.7% polyethylene bags
% of Waste Recycled (per year)	1.1%	1.1%	1.1%	1.1%	1.1%	Based on tables in evaluation plan and from survey and letter in 12/93 DOS description program
In-Landfill Density Factor (tons/cubic yard/year)	0.6	0.6	0.6	0.6	0.6	
% of Waste Residential (per year)	100%	100%	100%	100%	100%	All residential waste
% of Waste Commercial (per year)	0%	0%	0%	0%	0%	
Waste Prevented (cubic yards/year)	26	26	27	27	27	Waste prevented x Density Factor
Reductions in Recycling (tons/year)	3	3	3	3	3	Waste prevented x % of Waste Recycled
Reductions in Landfill Capacity Required (cubic yd/year)	183	184	185	186	187	Waste prevented x In-Landfill Density Factor
Reductions in Local Landfill Capacity Required (cubic yd/year)	183	184	185	186	187	Reductions in Landfill Capacity Required x % of Waste Disposed in NYC
Reductions in Export Landfill Capacity Required (cubic yd/year)	0	0	0	0	0	Reductions in Landfill Capacity Required x % of Waste Disposed/Exported
COSTS AND SAVINGS						
Waste Disposal Cost ($/ton/year)	$41.50	$55.75	$62.88	$70.00	$70.00	DOS disposal costs
Procurement Cost Savings ($/ton/year)	$1,740	$1,740	$1,740	$1,740	$1,740	Procurement cost per ton based on cost of $30/case of 500 hangers weighing 0.017 tons. No cost savings for bags included.
DOS Implementation Costs (per year)	$0	$0	$0	$0	$0	One-time costs incurred in 1993 are not included.
Other Participant Costs (per year)	$0	$0	$0	$0	$0	
Total All Participants Cost of Implementing (per year)	$0	$0	$0	$0	$0	Waste Prevented x Waste Disposal Cost
Garbage Disposal Cost Savings (per year)	$12,658	$17,090	$19,375	$21,678	$21,789	Waste Prevented x Waste Disposal Cost
Dry Cleaner Procurement Cost Savings (per year)	$530,700	$533,407	$536,127	$538,861	$541,609	Waste Prevented x Procurement Cost
Total All Participants Savings (per year)	$543,358	$550,497	$555,501	$560,540	$563,398	

Table 2-18. (continued) Estimated Impacts of Outreach to Dry Cleaners, 1998-2002

AGGREGATE NET PRESENT VALUES OF COSTS AND SAVINGS		
Interest Rate	5.42%	Yield on New York Metropolitan Transportation Authority Bonds
NPV Cost of Implementing for All Participants	$0	
NPV Cost of Implementing to DOS	$0	
NPV Savings for All Participants	$2,371,484	
NPV Savings to DOS	$78,209	
NPV of Program to All Participants (NPV Savings to All Participants – NPV Cost to Implement for All Participants)	$2,371,484	
NPV of Program to DOS (NPV Savings to DOS – NPV Cost to Implement to DOS)	$78,209	
All Participants Payback Period	0.00	
DOS Payback Period	0.00	
Net Annual Amortized Savings to All Participants	$554,659	
Net Annual Amortized Savings to DOS	$18,518	

questions focused on waste prevention activities targeting grocery bags. The other eleven questions focused on obtaining information related to other types of waste prevention activities that may be conducted at grocery stores, including: reducing product packaging, using returnable shipping containers, donating unsold food to charitable organizations, selling products in concentrated form, and composting food wastes.

After receiving completed surveys from the headquarters staff of 24 chains (representing 127 stores), DOS staff visited 18 grocery stores to conduct additional outreach activities. The store visits resulted in the completion of an additional 16 surveys. During the store visits, DOS staff spoke with store managers to educate them about waste prevention opportunities and the benefits to the store, its customers, and the City, of implementing waste prevention activities.

2. Comments On DOS Approach

DOS measurement and evaluation activities focused on evaluating store waste prevention activities, particularly grocery bag usage and reduction. In addition to tabulating the survey results, DOS staff compared the surveys returned by headquarters staff of grocery chains and the responses provided by store managers during the 18 site visits. This comparison of survey results indicated that store managers were less likely than headquarters staff to report that the stores were implementing waste prevention activities. In particular, in responding to the survey questions that focused on grocery bags, store managers reported undertaking fewer waste prevention activities than did the headquarters staff.

The store managers did inform DOS staff that check-out clerks generally were trained both to ask customers if they needed a bag and to avoid double-bagging groceries. DOS staff observed general store operations during each visit. They reported that, in general, check-out clerks rarely asked customers whether or not they needed a bag and routinely double-bagged purchases.

DOS's measurement and evaluation approach was reasonable, given the objectives of this program, although DOS should consider whether seasonal variances will apply to the data collected. The program was designed to introduce grocery store managers to waste prevention issues. The measurement and evaluation activities are appropriate for those objectives.

As discussed in Chapter 1, a quantitative analysis of the impact of an outreach program is likely to provide a very rough estimate of the tonnage of waste prevented at best. However, some further analysis of the survey results and information obtained through the *NYC WasteLe$$* program subsequent to the outreach shows that substantial waste prevention may have been achieved through grocery store bag reuse and prevention. As shown in Table 2-7 in Section 2.2.3, an onsite visit to Shop Rite showed that an estimated 40.6 tons of plastic bags and 164.5 tons of paper bags were prevented per year.

3. Program Evaluation Recommendations

DOS focused its efforts on the prevention of grocery bags. DOS developed posters that highlighted the importance of bringing one's own bag and focused the survey on bag-related waste prevention. Grocery bags constitute a small, albeit highly visible, percentage of the waste generated by grocery stores and also are a component of the DOS-collected waste stream. DOS's analysis of the City's waste stream, as part of the Waste Prevention and Recycled Product Research project, shows that between 16,000 and 19,000 tons of grocery bags are generated per year.[68]

DOS surveys and the *NYC WasteLe$$* research on the grocery store sector provide a basis for a rough estimate of grocery store bag reuse and prevention, as shown in Table 2-19.

Table 2-19. Grocery Bag Waste Prevention in NYC

Percentage of stores with bag program[69]	50%
Bag prevention per store per week[70]	400
Percentage of bags that are plastic[71]	75%
Percentage of bags that are paper[72]	25%
Weight of plastic bag (lbs.)[73]	0.015
Weight of paper bag (lbs.)[74]	0.118
Grocery stores in NYC[75]	4,724
Pounds of bag prevention per store per week[76]	16.3
Pounds of bag prevention per store per year[77]	847.6
Pounds of bag prevention for all grocery stores per year[78]	2,002,031
Tons of bag prevention for participating stores per year[79]	1,001

4. Estimated Waste Prevention Impacts

As shown in Table 2-19, the grocery store industry is preventing 1,001 tons of paper and plastic bag waste per year. This is a very rough estimate and does not include waste prevention other than bags. This analysis also does not include the reduction in bag use at specialty food stores (such as fish stores or fruit and vegetable stores). The waste prevention quantified includes both the results of store-initiated efforts and DOS-sponsored efforts; it was not feasible to separate these types of impacts. For the 16 stores that completed surveys as part of the Summer Outreach and the 127 stores represented by the grocery store chains that sent back surveys by mail, the impact is estimated at approximately 30 tons of grocery bags prevented. However, the survey materials were sent to 350 grocery store chain headquarters and individual stores. Failure to return the survey does not mean that the survey had no effect. Since the purchase of bags is a significant cost for the stores, and unnecessary bagging wastes money, it is reasonable to assume that the survey, returned or not, had an effect. Further, because the survey targeted chain headquarters, it is reasonable to assume a widespread effect.

There is no feasible method for determining what portion of the waste prevention due to reduced bag use is the result of the DOS program and what portion is the result of other factors. Since the DOS program is likely to have had a substantial, but undocumented, effect, all of the bag-related waste prevention is included in the analysis.[80]

Grocery store waste prevention is part of DOS's ongoing outreach efforts, therefore it is reasonable to assume that this waste prevention will continue. It is estimated that the waste prevention will expand in proportion to population increases, since the amount of groceries purchased will keep pace with the population.[81] Therefore, it is extrapolated that grocery store bag prevention efforts would prevent about 1,027 tons in 1997.

5. Estimated Other Impacts

The specific data used to apply the methods is discussed in the table of estimated impacts. For this program, the DOS costs for an intern to conduct the outreach and for printing posters in 1993 are not included in this analysis.

6. Waste Prevention Projections In 2002

As noted above, bag prevention by NYC grocery stores is expected to continue as a result of continuing outreach under the *NYC WasteLe$$* program. Further, as discussed above, it is reasonable to assume that the prevention of grocery bags grows in proportion to the increase in the population of NYC. If: (1) the amount of bag prevention by the average store remains constant and (2) bag prevention data are accurate and representative of the industry citywide, then bag prevention by City grocery stores in 2002 is expected to be 1,048 tons. This does not change the portion of waste prevented, of course; waste prevention is expected to increase at the same rate as waste generation, as shown in Table 2-20. Because one-time costs for the program were incurred in 1993, the program is projected to yield a positive net present value of saving less costs to DOS of $263,347 between 1998 and 2002. For the purposes of this report, it is assumed that the amount of waste prevented will keep pace with increases in the

Table 2-20. Estimated Impacts of Grocery Store Outreach Program, 1998-2002

	1998	1999	2000	2001	2002	Notes
WASTE PREVENTION QUANTITY CHANGES						
Waste Prevention (tons/year)	1,027	1,032	1,038	1,043	1,048	Based on 1993 data, assuming increases proportional to 0.51% annual increase in population
Density Factor (tons/cubic yard/year)	0.14175	0.14175	0.14175	0.14175	0.14175	Loose density of mixed institutional waste from NYC SWMP compaction tests
% of Waste Recycled (per year)	0.95%	0.95%	0.95%	0.95%	0.95%	Weighted average percent of plastic and paper bags recycled based on NYC Composition Analysis research
In-Landfill Density Factor (tons/cubic yard/year)	0.6	0.6	0.6	0.6	0.6	
% of Waste Residential (per year)	100%	100%	100%	100%	100%	All residential waste
% of Waste Commercial (per year)	0%	0%	0%	0%	0%	No commercial waste
Waste Prevented (cubic yards/year)	146	146	147	148	149	Waste prevented x Density Factor
Reductions in Recycling (tons/year)	10	10	10	10	10	Waste prevented x % of Waste Recycled
Reductions in Landfill Capacity Required (cubic yd/year)	616	619	623	626	629	Waste prevented x In-Landfill Density Factor
Reductions in Local Landfill Capacity Required (cubic yd/year)	616	619	623	626	629	Reductions in Landfill Capacity Required x % of Waste Disposed in NYC
Reductions in Export Landfill Capacity Required (cubic yd/year)	0	0	0	0	0	Reductions in Landfill Capacity Required x % of Waste Disposed/Exported
COSTS AND SAVINGS						
Waste Disposal Cost ($/ton/year)	$41.50	$55.75	$62.88	$70.00	$70.00	DOS disposal costs
Procurement Cost Savings ($/ton/year)	$2,297	$2,297	$2,297	$2,297	$2,297	Based on purchase cost of $0.02/plastic bag and $0.07/paper bag, scaled to tons based on WasteLe$$ research
DOS Implementation Costs (per year)	$0	$0	$0	$0	$0	One-time costs incurred in 1993 are not included.
Other Participant Costs (per year)						
Total All Participants Cost of Implementing (per year)	$0	$0	$0	$0	$0	
Garbage Disposal Cost Savings (per year)	$42,621	$57,547	$65,238	$72,996	$73,368	Waste Prevented x Waste Disposal Cost Savings
Grocery Store Procurement Cost Savings (per year)	$2,359,019	$2,371,050	$2,383,142	$2,395,296	$2,407,512	Waste Prevented x Procurement Cost Savings
Total All Participants Savings (per year)	$2,401,640	$2,428,597	$2,448,380	$2,468,292	$2,480,880	

Table 2-20. (continued) Estimated Impacts of Grocery Store Outreach Program, 1998-2002

AGGREGATE NET PRESENT VALUES OF COSTS AND SAVINGS		
Interest Rate	5.42%	Yield on New York Metropolitan Transportation Authority Bonds
NPV Cost of Implementing for All Participants	$0	
NPV Cost of Implementing to DOS	$0	
NPV Savings for All Participants	$10,457,201	
NPV Savings to DOS	$263,347	
NPV of Program to All Participants (NPV Savings to All Participants – NPV Cost to Implement for All Participants)	$10,457,201	
NPV of Program to DOS (NPV Savings to DOS – NPV Cost to Implement to DOS)	$263,347	
All Participants Payback Period	0.00	
DOS Payback Period	0.00	
Net Annual Amortized Savings to All Participants	$2,445,558	
Net Annual Amortized Savings to DOS	$62,354	

population. However, if outreach to the public is not continued, the quantity of waste prevented, and thus the savings, can be expected to diminish over time.

2.2.9 Evaluation Plan for *CENYC Waste Assessments*

1. Program Summary

The Council on the Environment of New York City (CENYC) has assisted organizations in New York City in developing waste prevention programs with funding and other assistance provided by DOS and Empire State Development. CENYC, with a portion of DOS funding, performed waste prevention assessments to identify waste prevention opportunities at ten organizations over two years, and provided follow-up technical assistance to these organizations. CENYC also conducted a waste prevention assessment for the NYC Department of Parks and Recreation (Parks), co-funded by DOS and Parks. Recent waste prevention assessments conducted by CENYC, independent of DOS, are a component of the cumulative impact analysis.

Between July and November 1993, CENYC conducted waste assessments at three organizations: Home Box Office, Columbia University and Kinney Shoes. CENYC conducted waste assessments at seven additional organizations between September 1994 and June 1995. These included:

- Grand Central Station Post Office;
- Lafayette High School;
- Bell Atlantic;[82]
- Barnard College;
- BT Summit;

- United Nations International School; and
- The Village Voice.

With funding provided by DOS and New York State Department of Economic Development, CENYC held a conference with workshops and follow-up site assistance to help area colleges reduce waste. Ten colleges participated, including School of Visual Arts, Queensborough Community College, College of Staten Island, CUNY Central, Fashion Institute of Technology, LaGuardia Community College, Medgar Evers College, New York University, Manhattan Community College and Bronx Community College.

2. Comments On DOS Approach

DOS relies on information provided by CENYC to evaluate the impacts of this program.

In December 1993, CENYC compiled a progress report on the organizations it assessed in the first year of the program. This report identified the waste composition and waste prevention opportunities at each of the three organizations evaluated in that year. Over the next two years, CENYC worked with these organizations to implement and measure waste prevention activities. In early 1996, DOS developed *Cutting Costs and Preventing Waste in New York City Office Buildings and Institutions: Three Case Studies* ("the Guide"). The Guide documented the waste prevention opportunities implemented by each of the organizations. The Guide reported the tonnage or volume of waste prevented and the money saved as a result of action on some individual waste prevention opportunities.

For each of the organizations assessed in the second year, CENYC prepared a report which indicated the total waste generated by each organization, provided a description of each waste prevention opportunity, estimated the tonnage of waste preventable by each of the waste prevention opportunities identified, and described the waste prevention opportunities that were "under consideration" or "to be implemented." In addition, CENYC provided DOS with summaries of the waste prevention, recycling, and procurement savings achieved by each of the organizations that had compiled results. For some organizations, disposal savings and increases in revenue due to the program also were documented.

DOS's approach is generally reasonable and appropriate. However, the results obtained by DOS could be extended to provide a more complete assessment of the waste prevented by this program. If possible, the impacts attributable to DOS funding could be separated from results attributable to other program participants. This may prove difficult and will be further complicated by external factors, such as corporate commitments to waste prevention, that may drive participation in waste prevention programs.

As explained in Section 3, for the second-year program, more complete estimates of tonnage prevented could be made by converting volumes of waste prevented to tonnage, and by adding tonnage data for Bell Atlantic and the United Nations International School when that information is available. For the first-year program, not enough data were available to convert from volume to weight for each category of waste prevented.

3. Program Evaluation Recommendations

As noted above, the Guide reports on some of the waste prevention activities implemented by the first-year organizations, but it does not report the total tonnage of waste prevented by the three organizations assessed in the first year of the program, or present this information in a table format similar to the 1996 results. Thus, it was not possible for SAIC to evaluate the total tonnage of waste actually prevented by the first-year organizations, as presented in CENYC's summary to DOS. It is recommended that DOS accept CENYC's summary of waste prevented for the first-year organizations, unless CENYC is able to provide DOS with an estimate of the volumes of waste prevented for which CENYC was unable to estimate a weight of waste prevented.

For the 1996 results, the amount of waste estimated by CENYC to be prevented appears to underestimate the tonnage of the waste prevented by the five second-year organizations for which estimates were prepared. For some of the waste prevention opportunities that were implemented, DOS was provided by CENYC with only the volume of waste prevented, and not the weight corresponding to this volume of waste prevented. In those cases, although the volume of waste prevented was known, the weight of the waste prevented was reported as zero.

Volume-only estimates of waste prevented can be used to estimate the weight of waste prevented, using a density conversion factor for each material prevented, as shown in Table 2-21. When this is done, it becomes clear that approximately 29 tons of waste were prevented, but reported to DOS by CENYC only as volume of waste prevented. This additional tonnage should be added to the estimate of the waste prevented by the program.

4. Estimated Waste Prevention Impacts

The results of the assessments are presented in Table 2-22. In addition, the waste prevented by CENYC in subsequent work with Consolidated Edison and through its college workshops is included. Finally, the estimated tonnage of waste prevented reported by CENYC only by volume (as shown in Section 3) is included.

Because these organizations are expected to have institutionalized these waste prevention practices, based on two year data, impacts for 1997 and beyond are expected to, at least, remain constant at 1,334 tons.

5. Estimated Other Impacts

The additional impacts are estimated using the methods described in Table 2-1. The specific data used to apply the methods is discussed in the attached table. For this program, All Participants Costs refers to costs for the program budget to the sponsors, including DOS, non-profit organizations, a state agency, and Bell Atlantic. These do not include any costs of assessment or implementation that the businesses assessed may have incurred.

Table 2-21. Estimated Weight of Prevented Waste Reported to DOS by CENYC Only, by Volume (1995)

Item	Volume (Cubic Yards)	Pounds per Cubic Yard	Weight (Pounds)
Lafayette High School			
Textbooks[83]	9	529	4,761
Library Books[84]	2	529	1,058
Barnard College			
Disposable Dishware[85]	200	80	16,000
Grass Clippings[86]	30	280	8,400
Newspaper[87]	8	500	4,000
Library Books[88]	3	529	1,587
BT Summit			
Air Filters[89]	9	834	7,506
The Village Voice			
Liquid Production[90]	9	1,653	14,877
Cleaning Product[91]	1	117	117
Coffee Creamers[92]	1	57	144
Total (Pounds)			58,450
Total (Pounds)			29

Table 2-22. Summary of Waste Prevented Through CENYC Programs in 1996

Organization	Waste Prevented (Lbs.)
Kinney Shoe	147,995
Columbia University	328,439
Home Box Office	34,175
Bell Atlantic (NYNEX)	156,592
Barnard College	28,751
Grand Central Post Office	43,034
BT Office Products (BT Summit)	16,588
The Village Voice	44,491
Lafayette High School	5,686
U. N. International School	612,295
Total Waste Prevention Reported by CENYC (In Pounds)	1,418,046
Summary	**Waste Prevented in Tons**
Total Waste Prevention Reported by CENYC (Tons)	709
Additional Waste Prevention: Consolidated Edison & college workshops[93]	33
Additional Waste Prevented Reported by CENYC Only in Volume	592
Total Tonnage of Waste Prevented Through CENYC Programs	**1,334**

6. Waste Prevention Projections In 2002

As stated in Section 4, the organizations which have been assessed are estimated to prevent at least 1,334 tons per year. These organizations have institutionalized these waste prevention practices. It is, therefore, reasonable to assume that the quantity of waste prevented will remain approximately constant over time. Waste prevention impacts may in fact increase as recommendations previously provided by CENYC, or subsequently developed by the participating organizations as a result of their increased awareness of the benefits of waste prevention, are implemented during the next few years. Therefore, it is assumed that the program will prevent at least 1,334 tons in the years 1999-2002, as shown in Table 2-23 [next page].

Because there are no longer any implementation costs, the net present value of DOS savings less costs is $0 over the period 1998-2002. This program benefits the commercial sector. DOS however, will realize no savings, since it does not manage the prevented waste. When All Participants costs and savings are considered, the program results in a positive net present value of over $4.5 million from 1998-2002.

2.2.10 Evaluation Plan for the Department of Citywide Administrative Services

1. Program Summary

Program Description

DCAS is an Agency of New York City government, established to provide human resources, facilities management and procurement support to all City Agencies that provide services to the public. DCAS Divisions include: Equal Employment Opportunity; Citywide Personnel Services; Facilities Management and Construction; Real Estate Services; and Municipal Supply Services (DMSS).

DMSS is responsible for the procurement of goods and services to support the missions of City Agency operations throughout the City of New York. Specific duties of DMSS staff include product specification; product evaluation and inspection; competitive bidding; warehousing commonly used items; and reallocation of reusable goods. DMSS provides oversight to the operations of the DCAS Central Storehouse and the Office of Surplus Activities (OSA), which oversees the B-53 Surplus Warehouse.

Department of Municipal Supply Services

DMSS develops specifications, or uses specifications provided by City Agencies, to produce competitive bids that ensure that vendors provide the best value for City purchases. DMSS coordinates access to and maintains approximately 1,200 Requirements Contracts for those products and materials routinely purchased by City Agencies in annual amounts of more than $25,000 and for construction and construction-related services valued at more than $50,000. DMSS is responsible for annual purchases of $500 to $700 million in goods and services.

Table 2-23. Estimated Impacts of CENYC Waste Assessments Program, 1998-2002

	1998	1999	2000	2001	2002	Notes
WASTE PREVENTION QUANTITY CHANGES						
Waste Prevention (tons/year)	1,334	1,334	1,334	1,334	1,334	Based on 1997 CENYC data assuming institutionalization of existing programs but no further growth
Density Factor (tons/cubic yard/year)	0.14175	0.14175	0.14175	0.14175	0.14175	Loose density of mixed institutional waste from NYC SWMP compaction tests
% of Waste Recycled (per year)	21%	21%	21%	21%	21%	Avg. private carter rate FY 95 SWMP
In-Landfill Density Factor (tons/cubic yard/year)	0.6	0.6	0.6	0.6	0.6	
% of Waste Residential (per year)	0%	0%	0%	0%	0%	
% of Waste Commercial (per year)	100%	100%	100%	100%	100%	Commercial waste all exported
Waste Prevented (cubic yards/year)	189	189	189	189	189	Waste prevented x Density Factor
Reductions in Recycling (tons/year)	280	280	280	280	280	Waste prevented x % of Waste Recycled
Reductions in Landfill Capacity Required (cubic yd/year)	800	800	800	800	800	Waste prevented x In-Landfill Density Factor
Reductions in Local Landfill Capacity Required (cubic yd/year)	0	0	0	0	0	Reductions in Landfill Capacity Required x % of Waste Disposed in NYC
Reductions in Export Landfill Capacity Required (cubic yd/year)	800	800	800	800	800	Reductions in Landfill Capacity Required x % of Waste Disposed/Exported
COSTS AND SAVINGS						
Waste Disposal Cost ($/ton/year)	$54.32	$54.32	$54.32	$54.32	$54.32	Commercial disposal cost
Procurement Cost Savings ($/ton/year)	$100	$100	$100	$100	$100	Based on LICBDC estimate
DOS Implementation Costs (per year)	$0	$0	$0	$0	$0	Year 1 & 2 on actual costs, Year 3-5 estimated
Other Participant Costs (per year)	$0	$0	$0	$0	$0	
Total All Participants Cost of Implementing (per year)	$0	$0	$0	$0	$0	

Table 2-23. (continued) Estimated Impacts of CENYC Waste Assessments Program, 1998-2002

AGGREGATE NET PRESENT VALUES OF COSTS AND SAVINGS		
Interest Rate	5.42%	Yield on New York Metropolitan Transportation Authority Bonds
NPV Cost of Implementing for All Participants	$0	
NPV Cost of Implementing to DOS	$0	
NPV Savings for All Participants	$4,511,156	
NPV Savings to DOS	$0	
NPV of Program to All Participants (NPV Savings to All Participants – NPV Cost to Implement for All Participants)	$4,511,156	
NPV of Program to DOS (NPV Savings to DOS – NPV Cost to Implement to DOS)	$0	
All Participants Payback Period	0.00	
DOS Payback Period	N/A	
Net Annual Amortized Savings to All Participants	$1,054,090	
Net Annual Amortized Savings to DOS	$0	

Since 1991, DMSS has lost of half its procurement staff and, thus, no longer has personnel assigned to work exclusively on waste prevention, life cycle analysis, cost benefit analysis, product performance analysis or recycled product procurement. Despite the loss of staff, DMSS pursues a variety of environmental options. During Fiscal 1997 and 1998, DMSS purchased a combined total of $13.2 million worth of recycled content paper products, most of which met the mandated 20 percent post-consumer recovered content requirement. DMSS also maintains the contract with Staples to provide office supplies for City Agencies. The DMSS contract requires Staples to publish and distribute a separate catalogue of recycled-content items from which City Agencies purchased $631,000 worth of products in FY 1998. DMSS also issued contracts for vehicle tires and batteries that include a provision for the vendor to take back the product when it is no longer usable.

DMSS operates the Central Storehouse, a 400,000 sq. ft. warehouse for storage and distribution of a $7 to $8 million inventory of products purchased by DMSS buyers for the use of Mayoral Agencies. Products and materials available from the DCAS Central Storehouse are listed in the *Central Storehouse Commodity Catalogue*. The Storehouse replenishes agency supplies, using both its own trucks and contractors to service a total of 2,200 delivery points.

Office of Surplus Activities

Through its Office of Surplus Activities (OSA), DMSS manages the reallocation or marketing and sales of a variety of equipment, materials and products that are no longer needed by the agencies that purchased them. OSA programs include:

- sealed bid sales of heavy equipment and other surplus items;
- bi-weekly auctions of vehicles taken out of commission due to age or damage;

- reallocation of property among City Agencies through on-site sales and direct transfers; and
- operation of the B-53 Surplus Warehouse.

The goal of OSA is to ensure that the City of New York "receives the greatest level of revenue through the resale of items when they have become obsolete or unusable."

Sealed bid sales:

Throughout the year, DMSS offers a variety of surplus items for sale via sealed bid. OSA staff is responsible for marketing activities, including targeted advertising, a facsimile mailing list and national and international distribution of a brochure, to promote sales of surplus building supplies, scrap metals, heavy equipment, office equipment including computers, and specialized equipment, such as fire fighting apparatus. Staff oversight of the appraisal process and administration of sealed bid solicitations ensure that New York City realizes the highest possible revenue from the sealed bid process.

Unusable heavy and light steel, primarily metal furniture, is sold to a single contractor each year, through a competitive, sealed bid process. Other, valuable metals, such as scrap aluminum from the Department of Transportation Sign Shop, are sold via individual sealed bids.

Vehicle auctions:

DMSS sells the City's surplus vehicles at bi-weekly public auctions. Cars and car parts, trucks, and motor scooters may be sold. OSA staff directs marketing efforts that include advertising heavy equipment via a variety of media outlets; publishing and distributing brochures to a list of domestic and international clients and tracking the clients in a comprehensive database. In FY 98, the average price per vehicle was $2,180.

Property reallocation:

When material is unusually heavy or large, it may be sold via sealed bid, directly from an Agency location. Agency on-site sales generated revenues for the City of $2.3 million (combined FY 97 and FY 98 figures). In addition, OSA tries to match agencies that are planning to dispose of items with other agencies seeking to acquire that same type of item. Direct transfers eliminate the need to transport materials to the Surplus Warehouse and store them prior to transport to the receiving Agency.

Surplus Warehouse:

The B-53 Surplus Warehouse provides an indoor facility to store surplus materials awaiting sale or exchange among City agencies wishing to dispose of and/or acquire surplus supplies and equipment, such as furniture and computers. To place surplus materials in the warehouse, City Agencies must submit approved relinquishment forms. DMSS does not employ a delivery staff and Agencies must transport the materials to the Brooklyn site at their own expense.

DMSS offers access to a private trucking contract at a cost of $400 per truckload. Agencies may requisition materials from the Surplus Warehouse at no charge other than transportation.

During FY 98, OSA initiated its Mix and Match program. Staff recovers usable components from broken equipment and uses them to repair similar items which are then eligible for reuse or sale. During FY 97 and 98, $5.2 million (appraised value) of surplus furniture and equipment was transferred among City agencies. During this same time period, OSA generated revenues of $450,000 from sales of scrap metals and $213,000 from sales of computers, office supplies and machine tools.

2. Comments on DOS Approach

The Department of Sanitation has not evaluated or quantified the waste prevention and cost savings impacts of DCAS procurement and surplus management programs. DOS is interested in determining the impact of these programs on the City's waste management costs. Program measurement and evaluation would require DCAS to track and provide to DOS data on the weight and volume of transactions between or among agencies or via auction or bid. Currently, DCAS presents dollar figures for procurement of recycled-content products and selected annual revenues from the OSA operations in its annual Environmental Procurement report to the Mayor and City Council.

In FY 95, DCAS conducted a cost benefit analysis to determine whether the Surplus Warehouse should be privatized. The public summary of this analysis provided some limited figures on the costs to operate the Surplus Warehouse and concluded that the Surplus Warehouse provided the City of New York with more than $1.5 million in cost avoidance by providing a location for metals to accumulate to meet vendor quantity needs and by supporting City Agency relinquishment and supply needs. In the combined FY 97 and 98 Environmental Procurement report, DCAS stated that the goal for OSA is to "ensure that the City of New York realizes the maximum utilization potential from all materials purchased and receives the greatest level of revenue through the resale of items when they have become obsolete or unusable."

3. Program Evaluation Recommendations

DOS is aware that DCAS operations divert a significant quantity of materials and goods from the waste stream. DOS wishes to quantify the waste prevention achieved by DCAS; however, DCAS does not presently track the weight, volume, or replacement value of the items sold or redistributed. DOS can work with DCAS to identify major costs and major savings and to initiate record keeping activities that will allow DOS to perform cost benefit analysis and to quantify the avoided disposal value of the DCAS surplus operations. DOS could assist DCAS in examining the feasibility of calculating the on-going economic impacts to the City for operating specific waste preventing activities, such as the vehicle auction or the Surplus Warehouse. DCAS also could consider establishing a tracking system that allows staff from each program to enter a description, the weight if known, as well as the revenue obtained for each item or lot of items sold or recovered for reuse, on a monthly or quarterly basis. If feasible, DCAS then could provide these figures to DOS. DOS could calculate the weight and replacement value of materials that were diverted from disposal to recycling or beneficial reuse.

Based on the value that DOS places on the management, including labor, truck operations, transfer station operations and ultimate disposal, of one ton of solid waste, DOS then could calculate the avoided disposal value of the quantity of material that was sold for recycling, the quantity of equipment repaired and returned to service, as well as the quantity of equipment and supplies diverted to reuse in other City Agencies.

4. Estimated Waste Prevention Impacts

If data become available, DOS and DCAS can present information on the present waste prevention impacts of the procurement and surplus operations of DCAS. Table 2-24 provides a framework for such a presentation.

Table 2-24. DCAS Waste Prevention

Material	Quantity	Management	Weight/Volume	Revenue
Vehicles		Auction		
Scrap Steel		Sealed bid		
Scrap Aluminum		Sealed bid		
Other Metals		Sealed bid		
Office equipment				
Computers				
Office furniture				

5. Estimated Other Impacts

Data currently exist only for the dollar value of certain sales of vehicles, property, and surplus goods. In order to adequately measure other impacts, data are required on the quantities of each type of product sold. Currently, OSA does not track quantities. Due to the varying weight of each type of material sold, it is impossible to determine the quantities of materials prevented from disposal in the Fresh Kills landfill.

6. Waste Prevention Projections in 2002

Data are not currently available to make the projections.

2.2.11 Evaluation Plan for the *NYCitySen$e* Program

1. Program Summary

Program Description

A Mayoral Directive on Waste Prevention (No. 92-5) was issued on September 9, 1992. The 1992 Directive required Mayoral agencies to implement specific waste prevention practices

targeting reduction in the purchase, use and disposal or recycling of paper, paper products and single use food service items. The 1992 Directive required City Agencies to report twice each year to the Mayor's Office of Operations on the waste prevention and reuse measures adopted and implemented.

Prior to the first reporting period, DOS conducted seminars on waste prevention and the Directive's requirements for representatives of all Mayoral agencies, including recycling coordinators, purchasing agents, and other employees interested in waste issues. DOS provided each Agency with tools, such as tip sheets on how employees can reduce paper waste, sample letters for copy rooms to institute a "double-sided copying only" policy, signs to be displayed over copy machines urging staff to copy double-sided and signs to identify recycling bins, to encourage City employees to comply with the Directive.

A DOS survey of Agencies indicated that, as a result of the Directive and the education efforts, most agencies reported undertaking at least some waste prevention measures. A number of agencies embraced the concept of waste prevention by taking steps, such as setting up electronic mail systems to reduce paper use, reusing furniture from the City's salvage center instead of buying new furniture, and purchasing items that help reduce waste, such as refillable laser toner cartridges. While the survey showed that Agencies were implementing waste prevention measures, it also indicated that waste prevention was not yet a standard operating procedure.

On September 27, 1996, Mayor Rudolph Giuliani issued a new *Directive on Waste Prevention and Efficient Materials Management Policies* (96-2) aimed at reducing costs by conserving supplies and reducing the amount of solid waste generated by City government. The directive emphasized practical measures to achieve measurable reductions in City Agency waste with requirements focused on office paper waste prevention and reuse; reducing waste from purchasing goods and supplies; reducing lawn and yard waste; and other measures.

In addition, agencies were required to assign a Waste Prevention Coordinator, responsible for compliance with the directive, and to report on their compliance annually to the Mayor's Office of Operations. Agencies that implemented cost effective waste prevention strategies are eligible for an annual recognition award from the Mayor's Office. The Directive was distributed to all heads of Mayoral Agencies and Agency departments.

DOS, Bureau of Waste Prevention, Reuse and Recycling (BWPRR), developed the 1996 Directive in consultation with its Legal Affairs Bureau, the Mayor's Office of Operations, and Corporation Counsel. The objective of the Directive was to save money for City Agencies, while reducing solid waste set out for DOS collection. DOS took steps to improve upon the 1992 Mayoral Directive by: 1) developing sections addressing additional opportunities to cost effectively prevent waste; 2) designing a streamlined reporting system that would facilitate compliance; 3) proposing the establishment of a task force and awards program to promote maximum results; 4) producing a waste prevention guide to be distributed to all Mayoral Agency employees highlighting cost-saving initiatives effectively implemented by various agencies.

Accompanying the Directive was a brochure, *Finding Dollars in City Trash: The Budget-Stretching Guide to Preventing Waste in NYC Government Agencies*, produced by BWPRR. The brochure was intended to guide agency actions and it includes examples of steps many Mayoral agencies already have undertaken to save money through waste prevention. The publication was distributed to all Mayoral agency employees. A poster, also produced by DOS, emphasizes the benefits of copying documents on both sides of the page, and provides tips to facilitate two-sided copying.

DOS has provided leadership and technical assistance to a multifaceted, citywide program to encourage businesses, institutions and community organizations to adopt new procurement and operational practices that will prevent waste. Working with the Mayor's Office of Operations, DOS also strives to promote waste prevention throughout City operations. To evaluate City Agencies progress in waste prevention, DOS and the Mayor's Office of Operations, working cooperatively with the Mayoral Agencies, developed a waste prevention and recycling assessment and enhancement pilot program targeting 12 key operations within DOS and 10 other Mayoral Agencies. Through this technical assistance program, *NYCitySen$e*, DOS created a framework for the Mayoral Agencies to "lead by example" in the City's campaign to prevent waste.

Between January 1998 and August 1999, through the *NYCitySen$e* program, DOS provided technical assistance for the conduct of waste sorts, waste prevention and enhanced recycling opportunity assessments, and implementation and measurement support to specific operations of the following 11 City Agencies:

- Department of Health,
- Human Resources Administration,
- Taxi and Limousine Commission,
- Department of Business Services,
- Department of Transportation,
- Department of Environmental Protection,
- Financial Information Services Agency,
- Fire Department,
- Department of Citywide Administrative Services,
- Department of Juvenile Justice, and
- Department of Sanitation.

The technical assistance provided to these agencies included support for the following activities:

- performance of waste sorts, and assessments of procurement practices and operations,
- identification of promising opportunities for waste prevention and enhanced recycling,
- development of implementation plans for waste prevention and enhanced recycling, implementation support for selected opportunities,
- review of waste prevention and enhanced recycling achievements, conducted at 45 day intervals, and
- program expansion and enhancement support where feasible.

Table 2-25 presents the major waste prevention and enhanced recycling opportunities identified to date for each of the participating City Agencies.

Table 2-25. *NYCitySen$e* Representative Waste Prevention and Recycling Opportunities by Agency

AGENCY	WASTE PREVENTION OPPORTUNITIES	ENHANCED RECYCLING OPPORTUNITIES
Department of Environmental Protection (DEP)	Develop a waste prevention awareness campaign Conduct rechargeable battery pilot project Install computer tracking system for stockroom	Initiate mixed paper recycling Initiate cooking grease recycling Reduce contamination in cardboard recycling
Human Resources Administration (HRA)	Establish two-way envelope pilot program Enhance duplex copying Reduce undeliverable mail	Initiate mixed paper recycling Establish toner cartridge recharge/recycle program Establish a pallet reuse and recycling program
Fire Department	Conduct staff training in waste prevention and recycling Install fluid dispensing and evacuation systems Substitute reusable absorbents Purchase less toxic solvents	Initiate mixed paper recycling Establish oil filter recycling Establish a pallet reuse and recycling program
Taxi & Limousine Commission	Conduct training for TLC staff Conduct training for regulated community, including taxi companies and drivers Enhance duplex copying	Initiate toner cartridge recharge/recycling program Establish recycling program for white paper, mixed paper, mixed containers, corrugated cardboard and bulk metal
Department of Health (DOH)	Document and expand furniture refinishing program Consider reusable distribution packaging Evaluate less toxic furniture refinishing products	Initiate toner cartridge recharge/recycling program Establish a pallet reuse and recycling program
Department of Transportation (DOT)	Review management of used rags Evaluate less toxic graffiti and tape remover Review solvent management practices	Establish a recycling program targeting mixed paper, mixed containers, and corrugated cardboard
Financial Information Services Administration (FISA)	Identify reuse option for unused white paper Train City employees to access FISA reports electronically Return caps from rolls of computer paper to vendor	Initiate mixed paper recycling Initiate mixed container recycling Initiate recycling programs for plastic film and strapping

Table 2-25. (continued) *NYCitySen$e* Representative Waste Prevention and Recycling Opportunities by Agency

AGENCY	WASTE PREVENTION OPPORTUNITIES	ENHANCED RECYCLING OPPORTUNITIES
Department of Juvenile Justice (DJJ)	Replace single-use, disposable cups and bowls with durable reusables Install bulk distribution for cereal Install bulk dispensers for beverages Compost food preparation wastes	Initiate toner cartridge recharge/recycling program Implement recycling for milk and juice containers Implement recycling for cereal boxes
Department of Sanitation (DOS) Queens 5 Garage	Purchase a more effective soap for equipment cleaning Consider an oil evacuation system Evaluate solvent use	Establish a pallet reuse/recycling program
Department of Sanitation (DOS) 44 Beaver Street	Introduce waste prevention concepts into annual Right to Know training Enhance duplex copying	Document toner cartridge recharge/recycling program
Department of Business Services (DBS)	Issue a waste prevention policy statement Designate a reusable office supplies area in the supply room Enhance the relationship between DOS programs and DBS outreach activities	Consider additional containers and labeling for paper recycling Consider a mixed container recycling program
Department of Citywide Administrative Services (DCAS)	Work with Procurement Training Institute to develop a course on buying environmentally preferable and recycled content products Use ACCO meetings and Procurement Bulletins to disseminate information about recycled content and environmentally preferable products and programs Promote agency successes with environmentally preferable and recycled content products to other agencies	Incorporate recycling requirements into DCAS-negotiated leases Encourage return of pallets to the Central Storehouse Encourage City Agencies to establish toner cartridge recharge/recycle programs

This is not a complete list of recommendations.

DOS Measurement and Evaluation Methods

The *NYCitySen$e* program included three measurement-related activities:

1) Waste Sorts
2) Waste Reduction Estimation
3) Waste Reduction Extrapolation

Waste Sorts

During the summer of 1998, the ***NYCitySen$e*** project contractor, assisted in some instances by the Council on the Environment of New York City (CENYC), conducted waste sorts to characterize and quantify the waste generated by the participating City Agency operations and to provide information to help focus waste prevention opportunity assessments. The sorts were single-day events based on a 24 hour accumulation of waste and are not construed to be statistically valid or representative. No follow-up waste sorts are planned. The information resulting from these waste composition analyses was exclusively used to guide the identification of promising waste prevention opportunities, not to serve as a baseline for waste prevention measurement.

However, the information developed during these sorting exercises can shed light on some of the key opportunities evident in the waste generation and management practices of the City Agencies. A brief summary of highlights of the results of the waste sorts is presented as Table 2-25. In this presentation, estimates for annual generation of specific materials are provided. These rough estimates represent extrapolations from a sample of 24 hours of material generation to a full year's presumed generation, based simply on the same daily waste and recyclables generation during an assumed 250-day year.

As is evident from the data presented in Table 2-26, through the initial waste sorts, the technical assistance teams identified a number of highly promising waste prevention opportunities. For example, in the case of the Department of Transportation waste sort, the technical assistance team estimated that approximately 47,500 pounds of pallets are generated and discarded as solid waste on an annual basis. A variety of refurbishment and reuse options could plausibly be exercised to divert this waste stream and prevent this waste. Pallets also were observed commingled in the trash of several other agencies during follow-up site visits, but were not observed during the sorts; just one example of further evidence that the data for the one-day sorts probably were not representative.

Table 2-26. Highlights of NYCitySen$e Waste Sorts (estimated annual quantities generated in pounds)*

Agency	Recycled White Paper	Recycled Mixed Paper	Recycled Corrugated Cardboard	Recycled Mixed Containers	Disposed White Paper	Disposed Mixed Paper	Disposed Corrugated Cardboard	Disposed Mixed Containers	Disposed Plastic Food Service	Disposed Paper Food Service	Disposed Food/Liquid	Dipsosed Pallets
DBS/2nd Floor	1,875	1,875	0	0	0	1,375	1,875	2,400	875	1,375	1,750	0
DBS/3rd Floor	4,000	4,000	5,000	500	2,000	2,750	0	3,578	1,281	2,844	1,750	0
DEP/Photocopy Ops.	4,063	0	5,500	5,500	563	750	0	375	0	63	0	0
DEP/Cafeteria- Kitchen	0	0	8,875	0	0	0	125	2,625	688	688	14,900	0
DEP/Cafeteria- Dining	0	0	0	1,375	0	875	0	3,813	3,594	3,954	6,000	0
DOH Distrib. Warehouse	0	500	1,188	335	125	375	250	180	63	313	438	0
DJJ/Cafeteria	0	0	50,370	9,855	0	47	548	14,874	3,833	14,965	89,060	0
DJJ/Admissions	9,125	0	0	0	183	548	0	456	548	1,278	1,460	0
DJJ/Clinic	219	0	0	0	365	548	0	456	183	412	365	0
DOS/5th Floor	313	3,125	1,688	125	5	250	0	33	125	203	250	0
DOS/6th Floor	1125	875	0	63	0	0	0	13	125	133	250	0
DOS/Garage	0	1,125	0	2,500	63	125	0	35	188	313	0	0
DOT/Sign Shop	0	0	8,250	0	125	375	250	1,248	250	813	813	47,500
Fire /EMS Fleet Maintenance	0	0	33,750	0	875	2,938	4,250	1,375	375	1,375	1,500	210,000
FISA/Computer	84,250	0	0	0	1,125	875	1,250	2,438	375	1,125	875	0
FISA/Warehouse	188	0	1,000	0	63	0	0	283	33	158	0	0
HRA/2nd Floor	4,500	0	4,500	0	5,250	15,938	63	11,188	2,025	5,753	10,750	0
HRA/9th Floor	4,125	0	1,000	375	1,750	10,875	63	3,250	1,125	2,000	5,000	0
TLC/Inspection	0	0	0	0	7,500	6,750	3,250	3,000	938	1,625	3,000	0
TOTALS	113,783	11,500	121,121	20,628	19,992	45,394	11,924	51,620	16,624	39,390	138,161	257,500

These figures are based on a one day waste sort and should not be considered a statistically valid sample. Annual figures calculated using 250 day work year, except for DJJ, which uses a 365 day year. Recycling figures do not include contaminants.

In the case of the DEP cafeteria waste sort (reportedly yielding estimates of as much as 15,000 pounds of food waste annually) and the Department of Juvenile Justice cafeteria (estimated at 61,000 pounds of food waste per year), the technical assistance team recommended composting options to divert waste from disposal.

Although these waste sort data do not provide a conclusive indication of waste volumes and waste types, they do represent one of the few sets of actual measured and monitored waste data and provide key indications of major waste prevention opportunities.

Waste Reduction Estimation

The major waste prevention survey information developed through *NYCitySen$e* resulted from on-site assessments, interviews with key staff, purchasing records analysis, and general site assessments. The team interviewed agency personnel using detailed and specifically tailored questionnaires concerning numbers of employees working in various operational aspects and locations of the surveyed facilities and waste management practices and waste generation patterns. They also surveyed agency personnel in terms of their waste hauling arrangements, collection schedules, and cost basis and reviewed the waste hauling contracts, invoices, and receipts, as possible. Further, they reviewed agency procurement policies and other activities and policies affecting hazardous waste generation, pest management, cleaning product selection and use and general materials management.

Based on the pre-assessment surveys, site visits and opportunity assessments, the project team developed detailed facility assessment and waste prevention reports, complete with facility descriptions, descriptions of current waste prevention and recycling initiatives, recapitulation of the results of the waste sorts, and recommendations for enhancements to existing recycling programs. These reports represent the basis for a baseline inventory of waste generation and prevention opportunities. Follow-up visits were expected to provide the basis for estimating (measuring) the effectiveness of the program in terms of waste prevention and to provide the basis for estimating the potential for replication of the waste prevention and enhanced recycling agency-wide, for each participating agency. In some cases, the experience of a particular agency in terms of a particular activity (*e.g.* food preparation, vehicle maintenance) may serve as the basis for cross agency extrapolation to another participating agency where similar activities and procedures are used. The culmination of this phase of the effort, thus, was intended to result in estimates of the actual amount of waste reduced via specific waste prevention or enhanced recycling initiatives undertaken by the participating City Agency operations.

Waste Reduction Extrapolation

Measuring the results of any program is key to assisting City Agencies in determining if their resources are being allocated responsibly. Documenting successful initiatives also provides a mechanism for informing other Agencies that they can anticipate cost savings and prevent waste if they take the time to implement similar waste prevention techniques. Also key to cost-effective waste prevention measurement is the use of feasible and realistic measurement strategies. Through the *NYCitySen$e* project, DOS hoped to establish baseline waste generation

information from each participating City Agency operation, implement waste prevention initiatives for key waste streams within each operation, and track and measure the changes in the quantity of waste generated after implementation of the waste prevention programs. Using this information, DOS hoped to present overall waste prevention achieved by the participating Agencies and make Citywide projections based on the data recorded by the participating City Agencies. While *NYCitySen$e* succeeded in measuring the achievements of specific waste prevention initiatives within select City Agency operations, the program also identified impediments to obtaining accurate data for forecasting Citywide waste prevention.

If a single City Agency operation implements a specific waste prevention program, it may be possible to estimate the waste prevention achieved from procurement records, vendor records, waste audits, and employee surveys. For example, the Department of Sanitation was able to provide detailed data on the waste and cost impacts of extending the preventive maintenance schedule for its vehicle fleet.

In contrast, when an Agency conducts a large-scale waste prevention awareness and/or education campaign, contact with participants is often fleeting. The contact may occur during a brief site visit, at a city-sponsored seminar, through the mail, via a newspaper article, or through other methods for which cause and effect are difficult to observe, evaluate, and quantify. The City's efforts to promote duplex copying fall into this category. Further, to the extent that projects affect multiple Agencies, extrapolation of results from a small set to the larger universe may result in mis-estimation of the impacts.

For example, the Department of Business Services issued a policy statement to its employees regarding the Agency's recycling and waste prevention effort. DBS does not know how many employees read the statement or how many individuals changed their behavior in response to the information presented in the statement. Contacting each employee to inquire about the impacts of the policy statement is possible, but would be time-consuming and costly. Designing and implementing a scientific, statistically significant survey to determine how and to what extent the policy encouraged a positive change in behavior is even more expensive. In some cases, the cost of measuring the impact of a waste prevention program may actually exceed the cost savings and other benefits of the waste prevention effort.

The sheer size and complexity of City government, including Agencies with limited staff and multiple operations and locations, complicate reporting at an Agency level. Each Agency would have to assign staff to develop a mechanism to track the waste prevention and recycling efforts of each operation or location. Historically, the computer systems and equipment available to City Agencies do not provide employees with the tools needed to track products or materials from the procurement process, through use, to the point of recycling or discard of the material and packaging. Further confounding the measurement process is the fact that the City tracks procurement of goods by the dollars spent, not by the individual items purchased by each Agency.

Many of the initiatives and programs that City Agencies undertook in response to the *NYCitySen$e* program have not been in place for a sufficient period of time to allow measurement of success. Several of the waste prevention initiatives presented to the Agencies required the purchase of

new equipment or alternative products. In these instances, several Agencies considered specific recommendations and elected to implement a pilot project to determine the effectiveness of the product or equipment in their unique operations and to gauge the potential for larger-scale success. The data and information generated as a result of these pilot programs will assist the Agencies in determining if full implementation of the initiative could result in significant savings and prevention of waste in the future.

2. Comments on DOS Approach

DOS conducted a survey to evaluate City Agencies' compliance with the 1992 Mayoral Directive. The results of that survey indicated that Agencies needed additional information and technical assistance, both to implement waste prevention opportunities and to track the impacts of those opportunities on waste generation and recycling. The self-reporting option did not generate reliable data. The 1996 Mayoral Directive added additional requirements and the DOS guidance manual provided success stories, but the City has retained the self-reporting option. Since City Agencies cannot easily track purchases of specific items, procurement data, from which accurate waste quantities and waste prevention calculations derive, is not readily available.

Quantifying source reduction relies on direct measurements of reported changes in waste stream quantities, either by volume or weight. Several specific methods, such as program monitoring through audits or mandatory internal reporting; dedicated surveys and field work; and/or hands-on waste sorts, may be used to obtain direct measurement data. Once the City has implemented the new Financial Management System, FMS 2000, City Agencies may be able to develop facility or operation-specific and Agency-wide waste reduction measurement programs that use quantities of waste collected, purchasing records, employee surveys and facility walk-throughs, and waste sorts to collect direct information. Maintaining consistent formats for data collection would allow data from individual operations to provide the basis for extrapolating to potential, citywide impacts. Current data would be difficult to aggregate because of inconsistencies in measurement approaches and participation. Table 2-27 [next page] provides an overview of some of the waste prevention successes achieved to date by certain participating City agencies.

3. Program Evaluation Recommendations

NYCitySen$e offers DOS an important platform for promoting waste prevention because it represents the Department's effort to "lead by example." *NYCitySen$e* actually provides the Department with an avenue to describe its own model waste prevention successes and cost savings, as well as those of its sister agencies, within a leadership framework. This program represents an unparalleled opportunity for DOS to relate first hand experience, thereby enriching the outreach campaign with compelling examples.

The ideal program construct would utilize consistent formats for collection of baseline waste generation data and follow-up waste sorts to actually measure the program success. Through follow-up waste sorts, DOS could measure progress and correlate the observed waste reductions

Table 2-27. City Agency Waste Prevention and Recycling Successes

Agency	Waste Prevention Successes
Department of Environmental Protection	Computerized inventory system
Human Resources Administration	Two way envelope pilot program Paper purchase and use reductions Recharge toner cartridges
Fire Department	Extended PM Schedule On-site transmission fluid recharge and reuse Incorporating waste prevention concepts and equipment into design of new facility
Department of Health	Used furniture repair and refurbishment program Reusable mugs
Department of Transportation	Extended solvent contractor schedule Reduced toxicity Reusable distribution packaging
Department of Sanitation, Queens 5 Garage	Less costly bulk soap for vehicle washing Extended PM schedule
Department of Business Services	Agency waste prevention policy statement
Department of Sanitation, BWPRR 44 Beaver Street	Set copy machines to default to duplex Recharge toner cartridges
Department of Citywide Administrative Services	Surplus Warehouse

to the specific opportunities that targeted the reduced commodities. This analysis could facilitate the extrapolation of waste prevention potential to other City Agencies and other businesses engaged in similar activities throughout the City. These, however, would be costly and labor intensive.

DOS also can make an effort to track the impacts of any new waste prevention efforts resulting from participation in the eight *NYCitySen$e* seminars. The recommendations from seminar participants and additional waste prevention successes identified through the seminars may assist DOS and the Mayor's Office of Operations in targeting additional specific waste prevention opportunities for further educational efforts or technical assistance. Publication of an updated, enhanced waste prevention Guide for City Agencies, based on the experiences of the *NYCitySen$e* partners and the seminar participants, will provide City Agencies with waste prevention targets that fully recognize the challenges for City employees, based on the experiences of their peers.

4. Estimated Waste Prevention Impacts

The waste sort data, when combined with data from the site assessments and surveys, and when considered against the waste prevention recommendations, offer a rough indication of the potential to reduce the generation of certain target commodities through the application of specific strategies. Table 2-28 presents, for each participating agency's program, an inventory of selected major commodities targeted for waste prevention and rough estimates of the quantities of those commodities recorded through the waste sorts, pre-assessment surveys, and site assessments.

Two key factors reinforce the potential waste prevention benefits of the project. The first concerns the profound similarities between the activities undertaken within the City Agency operations receiving technical assistance and other City Agency operations within the City. As a result, the waste prevention recommendations applicable to *NYCitySen$e* facilities are, in the vast majority of cases, directly applicable to other City Agency offices and facilities throughout the five boroughs.

The second factor concerns the reporting and operational structure of the Mayoral agencies. Because ultimately all of these agencies report directly to the Mayor's office, the potential for waste prevention guidance, recommendations, or even requirements to be carried out, once issued, is good. Therefore, the potential for the pilot efforts and lessons learned through *NYCitySen$e* to maximize waste prevention within and throughout City Agencies is excellent.

Table 2-28. Inventory of Selected Major Commodities Targeted for Waste Prevention, by Agency*

Agency	Primary Targeted Commodities	Estimated Quantities for Surveyed Operations Only (pounds/year)
DEP	Mixed Paper	1,625 (sort data extrapolation)
HRA	White Paper	7,000 (sort data extrapolation)
	Mixed Paper	26,813 (sort data extrapolation)
Fire Department	Oil Filters	4,682 (assessment data)
Taxi and Limo	White Paper	7,500 (sort data extrapolation)
	Mixed Paper	6,750 (sort data extrapolation)
	Corrugated Cardboard	3,250 (sort data extrapolation)
DOH	Furniture	69,643 (assessment data)
DOT	Rags	3,500 (assessment data)
	Mixed Paper	375 (assessment data)
	Corrugated Cardboard	250 (sort data)
FISA	White Paper	1,167 (sort data extrapolation)
DJJ	Disposable Cups and Bowls	3,743 (assessment and sort data extrapolation)
DCAS	Pallets	160,000 (assessment data)

*These figures are based on the quantity of each materials found in the Agency's waste stream targeted for disposal rather than recycling during a one-day waste sort. The extrapolations are for comparison purposes only.

5. Estimated Other Impacts

The emphasis of this project on the leadership role of DOS and the Mayoral agencies invites potential for considerable positive impacts, particularly in terms of raising awareness of waste prevention potential and enhancing the confidence of Agency personnel, businesses and the public in the City's approach to waste prevention, commitment to waste prevention, and potential to provide technical assistance and guidance in waste prevention.

6. Waste Prevention Projections in 2002

Waste prevention and enhanced recycling projects implemented through the *NYCitySen$e* program can help City Agencies to conserve resources, reduce energy consumption and reduce both operating and waste management costs for the City of New York. Measuring the impacts of these City Agency waste prevention and recycling programs is an essential component of a long-term effort to expand and maintain these programs. Measurement results may help the City determine if City Agency resources are being allocated responsibly. Documenting successful initiatives also provides a mechanism for informing other Agencies that they can anticipate cost savings and prevent waste if they make a commitment to implementing similar waste prevention techniques.

Key to cost-effective waste prevention measurement is the use of feasible and realistic measurement strategies. Given the current status of technological improvements, and the staffing to meet the demands of the missions of City Agencies, it is currently feasible to measure waste prevented only for certain activities and operations. Because of the challenges associated with implementing consistent measurement approaches and establishing baseline product and packaging waste data, the scope of the potential for waste prevention in 2002 is not yet finalized.

2.2.12 Evaluation Plan for the Botanical Gardens Compost Projects

1. Program Summary

Program Description

In 1993, DOS initiated an agreement among the New York City Department of Cultural Affairs (DCA) and four botanical gardens: Brooklyn, Queens, Staten Island and The New York Botanical Garden in the Bronx. The agreement specified that DOS-funded staff at the Botanical Gardens would promote backyard and small-scale composting to NY City residents, institutions and businesses through outreach, education and technical assistance. The goal of the Botanical Gardens Compost Project is to divert organics from the waste stream and to quantify the Project's impacts by measuring waste diverted, as well as the number of participants in various programs. DOS recognized that these Botanical Gardens are known and respected in their communities and provide services, expertise and access to audiences that might not easily be reached through citywide campaigns.

The Botanical Gardens compost their own leaf and yard waste on-site. From FY 94 to FY 97, the Gardens installed backyard composting demonstration sites on their own grounds, as well

as at satellite locations in their boroughs. Staff used these sites to host composting workshops and training programs. Staff also presented composting workshops at street fairs and festivals and in New York City schools. Table 2-29 summarizes this effort.

Table 2-29. Backyard Composting Workshops

Event	Number Conducted	Attendees
Classes, workshops, presentations	284	15,000
School workshops	200	6,000
Fairs, special events	186	23,000

From FY 96 through FY 98, the Gardens provided technical assistance to New York City institutions, including the New York City Housing Authority (NYCHA). Gardens' staff provided training in on-site composting of leaves and trimmings and grass recycling to 15 public schools, 16 institutions of higher learning, 16 cemeteries, eight golf courses and eight hospitals throughout the five boroughs.

A series of seminars targeting NYCHA groundskeepers resulted in a NYCHA decision to eliminate disposal of bagged grass clippings and leave them on the lawn. NYCHA grounds crews maintain 300 grassy areas ranging in size from three to 65 acres and totaling 2,400 acres of lawn. This policy change annually diverts approximately 7,200 tons of grass from disposal to beneficial reuse.

In addition, in January and February, 1997, DOS and Botanical Gardens staff visited every NYCHA composting site. At each site, DOS measured the length, width and height of the leaf pile to calculate total volume. Using conservative data provided by contractor, Organic Recycling Inc., DOS accounted for the degradation of leaves between November and February to calculate the total volume of leaves diverted. DOS used a standard conversion rate of 4 cubic yards per tone to determine the total tonnage of leaves diverted. Sixty NYCHA sites located throughout the five boroughs diverted nearly 6,500 cubic yards of leaves from disposal in one year. This is an on-going program and additional NYCHA sites have initiated leaf composting. DOS has not yet quantified the ongoing impact of these programs.

In FY 96 and FY 97, the Queens and Staten Island Botanical Gardens trained local landscapers in grass recycling, decreased use of fertilizer and pesticide and increased use of compost. Two conferences on natural landscape maintenance, held at the Queens and Brooklyn Botanic Gardens, drew nearly 300 participants.

In FY 98, at ten promotional events, more than 800 compost bins were sold to New York City residents. In addition, the Gardens participated in the DOS one year study of backyard composting. This pilot program in four test neighborhoods in the Bronx, Brooklyn, Queens and Staten Island evaluated the diversion impacts and costs and benefits that could result if a composting program were promoted citywide. The results of this pilot are presented in a report entitled *Backyard Composting in New York City: A Comprehensive Program Evaluation*, issued in June, 1999.

In FY 99, the Gardens conducted 17 workshops on *Wormbin Composting in the Classroom* for 240 public school teachers. Each teacher received a bin, worms and materials that allow them to incorporate lessons on waste prevention through composting into the curriculum.

DOS has produced a number of educational materials that are disseminated through the Botanical Gardens. These include: *The Urban Home Composting Guide*, an illustrated brochure on backyard composting techniques; *Leave It On the Lawn*, a flier encouraging grass recycling; *Home Composting Video*, providing step-by-step instructions on backyard composting and grass mulching; *Institutional Composting Video*, targeting groundskeeping and maintenance staff at NYCity institutions; and *Easy Compost*, a booklet produced by the Brooklyn Botanic Garden. In addition, DOS distributed the Composting Magnet, a refrigerator magnet promoting residential composting and a Grass Mulching Ruler, a promotional item that indicates the ideal height to cut grass for mulching. DOS did not provide information on the quantities of each item produced and/or distributed.

2. Comments on DOS Approach

Because of the anticipated staff and funding needed, the Department of Sanitation has not initiated a comprehensive effort to evaluate or quantify the full waste prevention and cost savings impacts of the ongoing compost initiatives undertaken by DOS-funded staff at the Botanical Gardens. DOS has not, for example, conducted a survey to determine how many participants in the original composting workshops actually initiated composting efforts in their homes and classrooms. Since 1997, DOS has not updated the total number of NYCHA facilities participating in on-site leaf composting and grass mulching efforts nor the total quantity of organic waste diverted from disposal to beneficial reuse by NYCHA. The New York Botanical Garden tracks the quantity of on-site composting. DOS may wish to work with all of the Botanical Gardens to track the waste prevention impacts of on-site composting. DOS also has not conducted research into the effectiveness of the classroom worm bin distribution effort or the number of teachers who actually introduced composting lessons.

Follow-up contact with participants is certainly possible, but designing and implementing a scientific, statistically significant survey to determine how and to what extent the information from these training and outreach efforts produced quantifiable waste prevention and cost savings would require extensive staff time and, potentially, could be even more expensive than the training programs it measured.

3. Program Evaluation Recommendations

As noted throughout this report, it may not be practical or even possible to quantify the waste prevention resulting from the educational initiatives described above. However, DOS may wish to consider working with the New York City Housing Authority to update the quantities of leaves composted and quantify the ongoing waste prevention from grass diverted from disposal through the decision to leave grass clippings on the lawn. DOS staff indicated that they intend to reevaluate the NYCHA programs in the winter of 2000. DOS also may wish to track waste prevention initiatives that arose from the Botanical Gardens Project.

In addition, DOS may wish to determine the number of teachers who actually incorporated lessons on waste prevention and/or composting into their curriculum, as a result of participation in the composting workshops.

4. Estimated Waste Prevention Impacts

Current data not available.

5. Estimated Other Impacts

Not applicable.

6. Waste Prevention Projections in 2002

Not applicable.

2.2.13 Evaluation Plan for DOS Public Education Materials, Seminars and Other Outreach and Education Initiatives

1. Program Summary

Program Description

For almost a decade, DOS has provided residents, businesses, not-for-profit organizations and government agencies with targeted outreach and educational materials about how to prevent waste. In 2000, DOS will release a report, *New York City Recycles: Over a Decade of Outreach from the New York City Department of Sanitation*, summarizing DOS's efforts to provide information to the public. DOS outreach and public education about waste prevention has taken various forms: 1) outreach staff present basic waste prevention strategies in community meetings and school assemblies, in the context of the "reduce, reuse, recycle" solid waste management hierarchy; 2) DOS provides a Sanitation Action Center (SAC) telephone hotline, through which callers hear pre-recorded information, can order DOS publications, and can obtain responses to questions posed to SAC community service staff; 3) DOS has produced brochures, booklets, and reports as well as information sheets and posters and distributes these items in response to calls to SAC, at meetings and events, through Citywide direct mailings, to roundtable participants, and through the DOS web site; 4) Under programs such as *NYC WasteLe$$* and *NYCitySen$e*, DOS has conducted meetings and seminars for specific audiences; 5) waste prevention studies, including focus groups, market research surveys, waste prevention assessments and measurement efforts, funded by DOS, create a body of experience that educates those who participate in the studies and guides the development and implementation of DOS education and outreach initiatives; and 6) BWPRR is taking its waste prevention message to a worldwide audience through the DOS and the *NYC WasteLe$$* web sites.

The Department has produced and distributed informational booklets, brochures and videos, many of which are discussed in the context of the specific programs for which they were produced. Various waste prevention publications and other DOS outreach and educational efforts are described below.

The Waste Reduction Handbook

The *Waste Reduction Handbook* was produced in 1991 and promoted through a 3-month subway campaign, as well as by outreach staff. More than 100,000 handbooks were distributed in response to calls received by SAC as a result of the subway campaign. All of the approximately 10,000 DOS employees received copies of the handbook with their paychecks, and the handbook is distributed at meetings and seminars.

Information in the Yellow Pages

Perhaps the broadest audience for waste prevention education was reached through the inclusion of a page of waste prevention information in Yellow Pages directories. The information division of NYNEX agreed to work with DOS to prepare this page, which first appeared in the 1993-1994 "Community Pages." The page had tips on preventing waste at home and while shopping, as well as a list of the Yellow Pages headings that promote reuse. In 1994-1995, the Business to Business Directory ran two pages of business waste prevention tips. Since then, both the regular and business Yellow Pages directories include a waste prevention information page, even following NYNEX's merger with Bell Atlantic.

DOS Guide to Reuse in NYC ("Reuse It, Repair It, Rent It, Donate It—But Don't Throw it Away!")

Produced in 1993, this guide is directed at New York City residents and provides reuse tips and lists of Yellow Pages subject headings for repairs, rental, used goods, and donations. It has been distributed broadly by Department outreach staff at meetings and events throughout the City and mailed to Sanitation Action Center Hotline callers who have reuse questions. It also is available on the DOS web site. DOS's planned Reuse Hotline, presented elsewhere in this study, will be a much more extensive service to educate the public and promote the reuse services of nearly 10,000 non-profit and small businesses in New York City.

A Business Guide to Waste Prevention ("It Makes Business Cents to Prevent Waste")

Produced in 1994, this guide offers key strategies for implementing a waste prevention program in office and other workplace settings, with some actual examples and a list of NYC organizations that accept donations. DOS printed 25,000 copies that were distributed through seminars, the Sanitation Action Center and, in addition, the guide is available on the Department's Web site and is mentioned on the recycling page in the Business-to-Business phone directory.

Budget Stretching Guide to Preventing Waste In NYC Government Agencies

This guide, which includes a quote from Mayor Rudolph Giuliani, urges conservation of supplies and inventory, reduction and reuse of packaging, and other proactive measures that prevent

waste and can reduce purchasing, operating and waste management costs for the City of New York. The guide includes practical information on strategies for meeting waste prevention objectives established in the Mayoral Directive on Waste Prevention and Efficient Materials Management (September, 1996) and real examples from New York City agencies. In addition, DOS BWPRR produced and distributed to City Agencies a poster promoting double-sided copying. The poster is intended for placement next to or above copy machines to encourage staff to copy on both sides of the paper. The poster includes tips to facilitate duplex copying.

DOS developed the text for the guide and poster in-house and used a contracted consultant to produce and print the guide and the poster in June, 1996. A total of 152,400 guides were distributed to personnel of all Mayoral Agencies and others requesting copies between October 1996 and September, 1998. During the same time, 1,325 posters were distributed. Promotion and distribution of the posters continued through August, 1999 as a component of the *NYCitySen$e* program.

Safeguard Your Home from Harmful Products

Developed in consultation with the New York City Department of Health, this guide provides residents of New York City with information about: how to identify potentially harmful products; how to reduce chemical exposure and use products safely; how to store products and safely discard empty containers; less toxic product substitutes; and resources for obtaining additional information.

DOS developed the text of the guide in-house, with assistance from DOH; a contracted consultant produced and printed 3,300,000 copies. DOS produced a mass mailing of 3,028,000 copies to New York City households in the fall of 1998; an additional 132,900 copies were sent out in response to specific requests. This guide is available via the Sanitation Action Center hotline and the DOS web site.

School Waste Prevention

A packaging design contest for students was co-sponsored by BWPRR, Fashion Institute of Technology (FIT), Parsons School of Design, and Pratt Institute on April 13, 1994. A panel of judges, including representatives of the Department, design schools, industry, environmental organizations, and others selected the winners, from over 100 entries, for $500 Department-funded prizes for each of three categories.

An 8-page guide on waste prevention and recycling, including waste prevention tips for teachers and students and an order form for waste prevention publications, was sent by DOS to NYC teachers in fiscal year 1994. In addition, two posters were produced, one for elementary schools and one for secondary schools. These posters were made available to schools upon request and were advertised in the 8-page guide.

NYC WasteLe$$* included work with NYC public and private schools. A seminar, newsletters, and information on the *NYC WasteLe$$ web site provides information to schools pertinent to reducing waste generated within schools, and to instructing students on waste prevention.

Other waste prevention and recycling outreach and education to schools, including teachers and students, has been undertaken and is anticipated to continue.

Other Initiatives

DOS has developed various other outreach and education publications, presented waste prevention information at seminars, and conducted various other outreach and education initiatives that include focus on waste prevention. Publications and activities pertaining to organics reduction (i.e., backyard composting) are presented elsewhere in this study.

2. Comments on DOS Approach

Although DOS has provided a body of evidence on its extensive array of waste prevention outreach and public education initiatives, including indicating the extent of the distribution of many of these publications, DOS has not initiated an effort to evaluate or quantify the waste prevention and cost savings impacts of its outreach efforts. As discussed in Chapter 1, when DOS conducts an awareness and education campaign, contact with participants is limited.

3. Program Evaluation Recommendations

As noted in Chapter 1, follow-up contact with recipients of publications and attendees of seminars/presentations certainly is possible, but designing and implementing a scientific, statistically significant survey to determine how and to what extent the information from these publications produced quantifiable waste prevention and cost savings would require extensive staff time and, potentially, could be even more expensive than the outreach effort it measured.

4. Estimated Waste Prevention Impacts

Data not currently available.

5. Estimated Other Impacts

Not applicable.

6. Waste Prevention Projections in 2002

Not applicable.

2.2.14 Evaluation Plan for the NYC Partnership for Waste Prevention for Waste Prevention Training and Technical Assistance Services to Local Development Corporations

1. Program Summary

Program Description

The Partnership for Waste Prevention was initiated by DOS in September 1991 as an effort shared among New York City businesses, trade associations, and government, to educate businesses about the economic and environmental benefits of waste prevention, provide strategies and models for waste prevention initiatives, and identify barriers to the implementation of these strategies. In 1997, DOS used a grant from U. S. EPA, Region 2 to hire a consulting firm, Hammer Environmental Consulting (HEC) to develop and deliver a training program for New York City-based Local Development Corporations (LDCs) on how to provide waste prevention technical assistance services to businesses in their service area. Local universities and colleges with research institutes and degree programs involving waste prevention issues also were invited to participate in the training program.

The training itself consisted of two different workshops. The first covered: 1) what services a technical assistance program might offer; 2) how to fund a program; and 3) how to market these services to local businesses. Participants also received training on conducting a waste prevention assessment of a business, and how to market reusable or recyclable materials on behalf of a business client. The second day of this workshop included waste prevention assessments of Salant Accessories and Plaxall Inc., so that participants had hands-on experience in applying their newly-acquired knowledge. The second workshop focused on funding issues and attempted to foster closer ties between university participants and LDCs.

Project Results

Seven LDCs from Brooklyn and the Bronx, seven academic institutions, and a number of businesses—a total of 40 organizations—participated in the training. The consultant developed a "toolkit," detailing a wide range of information about the development and delivery of technical assistance services. While the toolkit may need periodic updating, it should continue to serve as a resource and desk reference for any organization in New York City interested in establishing a technical assistance program. Several university participants have forged closer ties with one or more LDCs.

As a result of the training, participants initiated the following waste prevention efforts:

- Plaxall, one of the companies the workshop participants toured during the first workshop, negotiated a materials exchange for wooden pallets with the Brooklyn Navy Yard Local Development Corporation, an LDC participating in the training. The savings to both organizations (reduced disposal costs for the Navy Yard and reduced purchase costs for Plaxall) total more than $1,900.

- Fashion Institute of Technology (FIT) and Long Island City Business Development Corporation (LICBDC): in March, FIT and LICBDC jointly submitted a funding proposal to U.S. EPA to sponsor a conference discussing waste prevention issues in the textile manufacturing industry.

- Bathgate Industrial Park Development Corporation and Cornell University Cooperative Extension: Bathgate has surveyed industrial park tenants on materials exchange opportunities and their interest in receiving waste prevention technical assistance and has decided to move forward with a full technical assistance program. Bathgate submitted a request to the U.S. EPA for funds to work with Cornell University Cooperative Extension of NYC to staff an intern position and provide technical assistance services.

- Hofstra University Industrial Assessment Center regularly provides energy conservation assessments to manufacturing firms under a contract from the U.S. Dept. of Energy. Following the workshop, the Center approached the New York State Energy Research and Development Authority (NYSERDA) about funding a workshop series on energy conservation and solid waste prevention. Hofstra staff also worked with Plaxall, one of the demonstration sites toured as part of the first workshop in September, to determine potential energy cost savings at that company. Should Plaxall implement all these recommendations, the energy cost savings could total approximately $18,000 per year.

- East New York Local Development Corporation and Ecosav Inc.: Although this LDC was unable to attend the training, they did receive a copy of the training toolkit. As a result, the LDC contracted with a private consultant (Ecosav Inc.) to provide technical assistance services to businesses referred to the consultant by the LDC.

- Collaboration between Brooklyn Navy Yard Local Development Corporation and Phoenix Recycling and Maintenance Inc.—At the request of the New York State Office of Recycling Market Development, Phoenix Recycling and Maintenance, Inc. was invited to participate in the training. During the summer of 1999, Phoenix will begin providing janitorial service to several businesses located in the Brooklyn Navy Yard. As part of this contract, the LDC has asked Phoenix, a non-profit organization employing mentally handicapped adults, to consolidate the trash hauling arrangements of these companies. This consolidation should result in both cost savings and an improvement of recycling efforts at the Navy Yard.

- South Brooklyn LDC began surveying local businesses about materials exchange opportunities. One company has formally registered with the *NY Wa$teMatch* program, and the LDC expects others to do so as well.

- New York Institute of Technology—NYIT is actively seeking internship opportunities for their students in waste prevention programs throughout the city. One student has been placed with the *NY Wa$teMatch* program. NYIT is also using the training toolkit in their new undergraduate waste management course offered this semester.

2. Comments on DOS Approach

The consultant has provided evidence of the project results, as itemized above, indicating that this project has been successful in the implementation of new initiatives. Beyond this summary, the Department of Sanitation has not quantified the impacts of its Waste Prevention Training and Technical Assistance Services to Local Development Corporations. As discussed in Chapter 1, when DOS conducts a business waste prevention awareness and education campaign, contact with participants is limited. In this case, the two training sessions were provided over three days. Follow-up contact with participants is certainly possible, but would require a significant commitment of staff time. The consultant already "contacted each participant on several occasions to both help and encourage the trainees in development of their own programs."[94] Further, to the extent that DOS projects affect multiple businesses, extrapolation of results from a small set to the larger universe may result in mis-estimation of impacts. Designing and implementing a scientific, statistically significant survey to determine how and to what extent the information from the seminars produced quantifiable waste prevention and cost savings would require extensive staff time and, potentially, could be even more expensive than the training program it measured.

3. Program Evaluation Recommendations

While it may not be practical or even possible to quantify all of the waste prevention resulting from these collaborations and initiatives, DOS may wish to consider working with the Department of Business Services to initiate a mechanism to track waste prevention initiatives that arise from this and subsequent efforts to involve LDCs in waste prevention technical assistance efforts. DOS and DBS may wish to encourage each LDC to track and report on tangible local information they can use to market the program to other businesses in their area and to seek their own funding from foundation and corporate sources.

4. Estimated Waste Prevention Impacts

Data not currently available.

5. Estimated Other Impacts

Not applicable.

6. Waste Prevention Projections in 2002

Not applicable.

3. CUMULATIVE IMPACTS

The term cumulative impacts refers to the total annual quantity of waste prevented. Analysis of cumulative impacts will assist DOS in measuring waste prevention achieved in New York City from the 1992 publication of the 20-Year Solid Waste Management Plan through 2002.

This chapter discusses two methods for evaluating cumulative impacts. The first approach, top-down estimation, derives cumulative impacts based on an estimate of the anticipated quantity of waste that would be collected in the absence of waste prevention. The second approach, referred to as bottom-up estimation, proceeds by "adding up" the total quantity of waste prevented by individual waste prevention activities. As discussed in Section 3.1, this report does not recommend the use of the top-down method. For evaluation purposes, the bottom-up approach is applied to estimate cumulative impacts.

The first step in applying the bottom-up approach is to decide which individual sources of waste prevention to include in the analysis. The analysis presented in this chapter includes consideration of the impacts of waste prevention programs instituted by DOS and other entities, as well as impacts of other non-programmatic actions and developments that influence waste prevention.

In addition to the City's own waste prevention programs, a variety of other governmental and non-governmental waste prevention programs currently are active. Further, effective waste prevention actions may be implemented by individuals and commercial enterprises, working independently. Finally, general economic trends, such as shifts to lighter-weight packaging, also will reduce the waste stream.[95] Ideally, an analysis of cumulative impacts would fully quantify the waste prevented due to all of these factors. However, such an analysis is not feasible because the data are not available. Nevertheless, the analysis presented in this chapter is as complete as the limitations of data and information permit.

Based on the analysis conducted to date, approximately 78,663 tons of waste are anticipated to be prevented in 2002 by New York City programs evaluated in Chapter 2. An additional 456,126 tons are expected to be prevented in 2002 through other means, including non-NYC programs and trends in packaging and reuse. A total of 534,789 tons is expected to be prevented in 2002. This is based on the bottom-up analysis of cumulative impacts discussed below. These estimates are subject to revision in subsequent years as additional programs are examined, new programs are planned and implemented and developing waste prevention programs mature, providing additional data.

3.1 Methods for Evaluating Cumulative Impacts

Top-down estimation of the cumulative impacts of all waste prevention is based on a simple observation: if, beginning in 1992, there was no increase in waste prevention, then the City's solid waste tonnage would grow from its 1992 level, based on an increase in population and historical trends, if any, in per-capita waste generation. Thus, as a hypothetical example, if the population were growing at 0.5 percent per year and per-capita waste generation were growing at 0.5 percent per year, then, absent waste prevention, the quantity of solid waste generated

would grow at 1 percent per year. Between 1992 and 1995, one would expect an increase in waste generation of approximately 3 percent.[96] If examination showed that actual waste tonnage was constant between 1992 and 1995, then one would infer that the 3 percent growth had been offset by an equal amount of waste prevention. In this example, the top-down estimate of waste prevention would be 3 percent of 1992 waste generation.

Two considerations favor use of the top-down approach. The first is simplicity: top-down calculations are easy to perform. The second is the method's comprehensive nature. Top-down calculations automatically account for non-City programs, as well as non-programmatic impacts. Against these attractive features, one must weigh the fact that top-down estimation is quite sensitive to the data used.

To apply the top-down method, data on the quantity of solid waste generated in 1992, as well as information sufficient to estimate anticipated growth in population and per-capita waste generation, is required. The City's *Comprehensive Solid Waste Management Plan Update* contains information on tonnage of waste collected by DOS in 1992. The U.S. Census provides estimates of New York City's population. A standard source of information on per-capita waste generation trends is the EPA's *Characterization of Municipal Solid Waste in the United States: 1998 Update*. Using these data, one could develop a top-down estimate of the cumulative impacts of waste prevention in New York City between, say, 1992 and 1995. Unfortunately, difficulties with the data in all three key areas—waste tonnage, population, and per-capita generation—preclude reliance on this calculation.

- **Non-Comparable Tonnage Data.** DOS does not have confidence in the quality of the 1992 tonnage data, particularly for the commercial waste stream. Commercial waste is not collected by DOS and the agency lacks direct access to data. Many municipalities in the U.S. are in a similar position. In the future, new requirements in NYC may greatly improve the overall quality of waste collection data. However, this will not improve the 1992 data. Since use of the top-down approach requires the use of estimates of current waste generation based on the 1992 data, the quality of the results will never be better than the quality of the 1992 data, itself.

- **Population.** The U.S. Census provides "official" population estimates for the City. However, the Census population estimates are subject to uncertainty. Furthermore, the accuracy of the population figures presented for NYC in the most recent Census were a subject of debate. This makes forecasts of population growth too uncertain to be used in calculating cumulative impact.

- **Per-Capita Generation.** This type of data is available only on a national basis. The national data can be adjusted, somewhat, for NYC conditions. However, the ability to make such adjustments is very limited; the U.S. is not a good proxy for NYC. As discussed earlier, the U.S. EPA is adopting an approach that estimates per-capita generation based on consumer spending. This approach cannot be applied in NYC because local consumer spending data are not available.

Rejection of the top-down method as a general basis for estimating cumulative impact does not mean that national data are of no use in analyzing the impact of waste prevention in the City. Top-down estimation of cumulative impacts is only one of many ways in which information on changes in the national solid waste stream can be used to analyze waste prevention impacts. The reasonableness of applying national data and trends to NYC needs to be considered on a case-by-case basis.

Cumulative impacts also can be estimated by adding up the total quantity of waste prevented by individual activities. There are two advantages to the bottom-up approach. First, it explicitly identifies the sources of prevented waste, making bottom-up calculations more credible than top-down calculations. Second, bottom-up calculations produce "sensible" results. In contrast, the top-down approach "backs out" an estimate of waste prevention as the difference between actual and anticipated waste generation. The top-down approach can produce negative estimates of waste prevented. Against these considerations one must weight the obvious complexity of the bottom-up method. Application of the bottom-up approach can require a significant amount of effort and expense, depending upon the program or activity selected for measurement. In addition, the bottom-up approach may not capture all waste prevention impacts. However, in light of the difficulties in applying the top-down method to NYC discussed above, it is most appropriate to accept these limitations, rather than rely on top-down calculations, which may not be accurate or reliable.

3.2 Application of the Bottom-Up Method to Estimate Cumulative Impact

The first step in applying the bottom-up approach is to decide which individual sources of waste prevention to include in the analysis. The bottom-up analysis presented in this chapter focuses on the following:

- **City Programs and Related Activities.** This refers to the DOS programs for which evaluation plans have been prepared by the consultant, and to waste prevention activities that are closely related to DOS's programs.
- **Non-City Programs.** This refers to waste prevention programs and activities with sponsors other than the City.
- **Underlying Trends.** This refers to changes in the economy, such as material substitutions, which may not necessarily be intended to reduce waste generation, but nevertheless, have that effect.

City Programs and Related Activities

Cumulative impacts of City programs and related activities are shown in Table 3-1. In estimating the current impact of City programs, the tonnage of existing and completed programs was included, but anticipated tonnage impacts of programs currently under development were not.

For City programs, use of a bottom-up approach underlines the need to make "ballpark" calculations of the potential impact of individual programs. Even if the impacts of a program are difficult to measure, an effort can be made to develop estimates of diversion from programs

with potentially large impacts. With this point in mind, preliminary estimates for 2002 have been included, when feasible, in the evaluation plans. In order to allow for comparison with Non-City programs, Table 3-1 presents the estimates for 2002.

Non-City Programs

Most non-City government organizations that undertake activities that achieve waste prevention do not publish estimates of past or future program impacts. To develop this information, non-City programs were contacted by DOS's consultant, and asked to respond to the following questions:

- When did the program begin?
- Is the program currently in operation? (If not, when did it stop?)
- How much waste (in tons, preferably) has the program prevented to date?
- Is the program expected to continue through 2000? (If not, when will it stop?)
- (For continuing programs) Do you expect expansion of the program in the future? (If so, please describe the expansion anticipated.)

Based on the responses to these questions, current waste prevention and likely impacts in 2000 were used to estimate impacts in 2002 using a simple linear regression. These estimates are presented in Table 3-2. The notes accompanying Table 3-2 identify the information sources for each program contacted that was able to provide an estimate of waste prevention.

Table 3-1. Annual Impact of Waste Prevention Due to City Programs and Related Activities[97]

Source of Waste Prevention	Waste Prevented (Tons)	
City Programs	***1998***	***2002***
NY Wa$teMatch	293	1,448
NYC Stuff Exchange	N/A*	4,994
NYC WasteLe$$	68,830	68,830
Unwanted Direct Mail	186	0
Materials for the Arts	434	578
Outreach to Chinese Restaurants	120	120
Outreach to Dry Cleaners	305	311
Grocery Store Outreach	1,027	1,048
CENYC Waste Assessments	1,334	1,334
DCAS	N/A	N/A
NYCitySen$e	N/A	N/A
TOTAL	**72,529**	**78,663**

* N/A means that the data are not yet available.

At the bottom of Table 3-2, additional waste prevention due to New Yorkers' reuse activities and reductions in unwanted direct mail, which are independent of the City's *NYC Stuff Exchange* and Unwanted Direct Mail programs, is included. These impacts were estimated as follows:

- **Reuse.** A survey of current reuse activity conducted by Blum & Weprin indicated that 82 percent of the City's approximately 3.5 million households donate to reuse outlets at least once a year. The same survey also supports an estimate of 30 pounds of material donated per transaction, although Blum & Weprin are not fully confident in the reliability of the finding. These estimates are applied in the absence of more reliable data. Based on these data, 2.87 million households donate 43,050 tons of materials to reuse centers annually. The analysis of the *NYC Stuff Exchange* in Section 2 offers a conservative estimate of 4,994 tons of materials captured by this program, therefore, the remaining 38,016 tons annually are donated by households not participating in DOS programs.

- **Direct Mail Reduction.** The Direct Marketing Association (DMA) administers the Mail Preference Service ("MPS"), a listing of people who wish to be excluded from direct mailings. Before DOS's Unwanted Direct Mail Reduction Campaign began, there were 58,689 City registrations with the MPS. As indicated in the evaluation plan for the Unwanted Direct Mail Reduction Campaign, each registration prevents 15.18 pounds of direct mail per year. Thus registrations before the campaign prevented an estimated 445 tons of waste per year.[98]

The data presented in Table 3-2 were requested for the initial year of operation and 2000. To obtain 2002 estimates, a simple linear regression was run. The initial year was assumed to be

Table 3-2. Annual Impact of Waste Prevention Due to Non-City Programs

Source of Waste Prevention	Waste Prevented (Tons)		
Program	*Initially*	*In 2000*	*In 2002*
CONEG Challenge[99]	0	0	0
EPA WasteWi$e[100]	7,017	7,053	7,065
Long Island City Business Development Corporation[101]	2,452	5,014	7,576
Bell Atlantic[102]	915	920	922
East Williamsburg Valley Industrial Development Corporation[103]	80	110	125
City Harvest Food Donation[104]	1,950	5,000	6,220
Food For Survival[105]	2,785	2,785	2,785
Goodwill Industries[106]	0	0	0
Salvation Army[107]	40	40	40
St. Vincent de Paul Society[108]	12	12	12
Times Square Delivers[109]	8	10	12
Independent Reductions in Direct Mail	445	445	445
Independent Reuse	38,106	38,106	38,106
TOTAL	**53,810**	**59,495**	**63,308**

the year stated in the footnote. If no year is provided, it is assumed to be the year prior to contact with the organization. In the absence of evidence to the contrary, waste prevention is expected to increase in proportion to population increases.

Neither of the preceding impacts is due to a specific waste prevention program. Rather, they represent independent initiatives by City residents and households (although DMA and others do intermittently publicize DMA's Mail Preference Service). The estimates of independent waste prevention make the conservative assumption that independent waste prevention will grow only at the rate of population increase. With increasing concerns about the economic and environmental burdens created by waste disposal, independent waste prevention could easily increase over time. In addition to the organizations listed above, the consultant team spoke with staff at the Direct Marketing Association's Environmental Stewardship Challenge, Furnish-a-Future, Costume Collection, and United Way of NYC. The consultant team attempted to contact Performing Arts Resources, New York Shares, NFTE Solutions, and Non-Profit Computing.

The results in Table 3-2 likely understate the impact of non-City programs, for a number of reasons:

- CONEG staff was unable to specify the waste prevention that occurred in NYC, or even in the US as a result of the Coneg Challenge. Since there was substantial overlap with the EPA's WasteWi$e program, it was assumed, in order to be very conservative and avoid double-counting, that the CONEG contribution was accounted for as part of the WasteWi$e tonnage. Furthermore, the CONEG Source Reduction Task Force was disbanded in 1996. Thus, the CONEG contribution was set at zero.[110]
- Independent consultants and "in-house" staff at City businesses are known to be active in waste prevention. The results of these activities are not reflected in Table 3-2.
- Growth in the City's businesses, as well as increasing consciousness of the economic and environmental impacts of solid waste disposal, make significant growth in the impact of non-City programs likely.

This report reflects DOS and the consultants ongoing effort to document non-City program impacts on waste prevention.

Underlying Trends

In addition to programmatic efforts and actions of individuals and firms that are specifically aimed at waste prevention, there are broad trends, within the economy as a whole, which result in waste prevention. In a number of cases, lightweight materials have displaced heavier materials for a specific use. In other instances, traditional materials are retained, but their use has changed, resulting in waste prevention. The best-known example is light-weighting of beverage containers. Between 1972 and 1992, the weight of all types of soft-drink containers—glass, steel, aluminum, and plastic (PET)—fell significantly. According to EPA, the decreases ranged between 18 and 37 percent.[111] While the light-weighting of soft-drink containers has largely run its course, there are other trends which are likely to be important for the years relevant to the analysis of cumulative impacts—1992 to 2002.

This report focuses on six such trends:

1. The shift from paper bags to plastic bags;
2. The shift from glass and steel to aluminum and plastic for beer and soft-drink containers;
3. The shift from milk cartons to plastic milk jugs;
4. Reductions in office paper use;
5. The replacement of single-use wood pallets with multi-use plastic pallets or with slip-sheets; and
6. The replacement of single-use corrugated shipping containers with multi-use containers.

For all six, the analysis shows that significant reductions in the quantity of waste generated will occur between 1992 and 2002.

Waste prevention due to the first three trends was analyzed based on the data developed and published by the U.S. EPA. Historical (1992 and 1997) national waste generation data for different types of bags, beer and soft drink containers, and milk containers were obtained from the EPA's *Characterization of Solid Waste in the United States: 1998 Update*. These data were used to estimate national waste generation data for 2002, using simple linear regression analysis.

Table 3-3 [next page] begins with the EPA data on the tonnage of paper and plastic bags in the U.S. waste stream in 1992 and 1997. Based on the unit weight of paper and plastic bags, the number of bags in the waste stream is computed.[112] As noted in the table, the 1992 EPA data indicate that 77 percent of bags were plastic and 23 percent were paper in that year. In order to assess the waste prevention due to the shift toward plastic bag use, it is necessary to know how much waste would have been generated if, in 2002, 77 percent of bags were plastic and the remaining 23 percent were still paper.

This is computed in two steps: (1) The total number of bags projected for 2002 is divided according to the 1992 proportions of paper and plastic bags; and (2) these numbers of bags are converted to waste tonnage using the unit weights of paper and plastic bags. The result of this calculation shows that, if the number of bags in the waste stream increased (as forecast by the EPA), but there was no shift from paper to plastic, paper bag waste would increase dramatically compared to the EPA tonnage forecast for 2002. For plastic bag waste, there would be a modest decline. For the United States, the anticipated waste prevention due to the shift from paper to plastic bags is simply the avoided paper bag waste (2,023 tons), less the increase in plastic bags (257 tons), or a net reduction of 1,766 tons. Except for the last row, Table 3-3 refers to the U.S. as a whole. To obtain the impact on NYC, the waste prevented in the U.S. as a whole is scaled, based on NYC population projections for the year 2002.[113]

Using the techniques applied in Table 3-3, Table 3-4 shows the impact of material use trends in beer and soft drink containers and milk containers, in addition to bags. For each category, growth in waste tonnage between 1992 and 2002, as shown in the EPA's data, occurs primarily in the lighter weight materials. In fact, the *number* of items used which are made from lighter-weight materials—plastic bags, aluminum drink cans, and plastic milk jugs and soda bottles—is

Table 3-3. Trends in Material Substitution for Paper and Plastic Bags

Tonnage of Bags in the U.S. Waste Stream (in thousands)	Paper	Plastic	Total
In 1992	2,320	970	**3,290**
In 1997	1,870	1,570	**3.390**
In 2002	1,801	1,856	**3,657**
Weight of One Bag (in Pounds)	0.118	0.015	
Number of Bags in the U.S. Waste Stream (in Thousands)			
In 1992	39,322,034	129,333,333	**168,655,367**
In 1997	31,694,915	209,333,333	**241,028,249**
In 2002	30,525,424	247,466,667	**277,992,090**
Proportion of Bags in the U.S. Waste Stream in 1992	23.32%	76.69%	**100%**
Number of Bags (in thousands) in the U.S. Waste Stream in 2002, based on the 1992 proportions	64,813,914	213,178,177	**277,992,090**
Tonnage of Bags (in thousands) in the U.S. Waste Stream in 2002, based on the 1992 proportions	3,824	1,599	**5,423**
Changes in the U.S. Waste Stream in 2002 due to the shift toward use of plastic in bags (in thousands of tons)	2,023	(257)	**1,766**
Changes in the NYC Waste Stream in 2002 due to the shift toward use of plastic in bags (in thousands of tons)	56.56	(7.19)	**49.37**

increasing more rapidly than the *tonnage* of these items, because the paper bags, glass bottles, steel cans, and milk cartons are heavier than their substitutes on a per-unit basis. The result of material substitution trends for bags, beer and soft drink containers, and milk containers is a reduction in the tonnage of waste generated from the use of these items—more than 100,000 tons in New York City in the year 2002.

The analysis in Table 3-4 [next page] was developed for this report based on information from the U.S. EPA's *Characterization of Municipal Solid Waste in the United States: 1998 Update* and the unit weights of each of the materials. The three categories analyzed in Table 3-4 are the only major categories for which the EPA's *Characterization of Municipal Solid Waste* provides sufficient detail to develop estimates of waste prevention resulting from material substitution trends. However, they are not the only categories in which underlying trends are likely to produce significant reductions in the quantity of waste generated. Office paper, wood waste (largely pallets), and corrugated boxes are among the additional categories of materials in which changes underway today can be anticipated to result in significant reductions in the amount of waste generated:

- Office paper and wood pallets continue to represent a large portion of wastes generated nationally. U.S. EPA and the NYC government encourage recycling of high quality office papers, and the U.S. EPA promotes recycling and reuse of wood pallets. Since

Table 3-4. Impact Resulting from Materials Substitution Trends (In Thousands of Tons)[114]

Product/ Material	Materials in Waste Stream					Waste Prevention in 2002 Resulting From Material Substitution	
	Historical Data: 1992	Historical Data: 1997	EPA Projected Data: 2000	Forecast With Material Substitution: 2002	Forecast Without Material Substitution: 2002	U.S.	NYC
Bags							
Paper	2,320	1,870	1760	1,801	3,824	2,023	56.56
Plastic	970	1,520	1570	1,856	1,599	(257)	(7.18)
Sub-total	**3,290**	**3,390**	**3,330**	**3,657**	**5,423**	**1,766**	**49.37**
Beer and Soft Drinks[115]							
Glass Containers	5,480	4,960	4,640	4,228	6,361	2,133	59.63
Aluminum Containers[116]	1,580	1,530	1,860	1,813	1,834	21	0.59
Steel Containers	80	0	0	0	93	93	2.60
Plastic Containers	510	760	770	903	592	(311)	(8.69)
Sub-total	**7,650**	**7,250**	**7,270**	**6,944**	**8,880**	**1,936**	**54.12**
Milk Containers[117]							
Paper Milk Cartons	480	460	500	511	670	159	4.45
Plastic Milk Jugs	510	670	740	891	711	(180)	(5.03)
Sub-total	**990**	**1,130**	**1,240**	**1,402**	**1,381**	**(21)**	**(0.59)**
Total	**11,930**	**11,770**	**11,840**	**12,003**	**15,684**	**3,681**	**102.91**

NYC is a major center of "office work" as well as wholesale and retail activity, it is likely to be affected by shifts toward recycling of office paper and wood pallets. Based on data from the U.S. EPA's *Characterization of Municipal Solid Waste in the United States: 1998 Update*, a simple linear regression was run to determine potential generation and recycling rates for these materials in 2002. To obtain the impact on NYC, the waste prevented in the U.S. as a whole is scaled, based on NYC population projections for the year 2002. If NYC achieved 25 percent of its technical potential reduction, office paper and wood waste would be reduced 33,738 tons and 5,193 tons, respectively, in 2002.

- A major, voluntary EPA waste prevention effort, the WasteWi$e program, encourages participating firms in the private sector to identify and implement practical, cost-effective waste prevention programs. By far the major target of WasteWi$e firms has been corrugated cardboard. In the first year, WasteWi$e firms reported reducing corrugated waste by 304 tons. However, such efforts are not confined to the firms involved in WasteWi$e. Numerous examples show that corrugated boxes are reused by many

different types and sizes of firms. Corrugated boxes are expected to account for 34.7 million tons of waste nationally in 2002, of which an estimated 27.5 million tons would be recovered. To obtain the impact on NYC, the waste prevented in the U.S. as a whole is scaled, based on NYC population projections for the year 2002. If NYC achieved 25 percent of its technical potential reduction, recovery of corrugated boxes would be 194,573 tons in 2002.

The anticipated impacts of the national trends on NYC's waste stream are substantial. The total reduction is 337,094 tons. This includes 103,950 tons from the three trends analyzed in Table 3-4 and additional amounts of 33,738, 5,193, and 194,573 tons due to reductions in waste from office paper, wood pallets and corrugated packaging, respectively, between 1992 and 2002. However, it is important to recognize that per capita generation of corrugated boxes and office papers has not shown a downward trend in the past few years. The per capita generation rates for these two items is flat. Therefore, the estimates presented for these items may be high.

For the past several years, there has been a downward trend in newspaper generation, attributable to several factors: publishers have reduced paper thickness (basis weight) and, in some instances, page size. Publishers also have developed ways of managing the printing process to minimize waste.[118]

In addition to the use of less newsprint per newspaper issue, on average, there also has been a decline in newspaper readership in many locations. Analysts attribute this decline to the growth in other sources of news, e.g., a proliferation of radio and television news stations and increasing access to on-line Internet news.[119]

Franklin Associates analyzed newspaper generation in New York City for 1992 and 1997 to determine if there has been source reduction in the City. The methodology used was devised by Franklin Associates and has been used for many previous studies, including a 1996 study for the Northeast Recycling Council.[120] The methodology makes use of published data on newspaper circulation (by county) and newsprint purchases by newspapers circulated in each county. The circulation data include not only papers published locally (e.g., the *New York Times*) but also newspapers published elsewhere (e.g., the *Boston Globe, Wall Street Journal, USA Today*). Franklin Associates makes adjustments to allow for the weight of ink and advertising inserts, as well as trim scrap losses.

The results are summarized in Table 3-5 [next page]. Between 1992 and 1997, weekly newspaper circulation in New York City declined from 11,493,600 to 9,368, 210. Generation in pounds per person per year declined from 114.8 in 1992 to 98.7 in 1997, while tonnage declined from 419,765 in 1992 to 364,460 in 1997. This results in source reduction of 55,300 tons in 1997 compared to 1992.

The projection of newspaper generation in 2002 was based on a projected City population and a projected newspaper generation rate in pounds per person per day. Population was projected to grow at the same rate of increase reported by the Bureau of the Census. It was assumed that newspaper generation per person would continue to decline to 96 pounds per person in

Table 3-5. Trend in Generation of Newspaper in New York City

	1992	1997	2002
Population	7,311,966	7,385,494	7,569,686
Weekly Circulation	11,493,604	9,368,205	
Circulation per person	1.57	1.27	
Newspaper generation (tons)	419,760	364,460	363,345
Newspaper generation (lb./person)	114.8	98.7	96.0
Source reduction from 1992 (tons)	0	55,300	56,415

2002. This decline is not as rapid as the decline from 1992 to 1997; in other words, it was assumed that most of the source reduction has already taken place. These assumptions yield newspaper generation of 363,345 tons in 2002, a source reduction of 56,415 tons compared to 1992.

As an analysis of the sensitivity of the source reduction results to generation in pounds per person per year, it was assumed that newspaper generation in 2002 could range from 94 to 98 pounds per person per year. This yields a range of 48,845 to 63,985 tons reduced in 2002 compared to 1992. Thus, even if generation of newspapers per person remains nearly constant at the 1997 level, a source reduction of about 48,850 tons could be expected.

As an analysis of the sensitivity of the source reduction results to the population growth assumption (about a 2.0 percent increase between 1998 and 2002), it was assumed that population growth would range between 1.0 percent and 3.0 percent between 1998 and 2000. This yields a range of 52,790 to 60,020 tons reduced in 2002, compared to 1992.

The impacts due to the seven trends analyzed are, of course, subject to some uncertainty. Nevertheless, it is essential that they be included in any bottom-up assessment of cumulative impact. There are certainly changes in materials use over time. For example, those over a certain age will recall a time when a trip to the supermarket did not include responding to the question, "paper or plastic?" There was only paper. The increase in plastic bag use has greatly decreased the weight of the individual bags which enter the waste stream (of course, light-weighting trends and bag reuse are also probably having an effect). Similar changes are underway today and can be expected to reduce the quantities of certain materials generated as waste by 2002. Ignoring these trends would greatly distort any analysis of the prospective impact of waste prevention. The analysis presented in this section provides a reasonable indication of the impacts likely to be seen in the future.

3.3 Summary of New York City Cumulative Prevention Impacts

Table 3-6 summarizes the various impacts included in the bottom-up analysis of cumulative impacts of waste prevention in NYC in the year 2002. Based on the analysis conducted to date, the cumulative impact is likely to be a reduction of at least 534,789 tons of waste generated.

Table 3-6. Summary of Cumulative Prevention Impacts

Source of Waste Prevention	Current (1998) Waste Prevention (Tons)	Waste Prevention in 2002 (Tons)
NYC Programs (From Table 3-1)	72,529	78,663
Non-NYC Programs (From Table 3-2)	53,810	63,308
Material Substitution Trends (Year 2000 data from Table 3-4)[121]		
Bags and Sacks: Paper to Plastic	11,390	49,370
Beer and Soft Drinks: Glass and Steel to Aluminum and Plastic	34,960	54,120
Milk Containers: Cartons to Plastic Jugs	(120)	(590)
Other Trends (Year 2000 data from text, previous page)		
Office Paper: 25% of Technical Potential	25,945	33,738
Wood Pallets: 25% of Technical Potential	4,363	5,193
Corrugated Boxes: 25% of Technical Potential	158,070	194,573
Newspapers	0	56,415
TOTAL	**417,362**	**534,789**

Table 3-6 presents 1998 actual and 2002 estimated waste prevention, in tons. The data from New York City programs are taken from the summary presented in Table 3-1. The non-New York City program quantities are taken from Table 3-2. Trends data were presented in Table 3-4 for bags and sacks, beer and soft drinks, and milk containers and subsequent text for office paper, wood pallets, and corrugated boxes. Because all trends data estimated reductions between 1992 and 2002, data for 1998 were adjusted to reflect the passage of six of the 10 years in the estimation range, using simple linear regression analysis.

The data in Table 3-6 provide an indication of the level of waste prevention achieved in New York City. The basis for comparison is waste generation in 1992, approximately 9.5 million tons. By 2002, waste prevention can be anticipated to increase to approximately 5.6 percent of 1992 waste generation. However, the results of the cumulative impacts analysis are, as yet, incomplete.

Furthermore, a bottom-up analysis of waste prevention will inevitably be unable to identify and quantify every waste prevention activity. Indeed, some waste prevention activities are inherently impractical or not feasible to quantify, as discussed earlier in this report. *As a result, the City of New York is probably further toward its goal of 9 percent waste prevention by 2000 than this analysis indicates.* Table 3-7 presents a sensitivity analysis for the data presented in Table 3-6. For each program or trend, the basis of the waste prevention estimate for 2002 is presented. Analyses of both low-end and high-end estimates are then presented. Based on the sensitivity analysis, NYC waste prevention in 2002 could be as low as 413,684 tons and as high as 928,050 tons.

Table 3-7. Sensitivity Analysis on Cumulative Impact of Waste Prevention

Source of Waste Prevention	2002 Estimate (tons)	Basis of Estimate	Basis of Low End Estimate	Low End Estimate (tons)	Basis of High End Estimate	High End Estimate (tons)
CITY PROGRAMS						
NY Wa$teMatch	1,448	5% annual increase 1998-1999; steady state 2000-2002	0% increase 1998-1999	1,377	5% annual increase 1998-2002	1,594
NYC Stuff Exchange	4,994	Transactions from 10% of calls; steady state 2000-2002	Transactions for 5% of calls	2,497	Transactions for 25% of calls	12,485
NYC WasteLe$$	68,830	10% participation rate	5% participation rate	34,415	25% participation rate	103,245
Unwanted Direct Mail	0	No increase without followup	No followup	0	Followup in 2000	401
Materials for the Arts	578	Inc. capacity 12 tons/month in FY 99; steady state 2000-2002	No capacity increase in FY 99	434	At capacity	578
Outreach to Chinese Restaurants	120	Residual effects at 10% of 1996 level	No residual effects	0	Renewed outreach, 25% participation	4,000
Outreach to Dry Cleaners	311	1.2% polybag and 9.9% hanger source reduction rate; Growth equal to population increase	0.6% polybag and 5% hanger source reduction	162	2.4% polybag and 19.8% hanger source reduction	606
Grocery Store Outreach	1,048	Growth equal to population increase, 50% participation rate	25% participation	501	75% participation	1,502
CENYC Waste Assessments	1,334	Steady state 1998-2002; no new projects	10% annual decrease	875	10% annual increase	1,953
DCAS	N/A	N/A				
NYCitySen$e	N/A	N/A				
Botanical Gardens	N/A	N/A				
DOS Public Education Efforts	N/A	N/A				
Technical Assistance to LDCs	N/A	N/A				
TOTAL, CITY PROGRAMS	**78,663**			**40,261**		**126,364**

Table 3-7. (continued) Sensitivity Analysis on Cumulative Impact of Waste Prevention

Source of Waste Prevention	2002 Estimate (tons)	Basis of Estimate	Basis of Low End Estimate	Low End Estimate (tons)	Basis of High End Estimate	High End Estimate (tons)
NON-NYC CITY PROGRAMS						
CONEG Challenge	0	Not possible to estimate				
EPA WasteWi$e	7,065	Predicted value	10% annual decrease	4,604	10% annual increase	10,273
Long Island City Business Development Corporation	7,576	32% annual increase	16% annual increase	4,440	48% annual increase	11,764
Bell Atlantic	922	2% annual increase	0% annual increase	915	4% annual increase	930
East Williamsburg Valley Industrial Development Corporation	125	12% annual increase	6% annual increase	101	18% annual increase	155
Food For Survival	2,785	0% annual increase	5% annual decrease	2,268	5% annual increase	3,385
City Harvest Food Donation	6,220	33.6% annual increase	16.8% annual increase	3,629	50.9% annual increase	10,111
Goodwill Industries	0	included in "Other Reuse"				
Salvation Army	40	0% annual increase	5% annual decrease	33	5% annual increase	49
St. Vincent de Paul Society	12	0% annual increase	5% annual decrease	7	5% annual increase	15
Times Square Delivers	12	10.7% annual increase	5% annual increase	10	16% annual increase	15
Independent Reductions in Direct Mail	445	0% annual increase	5% annual decrease	363	5% annual increase	541
Independent Reuse	38,106	0% annual increase	5% annual decrease	36,201	5% annual increase	40,011
TOTAL NON-NYC PROGRAMS	**63,308**			**52,571**		**77,249**
UNDERLYING NATIONAL TRENDS						
Material Substitution Trends						
Bags and Sacks: Paper to Plastic	49,370	1.5% annual increase	0% annual increase	45,828	3% annual increase	53,128
Beer and Soft Drinks: Glass and Steel to Aluminum and Plastic	54,120	2.6% annual decrease	3.9% annual decrease	51,249	1.3% annual decrease	66,698
Milk Containers: Cartons to Plastic Jugs	(590)	4.4% annual increase	6.6% annual increase	(655)	2.2% annual increase	(530)
Other Trends						
Office Paper	33,738	25% of Tech. Potential	10% of Tech. Potential	13,495	50% of Tech. Potential	67,476
Wood Pallets	5,193	25% of Tech. Potential	10% of Tech. Potential	2,077	50% of Tech. Potential	10,386
Corrugated Boxes	194,573	25% of Tech. Potential	10% of Tech. Potential	77,829	50% of Tech. Potential	389,146
Newspapers	56,415	96 lbs./person/year	94 lbs./person/year	48,845	98 lbs./person/year	63,895
TOTAL, UNDERLYING NATIONAL TRENDS	**392,818**			**238,668**		**650,199**
TOTAL, ALL PROGRAMS	**534,789**			**331,401**		**853,812**

3.4 Conclusions

1. **The process of municipal solid waste prevention measurement is still under development nationwide. This study contributes ideas and strategies to enhance subsequent efforts.**

   Waste prevention remains at the top of the U.S. EPA's hierarchy for addressing municipal solid waste management concerns, but there has been little national progress to date on the establishment of definitive strategies for measuring waste prevention.

   In December 1994, and again in April 1996, the U.S. EPA sponsored source reduction measurement round tables, facilitated by the Center for Policy Alternatives. These sessions provided participants from throughout the U.S. an opportunity to discuss obstacles and strategies to measuring waste prevention. The obstacles are numerous, while few effective strategies for measuring municipal solid waste prevention have been implemented.

   DOS proceeded with this study even in the context of the *New York State Solid Waste Management Plan 1995/96 Update*'s concession that measuring waste prevention may not be practical. Page 11 of the updated plan concludes that New York State believes ". . . that it is preferable to expend our finite resources to advance waste reduction efforts, rather than try to quantify waste reduction achievements." This conclusion is based on the State's finding that it is not feasible to obtain and manage the data necessary for measuring waste prevention on the macro-level. The State plan recommends focusing on reducing reliance on disposal capacity, instead of specifically measuring waste prevention.

   Many cities, states, and the U.S. EPA have sought, and to varying degrees succeeded, in measuring waste prevention on the micro-level—focusing, for example, on achievements of individual programs or individual businesses. DOS and its consultants, however, are not aware of any government effort that has successfully demonstrated how to practically and cost-effectively calculate waste prevention on the macro-level—that is, waste prevention actually achieved within an entire municipality, state, or country. As discussed in Section 1 of this report, the U.S. EPA developed a methodology that projects waste generation through its correlation to consumer spending, and then determines whether reductions are attributable to recycling or source reduction. This methodology is limited to national analyses, since local consumer spending data are not available. Also, as presented in Section 1, the State of Connecticut and Franklin Associates developed a method to estimate source reduction within the State. This approach can be used to ground truth findings from the bottom up analysis of New York City programs.

   DOS's contracted study seeks to develop, test, and refine methods to measure waste prevention by examining waste prevention achieved and projected citywide. Further progress is expected as DOS continues to advance measurement efforts.

2. Waste Prevention Measurement is a Worthwhile Undertaking.

Despite the stated obstacles to and limited experience in measuring waste prevention, DOS recognizes a number of factors reinforcing the push to develop and refine measurement approaches. These considerations include the need to:

- Determine which programs are most or least effective, thereby enabling DOS to target its limited resources most appropriately;
- Document the savings to businesses, taxpayers, and potential co-sponsors of municipal waste prevention efforts to generate support for worthy waste prevention initiatives;
- Justify any budgetary appropriations and expenditures on waste prevention program research, development, and implementation;
- Substantiate the level of need for, and potential benefits to be derived from, federal, state, or local legislation intended to promote waste prevention; and
- Motivate New York City businesses, and other non-governmental entities, to devote appropriate time, energy, and resources to preventing waste.

3. Results from this Waste Prevention Study Indicate that Significant Waste Prevention Achievements Will Require State, National and Industry Initiative.

New York City's Department of Sanitation has devoted substantial resources to development and implementation of a comprehensive and coordinated waste prevention effort. Additional initiatives that may be pursued by the Department of Sanitation during the coming years may lead to waste prevention achievements beyond the levels currently projected in this report. DOS's current and projected programs are comparable to, or more advanced than, those undertaken in other jurisdictions. This finding is consistent with the information presented in INFORM's 1996 report of waste prevention programs sponsored by jurisdictions in New York State, entitled *Local Lessons in Source Reduction: A Look at Six Planning Units in New York State*; and by the National Recycling Coalition's 1996 report presenting a survey of waste prevention programs throughout the United States, entitled *Making Source Reduction and Reuse Work in Your Community: A Manual for Local Governments.*

DOS has both the knowledge and capability to develop additional programs, such as the citywide public awareness campaign discussed in Section 2. DOS also would like to pursue programs, such as a ban on the residential set-out of grass clippings for DOS collection, although this action was blocked by local politicians. DOS also could consider a local quantity-based user fee for trash collection services. (User-fee programs such as this do face difficult implementation logistics in New York City, largely because of the high percentage of residents living in multi-family dwellings.) Some existing programs only require renewed outreach efforts similar to those conducted in the Summer of 1993. If DOS is to help achieve a waste prevention level that approaches

or exceeds the goal of nine percent by 2000 set forth in the City's 20-Year Solid Waste Management Plan of 1992, there likely will be a need for a high visibility citywide campaign to heighten awareness, provide explicit guidance, and offer incentives and penalties. Above all, the City must lead by example and publicize its own efforts and achievements. The City may wish to seek funding, preferably from outside the NYC government, and encourage voluntary national industry actions that complement the City's programmatic efforts.

DOS's programs are ambitious and comprehensive, targeting both residential and commercial waste. However, as evidenced in Table 3-5 and 3-6, programs operated by DOS are expected to contribute only a small portion of the anticipated reductions in waste generation. Non-city programs, as well as general trends in waste generation, account for a substantial portion of the expected reductions. To achieve the level of industry and consumer behavior change necessary for substantial reductions in the New York City solid waste stream, federal and state legislation and programs, voluntary industry initiatives, and politically challenging initiatives, such as quantity-based user fees, are needed.

4. Obstacles To Waste Prevention Measurement Should Not Justify Abandoning Waste Prevention Initiatives That May Be Difficult To Measure.

The findings of this study indicate that it may not always be practical or cost-effective to measure the impacts of a waste prevention initiative. Nevertheless, there may be inherent value to undertaking a waste prevention project for which measurement is problematic, such as conducting citywide public education. In these instances, a more qualitative approach, perhaps facilitated by the use of focus groups, surveys, and other types of market/behavioral research, can be a worthwhile approach for demonstrating the value of those waste prevention impacts that may not be directly measurable.

A primary difficulty is determining at what point the costs of waste prevention education (and measurement of its impact) exceed the benefits. This obstacle may continue to deter municipalities such as New York City from dedicating substantial funding to large-scale waste prevention education efforts.

APPENDIX A

NYC WasteLe$$ Seminar Evaluation Form

Airport/Airline Sector

Wednesday, April 14, 1999

General Information:

1) What type of airline/airport/service do you represent? Please check one.

Airline Manager/Staff _____ Ground Service Provider_____

Catering Service Provider _____ Other (please describe):

2) What is your position (e.g., Environmental Manager, Station Manager, Maintenance Manager etc.) at your airline/airport?

3) Have you implemented any initiatives expressly designed to reduce your waste stream or reduce energy use?

No _____ Yes _____ (Please describe)

Seminar Feedback:

4) How useful did you find the information presented in the seminar? Please check one response.

Very useful _____ Somewhat useful _____ Not at all useful _____

5) Were the seminar topics relevant to your operation? Please check one response.

Very relevant _____ Somewhat relevant _____ Not at all relevant _____

6) Please rank the following presentations from most to least informative with 1 being the most informative?

NYC WasteLe$$ LaGuardia _____ Waste Prevention & Recycling at LAX _____

Alternative Fuel Program _____ US EPA WasteWi$e _____

Energy Audits & Assistance _____ Lighting Technologies _____

Technical Assistance on the Web _____ Trade Waste Commission ____

7) Are there any waste prevention or energy efficiency topics that you believe should have been discussed but were not addressed?

8) Are you aware of any innovative waste prevention or energy efficiency initiatives at other airports/airline/service providers in the City (including your own)? If yes, please provide a brief description, name of the airport/airline/other service provider, and a point of contact.

Next Steps:

9) Which of the *waste prevention initiatives* discussed today might be possible to implement in your operation?

10) Which of the *energy efficiency initiatives* discussed today might be possible to implement in your operation?

11) Which, if any, of the initiatives will you pursue over the next six months?

12) Which of the initiatives discussed today do you think would be difficult to implement and why?

13) What type of waste reduction information or assistance would you like to have available in the future? (Please check all services that you might access or that would be helpful to you.)

On-site Waste Assessment _____

Information via Web Site _____

Vendor Information _____

Case Study and Cost/Benefit Analyses _____

Public Recognition Waste Prevention Program _____

Waste Exchange _____

Other _____

None _____

14) Will you consider joining and receiving technical assistance from U.S. EPA's WasteWi$e program?

Yes _____ No _____ Why or why not?

15) How did you hear about the seminar? _____

APPENDIX B

NYC WasteLe$$ Web Site: www.nycwasteless.com

General Content and Evaluation Questions

General Evaluation: Web Site May 19, 1999

Name: _____

Organization: _____ Address: _____

Telephone: _____ E-mail: _____

Thank you for reviewing the *NYC WasteLe$$* Web site. Your responses to the following questions will assist us in identifying strategies to enhance the *NYC WasteLe$$* site in terms of its practicality, completeness, accuracy, and user-friendliness.

Accessibility & Hardware

1) What are you using to view this site?

Operating System (e.g., Win NT, Win3X, Win 9X, Unix, Mac, etc.):

Browsing Software (e.g., Netscape 3X, Netscape 4, Explorer 3, Explorer 4, Explorer 5, etc.):

Modem Speed (e.g., 28.8, 14.4, 56, etc.) or

Lan (e.g., T1, T3, etc.):

Screen (e.g., 640x480, 800x600, 1240x1024, etc.):

Color (e.g., 16 color, 256, greater):

Clarity of Information

2) Does the home page provide you with enough information to determine the purpose of the Web site?

Yes ____ No ____ Comments:

3) Is it clear who the intended audience is?

Yes ____ No ____ Comments:

4) Do you think this Web site will prove useful to the intended user(s)?

Yes ____ No ____ Comments:

Navigability of Web site

5) Can you easily find the internal site links that you believe will provide the type of information you are seeking?

Yes _____ No _____ Comments:

6) How efficiently can you retrieve the information you seek from this site?

Very easily _____ Somewhat easily _____ Not easily _____ Comments:

Credibility of Information

7) Does the information presented reinforce the credibility of this site as an authoritative resource?

Yes _____ No _____ Comments:

8) Does the format reinforce the credibility of this site?

Yes _____ No _____ Comments:

9) Are the site's sponsorship and authorship clearly identified?

Yes _____ No _____ Comments:

Utility of Information

10) Does the scope (i.e., range of topics and context of material) meet your expectations?

Yes _____ No _____ Comments:

11) Does this site provide enough information for the user to take the next step toward implementing an initiative described in this Web site?

Yes _____ No _____ Comments:

12) Does the material appear current and is the plan for updating the site clearly indicated?

Yes _____ No _____ Comments:

13) Is this site interesting to view?

Yes _____ No _____ Comments:

14) Does the navigational design enhance information access?

Yes _____ No _____ Comments:

15) Did you find the outside links to be relevant to the information presented in this site?

Yes _____ No _____ Comments:

16) Were the external links operational at the time you linked to them?

Yes _____ No _____ Comments:

17) Is the material well written and grammatically correct?

Yes _____ No _____ Comments:

18) Is the tone appropriate to the audience?

Yes _____ No _____ Comments:

19) To which Web sites do you normally link for waste prevention, energy efficiency, water conservation information?

20) Does this Web site appear to offer the user advantages over other available resources presenting similar information?

21) Does the manner in which information is presented on this Web site appear biased in any way?

22) What suggestions can you offer for this site?

Optional Information:

Which two or three sections of this site do you believe are the best?

Which two or three sections of this site need improvement?

Please check all areas and provide comments for the areas on the site that you visited:

Partners_____ Comments:

Sectors_____ Comments:

Newsletters_____ Comments:

Tips_____ Comments:

Regulations_____ Comments:

Frequently Asked Questions_____ Comments:

Fun Facts_____ Comments:

Case Studies_____ Comments:

Tracking_____ Comments:

***NYC WasteLe$$* Web Site: www.nycwasteless.com**

Airline/Airport Sector Evaluation Form

Partners

Please view the information presented for the following partners:

- LaGuardia Airport & The Port Authority of NY & NJ
- US Airways
- British Airways

1. Did you find the description of each partner interesting and informative?
   Yes _____ No _____ Comments:

2. Do the descriptions reinforce the credibility of the Web site?
   Yes _____ No _____ Comments:

3. Is it easy to navigate among the partners in this section?
   Yes _____ No _____ Comments:

Sector

4. Does the information in this section offer valuable perspective on the Airline/Airport sector?
   Yes _____ No _____ Comments:

5. Is this information useful for members of the airline or airport community?
   Yes _____ No _____ Comments:

Newsletters

We will be producing sector specific newsletters focusing on energy efficiency, recycling, waste prevention and hot topics. For your review, the *NYC WasteLe$$* News Energy Efficiency Airline/Airport edition is loaded as a PDF file. Please view the newsletter on-line and respond to the following questions:

6. Did the file launch so that you were able to view the newsletter?
   Yes _____ No _____ Comments:

7. Did you find the newsletter informative?
   Yes _____ No _____ Comments:

Tips (Go to Airports/Airlines)

8. Is the organization of the tips section user-friendly?

   Yes _____ No _____ Comments:

9. How useful and informative are the tips offered in each section:

   Waste Prevention: Very informative _____ Somewhat informative _____
   Not informative _____ Comments:

   Enhanced Recycling: Very informative _____ Somewhat informative _____
   Not informative _____ Comments:

   Affirmative Procurement: Very informative _____ Somewhat informative _____
   Not informative _____ Comments:

   Toxics Reduction: Very informative _____ Somewhat informative _____
   Not informative _____ Comments:

   Energy Conservation: Very informative _____ Somewhat informative _____
   Not informative _____ Comments:

   Water Conservation: Very informative _____ Somewhat informative _____
   Not informative _____ Comments:

10. In your opinion, are any key topics missing from the tips section?

11. Are the links offered relevant to the content of this Web site?

12. The measurement tools that are on the Web site may not be relevant to all sectors. However, we ask that you take a look at the tools and try them out. We are interested in learning if similar tools, tailored to your business/organization, would be useful. How useful did you find the following interactive measurement & tracking tools?

13. Did you try inputting numbers reflective of your own organization to calculate a payback period?

Laundering reusable shop towels and rags:

Very useful____ Somewhat useful____ Not useful____

Comments:

Tried inputting data:

Yes ____ No ____ Comments:

Purchase reusable filters:

Very useful____ Somewhat useful____ Not useful____

Comments:

Tried inputting data:

Yes ____ No ____ Comments:

Substitute synthetic oil for conventional oil:

Very useful____ Somewhat useful____ Not useful____

Comments:

Tried inputting data:

Yes ____ No ____ Comments:

Regulations

14. How helpful is the regulations section for users seeking clarification of their responsibilities under New York City and state law?

Very useful____ Somewhat useful____ Not useful____

Comments:

Frequently Asked Questions for Airports & Airlines

15. Are the questions pertinent, logical, and practical?

Yes ____ No ____ Comments:

16. Do the responses appropriately answer the questions?

Yes ____ No ____ Comments:

Fun Facts

17. Did you find the fun facts section interesting?

Yes _____ No _____ Comments:

18. Would you ever find a cause to use the information provided in this section?

Case Studies (Airport & Airline Case Studies)

19. Does information in the Fluorescent Lamp Recycling Program case study serve as a planning model?

Yes _____ No _____ Comments:

20. Does the information presented in the Water Conservation Program case study serve as a planning model?

Yes _____ No _____ Comments:

21. Does the information in the Pallet Diversion Program case study serve as a planning model?

Yes _____ No _____ Comments:

Links

22. Did you find the list of external links in the General section useful?

Yes _____ No _____ Comments:

23. Did you find the external links in the Airport/Airline section useful?

Yes _____ No _____ Comments:

24. Are there any links that you believe we should include?

Search

25. Did you use the search engine feature?

Yes _____ No _____ Comments:

ENDNOTES

[1] Fox, Josh, et al., *Profiting from Source Reduction: Measuring the Hidden Benefits, A Report to the Alameda County Source Reduction and Recycling Board.* Alameda County (CA) Source Reduction and Recycling Board, Community Environmental Council, and Global Futures. December 1997.

[2] Springer, T., *Source Reduction Measurement Methods for Cities and Counties*, California Integrated Waste Management Board, Sacramento, CA, 1994.

[3] U.S. EPA Office of Solid Waste and Emergency Response, "The Measure of Success—Calculating Waste Reduction," *WasteWi$e Update*, EPA530-N-99-003, July 1999.

[4] Connecticut Resources Recovery Authority, *The Impact of Source Reduction and Recycling in Connecticut*, August 1999.

[5] Saphire, David and Sharene Azimi, *Rethinking Resources: New Ideas for Community Waste Programs*, INFORM, New York, New York, 1997.

[6] Indirect benefits, such as increased storage space available for other raw materials or products, can be valued based on the firm's plant rental changes per square foot. Other indirect benefits, such as preserving land that would otherwise be utilized as a landfill, are much more difficult to value. In assessing indirect benefits, the best practice is to consider rational benefits and value all those that can be reasonably quantified.

[7] Brown, Kenneth, *Waste Prevention: Source Reduction Now*, Minnesota Office of Waste Management, St. Paul, MN, 1993.

[8] Palmer, Scott and Dr. George Garland, U.S. EPA, "Quantifying the Amount of Municipal Solid Waste Minimization (Source Reduction) Occurring in the U.S.," April 21, 1999.

[9] Hellsten, Eva, et al., "SWEEA—Swedish Environmental and Economic Accounts," *Structural Change and Economic Dynamics*, Vol 10, 1999, pp. 39-72.

[10] Kelly, Elizabeth, *Source Reduction Roundtable II: Tools for State and Local Programs*, Center for Policy Alternatives, Washington, D.C., 1996.

[11] In ratios using costs, it would be necessary to adjust for price hikes, both in product sales prices and raw materials prices, to ensure that only changes in the efficiency of resource use are captured.

[12] U.S. EPA, *Source Reduction Program Potential: A Planning Tool*, Washington, DC, Office of Solid Waste and Emergency Response, EPA530-R-97-002, September 1997.

[13] DOS and SAIC, *Survey of Waste Prevention Programs in Major U.S. Cities*, Washington, DC, June 1997.

[14] The use of the term "free rider" in this report is taken from its use in the DSM industry. As will be explained in the rest of this section, the DSM usage of "free rider" differs somewhat from its usage in environmental economic theory.

[15] Hirst, E. and C. Sabo, *Electric-Utility DSM Programs: Terminology and Reporting Formats*, Oak Ridge National Laboratory, 1991, Appendix B.

[16] Hirst, E. and J. Reed, *Handbook of Evaluation of Utility DSM Programs*, Oak Ridge National Laboratory, 1991, Chapter 8, particularly pp. 132 and 134.

[17] Deming, E., *Sample Design in Business Research*, John Wiley and Sons, 1990. Table 15, pp. 350-352, lists the major approaches to sampling and explains how the associated sample sizes are developed.

[18] Cochran, W., *Sampling Techniques*, Wiley Applied Statistics Service, 1997. An example of the type cited is discussed on pp. 72-73 of Cochran's book. With a sample of 400, all of whom respond, there is still one chance in 20 of an error of more than 5 percent.

[19] Hirst, E. and J. Reed, eds., *Handbook of Evaluation of Utility DSM Program*, Oak Ridge National Laboratory, 1991, p. 38.

[20] Deming, E., *Sample Design in Business Research*, John Wiley and Sons, 1990. pp. 38 to 39.

[21] Blum & Weprin Associates, Inc., "New York City Department of Sanitation Second-Hand Telephone Poll of New York City Households," conducted January 8-11, 1995.

[22] Alreck, P. and R. Settle, *The Survey Research Handbook*, Irving, 1985, p. 93.

[23] NYC Department of Sanitation, "Waste Prevention: A Focus Group Inquiry on Awareness and Attitudes," June 1996 and NYC Department of Sanitation, "Waste Prevention Attitude and Awareness Telephone Study, Executive Report," June 1996.

[24] California Integrated Waste Management Board, "Report on Waste Management Strategic Development Consumer and Business Focus Groups," December 1991.

[25] Springer, T. and Roark Haver, "Preventing Waste at the Source: Educating the Public," *Resource Recycling*. (April 1994), p 95 f.

[26] Nadel, Steve, "Utility Demand-Side Management Experience and Potential—A Critical Review," *Annual Review of Energy and the Environment*, 1992, p. 515.

[27] Hirst, E. and J. Reed, eds., *Handbook of Evaluation of Utility DSM Programs*, Oak Ridge National Laboratory, 1991, p. 21.

[28] Harrigan, M., et al., "Documenting Energy Savings Enhancements from Energy Education Components of a Low-Income Weatherization Program," American Council for an Energy Efficient Economy, 1992 Summer Study Proceedings, Vol. 7, p. 87.

[29] Collins, N., Berry, L., Braid, R., Jones, D., Kerley, C., et al., *Past Efforts and Future Directions for Evaluating State Energy Conservation Programs*, ORNL-6113, Oak Ridge, TN: Oak Ridge National Laboratory, 1985, p. 85.

[30] See F. Krause and J. Eto, *Least Cost Utility Planning Handbook for Public Utility Commissioners*, Vol. 2, NARUC, 1988, Chapter III. This handbook refers to the All Participants approach as the Total Resources. The terms All Participants and Total Resources are both in common use.

[31] See M. Schweitzer, et al., *Demand-Side Management and Integrated Resource Planning: Findings from a Survey of 24 Electric Utilities*, Oak Ridge, TN: Oak Ridge National Laboratory, 1991, for confirmation of this point.

[32] DOS programs are developed and implemented by the Bureau of Waste Prevention, Reuse and Recycling (BWPRR).

[33] "Current" refers to the latest year for which data were available at the time of this report's writing (for ongoing and completed programs) or for the first full year of operation (for programs which were being developed at the time of this report).

[34] New York City Department of Sanitation, *A Comprehensive Solid Waste Management Plan for New York City*, 1992, Appendix 7.1.

[35] New York City Department of Sanitation, *Comprehensive Solid Waste Management Plan: Final Update and Plan Modification*, 1996, p. 5-8.

[36] Mixed commercial/institutional waste is assumed to have a density of 0.14175 tons/cubic yard.

[37] Tellus Institute, *New York State Waste Plan Default Data Report*, 1994. Prepared for the New York State Department of Environmental Conservation.

[38] Draft contract, p. 10.

[39] Texas Natural Resource Conservation Commission, *The RENEW Catalog*, Winter, 1996, p.2.

[40] "Successful" recipients and generators refers to recipients and generators who have completed transactions.

[41] DiPietro, Robbie, "How Can Waste Exchanges Work Better?" *BioCycle*, January, 1994, pp. 75-76.

[42] Blum & Weprin, New York City Department of Sanitation Second-Hand Hotline Telephone Poll of New York City Households, conducted January 9-11, 1995.

[43] Blum & Weprin, New York City Department of Sanitation Second-Hand Hotline Telephone Poll of New York City Households, conducted January 9-11, 1995.

[44] The procurement savings are based on an estimate of $5/lb. assuming used clothes sell for $1/lb. and new clothes sell for $6/lb. The new clothes estimate is very conservative, and is based on a sales price of $3 for a shirt and $6 for a skirt or pants.

[45] NYC DOS "A Statistical Profile of New York City for Solid Waste Management Planning," May 17, 1991.

[46] Based on initial assessments of *NYC WasteLe$$* clients for the restaurant, retail non-food, manufacturing, and retail food sectors. Hospital sector estimate based on case study reports. For wholesale sector, 20 percent estimate until better data are available.

[47] *NYC WasteLe$$* participants received direct technical assistance from SAIC and thus are expected to achieve a higher rate of waste prevented. Similar facilities are not likely to receive long-term assistance from a consultant.

[48] DOS, "Unwanted Direct Mail Reduction Campaign Report," October 1994, pp. 1-2.

[49] DOS memo, June 27, 1996.

[50] "Unwanted Direct Mail Reduction Campaign Report," p. 2.

[51] "Unwanted Direct Mail Reduction Campaign Report," p. 2.

[52] "Unwanted Direct Mail Reduction Campaign Report," p. 2.

[53] Such refinements, however, are unlikely to have a significant impact on the tonnage of waste prevented. Since DMA has indicated that City-specific data on MPS registrations would cost approximately $800, DOS may not wish to spend this amount if it believes that the expense is not justified by the level of refinement that is expected.

[54] During the third quarter, registrations in Manhattan increased by 6 percent; in Staten Island by 28 percent, and in the Bronx by 11 percent.

[55] Brooklyn had 6,829 registrations in the second quarter and 1,643 in the third, and Queens had 14,271 in the third quarter, for a total of 22,743. Manhattan added 1,588 in the third quarter. Staten Island added 267 in the third quarter. The Bronx added 459 registrations in the third quarter. Registrations in these three boroughs, therefore, increased by 2,312 during the program.

[56] Approximately 186 tons per year.

[57] [$29,000 – ($41.50 x 29.25 tons + $70 x 20.98 tons)] / 50.2 tons.

[58] Department of Sanitation, "The New York City Partnership for Waste Prevention," May 1994 Update, p. 7.

[59] The surveys did not collect information on the weight of extras. Tellus staff weighed samples of extras on a postal scale.

[60] Memorandum from DOS to Tellus Institute, "Dry Cleaner Measurement," October 17, 1995, p. 5.

[61] DOS Summer Outreach Program Report, p. 4.

[62] DOS Summer Outreach Program Report, pp. 4, 15.

[63] DOS Summer Outreach Program Report, pp. 4-5.

[64] The dry cleaning survey and outreach program did not include a question on the weight of a hanger. Tellus staff estimated hanger weight empirically by weighing a few wire hangers on a postal scale.

[65] The dry cleaner survey did not include a question on the weight of a dry cleaning polybag. Tellus staff estimated the weight of a polybag empirically by weighing a few polybags on a postal scale.

[66] Chris French Cleaners reports saving 90 of the 300 rolls of polybags they had been purchasing before introducing reusables. This is a 30 percent reduction in usage.

[67] The NYC population is expected to increase by 0.51 percent by 2000 according to p. 2-42 of Appendix Volume 1.1 of the NYC Solid Waste Master Plan.

[68] "New York City Waste Stream Composition Analysis—Grocery Bags," April 8, 1996 draft.

[69] This is estimated based on the survey responses, as summarized in DOS's "The Department of Sanitation's Summer Outreach Program to Dry Cleaners, Grocery Stores, and Chinese Restaurants in New York City—December 1993." The surveys asked a range of questions related to bag reuse and prevention of bag use. A widely varying percentage of stores reported pursuing the waste prevention activities itemized in the survey. During site visits, 56 percent of store managers reported that groceries were *not* automatically double-bagged at checkout. Preventing unnecessary double-bagging yields the most significant bag reuse and prevention results. Here, a 50 percent reduction is used as a rough estimate.

[70] According to research for the NYC WasteLe$$ project, the Wakefern store in Staten Island reported preventing about 400 bags per week. This is about half of what Wakefern's stores throughout the Northeast are preventing; the Staten Island store's results are conservative and take account of local conditions (*i.e.*, grocery stores in NYC are likely to be smaller than average Wakefern stores). Telephone conversation with Victor Bell, then of SAIC, April 22, 1997.

[71] SAIC, "Characterization of New York City's Solid Waste Stream—Grocery Bags," April 8, 1996, p. 3.

[72] SAIC, "Characterization of New York City's Solid Waste Stream—Grocery Bags," p. 3.

[73] SAIC, "Characterization of New York City's Solid Waste Stream—Grocery Bags," p. 2.

[74] SAIC, "Characterization of New York City's Solid Waste Stream—Grocery Bags," p. 2.

[75] Based on SAIC's research for the NYC WasteLe$$ project. This does not include specialty stores (such as meat stores, vegetable and fruit stores, etc.); these are omitted to be conservative.

[76] [(Bag prevention per store per week) x (Percentage of bags that are plastic) x (Weight of plastic bag (lbs.)] + [(Bag prevention per store per week) x (Percentage of bags that are paper) x (Weight of paper bag (lbs.)].

[77] Pounds of bag prevention per store per week times 52 weeks per year.

[78] Pounds of bag prevention per store per year times grocery stores in NYC.

[79] Pounds of bag prevention for all grocery stores per year divided by 2000 pounds per ton.

[80] This approach is, in fact, typical of the procedures used by electric utilities when they evaluate the impacts of educational programs for which it is essentially impossible to establish causal links to savings. See, for example, *Impact Evaluation of LILCO's 1992 Electric Conservation and Load Management Plan*, Long Island Lighting Company (LILCO), 1992, Chapter 1.

[81] The NYC population is expected to increase by 0.51 percent by 2000 according to p. 2-42 of Appendix Volume 1.1 of the *NYC Solid Waste Master Plan*.

[82] CENYC conducted a waste assessment of Bell Atlantic's office on East 38th St. and garage on Norman Avenue.

[83] *Conversion Factors for Individual Material Types*, submitted to California Integrated Waste Management Board by CalRecovery, Tellus Institute, and ACT...Now, December 1991, p. 10.

[84] *Conversion Factors for Individual Material Types*, p. 10.

[85] The density of disposable cup waste prevented by *The Village Voice* was used as a proxy for the density of the disposable dishware waste prevented by Barnard College. Since *The Village Voice* prevented 22 cubic yards of cups that weighed 1,750 pounds, the density of these cups is 80 pounds per cubic yard (1,750 / 22 = 80).

[86] *Conversion Factors for Individual Material Types*, p. 10.

[87] *Conversion Factors for Individual Material Types*, p. 7.

[88] *Conversion Factors for Individual Material Types*, p. 10.

[89] *Conversion Factors for Individual Material Types*, p. 11. The density of auto air filters was used as a proxy for the density of air conditioning air filters, the type prevented though this program.

[90] *Conversion Factors for Individual Material Types*, p. 4. The density of flammable liquids was used as a proxy for the density of Liquid Production Chemistry (an ink); no density conversion factor was available for Liquid Production Chemistry.

[91] *Conversion Factors for Individual Material Types*, p. 20. The density of empty household hazardous waste containers was used as a proxy for the density of cleaning product containers.

[92] *Conversion Factors for Individual Material Types*, p. 11. The density of aseptic packaging was used as a proxy for the density of single-use coffee creamer packaging; no density conversion factor was available for coffee creamers.

[93] CENYC programs at Consolidated Edison and college workshops prevented 560 tons of waste as of October 31, 1996 (memo from CENYC to Tellus Institute). It was not possible to disaggregate these impacts.

[94] Hammer, Steven, Final Report, *Waste Prevention Training and Technical Assistance Service to Local Development Corporations*. May 1998, p. 2.

[95] There also are trends that result in increases in the waste stream, such as increased use of single-use items.

[96] Actually, growth would be slightly higher than 3 percent due to the effects of compounding. However, for simplicity's sake, 3 percent is used in this illustrative example.

[97] "Current" refers to the most recent year for which data were available at the time of this report's writing.

[98] (58,689 registrants x 15.18 pounds per registrant per year) / 2000 pounds per ton.

[99] There was no feasible way to estimate the CONEG Challenge's contribution to reuse in New York City, as CONEG was able to estimate a worldwide figure only. As of 1994, the participating companies reported waste prevention of approximately 16 million tons. This is a *very* rough estimate of all waste prevention for all companies participating actively in the Challenge, including international companies. Moreover, many of these same companies are in WasteWi$e. Therefore, the CONEG contribution was set at zero, as a very conservative estimate. Telephone conversation between Ann Mathias, CONEG, and Susan Williams, Tellus, August 14, 1996.

[100] EPA, "First-Year Progress Report WasteWi$e," September, 1995, p. 2. WasteWi$e companies prevented generation of 240,000 tons of material in the US; we calculated NYC portion as 7,107 tons based on NYC portion of the U.S. population.

[101] Telephone conversation between John Okun, Long Island City Business Development, and Catherine Finney, SAIC, July 19, 1999. The "initial" figure refers to 1998.

[102] Telephone conversation between David Jean, Bell Atlantic, and Susan Williams, Tellus, May 16, 1996.

[103] Telephone conversation between Adriana Kontovrakis, East Williamsburg Valley Industrial Development Corporation, and Susan Williams, Tellus, September 17, 1997.

[104] Telephone conversation between John Krakowski, City Harvest, and Susan Williams, Tellus, August 6, 1996. In 1995, City Harvest collected 2,450 tons of food. Of this amount, 500 tons was from a canned food drive. Therefore, this 500 tons of "new" food was subtracted from the total collected. In 1998, City Harvest diverted 10,000,000 pounds or 5,000 tons of edible

food. Personal communication, Julia Erickson, City Harvest to Melody Drnach, SAIC, July, 1999. City Harvest has received some of its funding from DOS.

[105] Telephone conversation between Scott Wing, Director of Operations, Food For Survival, and Susan Williams, Tellus. Donations are expected to be flat through the year 2000, or even to decline. Donations to Food for Survival are divided into two categories: produce and non-produce. For produce donations, Food For Survival requires that produce be at least 80 percent usable. Therefore, 80 percent of the 4.9 million pounds of produce donated is waste prevented (the unusable portion of the produce is presumed to be disposed by the receiving agencies). Non-produce donations include packaged foods nearing or past the expiration date, or otherwise considered by the donor to be "past peak" or difficult to sell. Some of these donations would have been disposed in the absence of the Food For Survival program, while other food would have found other markets. In the absence of better information, 50 percent of the 3.3 million pounds of non-produce food donations is assumed to be waste prevented (materials that otherwise would have been disposed).

[106] Telephone conversation between Marty Cochran, Vice President of Contributed Goods, Goodwill Industries, and Susan Williams, Tellus, August 7, 1996. Yearly contributions of textiles only to Goodwill represent 3,500 tons. However, this is likely overlap with "other reuse" calculated separately in this report from responses to the Blum & Weprin survey for the *NYC Stuff Exchange*. Therefore, to be conservative and avoid double counting, Goodwill's contribution has been estimated as zero.

[107] Written communication from Arthur W. Carlson, The Salvation Army Adult Rehabilitation Center, to David Kleckner, DOS, February 1998.

[108] Written communication from Ralph Torres, General Manager, St. Vincent de Paul Society, to David Kleckner, DOS, January 1998.

[109] Written communication from Lizbeth Molloy, Times Square Delivers, to David Kleckner, DOS, January 1998.

[110] The October 29, 1996 issue of the *Recycling Times* stated that CONEG is closing its waste prevention forum. No other organization has taken over the "Challenge."

[111] U.S. EPA, *Characterization of Municipal Solid Waste in the United States: 1995 Update*. See Table 24, p. 85.

[112] Relative weights of paper and plastic bags were taken from Science Applications International Corporation's waste prevention research on grocery store waste. All other unit weight data were provided by the Steel Recycling Institute.

[113] U.S. Census Bureau data provide estimates of NYC population which are 5 to 10 percent lower than other sources. See J. Stutz and G. Prince, a *Statistical Profile of New York City for Solid Waste Management Planning*, Tellus Institute, 1991, pp. 2-39. U.S. Census data are used to ensure consistency with the EPA data for 2002 which reflect U.S. Census Bureau estimates. The U.S. population is expected to be 279,000,000 while the NYC population is estimated expected be 7,900,000 in the year 2002 (assuming a 0.51% annual population increase). This could cause the NYC impacts shown to be too low.

[114] The source for the figures in the "Historical Data: 1992" and "Forecast with Material Substitution: 2000" is the *Characterization of Municipal Solid Waste in the United States: the 1998 Update*. U.S. EPA, May 1999. The EPA data include residential, institutional and commercial MSW. The other columns are Tellus calculations. Note that negative numbers refer to increases in waste generation. Totals may not compute exactly due to rounding.

[115] Calculations based on following per item weights: 16 oz. glass container = 9.5 ounces; 12 oz. aluminum container = 0.595 ounces; large and small steel container = average of 1.27 oz. and 2.23 oz.; 20 oz. plastic container = 0.995 oz.

[116] The data indicate that for aluminum beverage containers and paper milk cartons, generation rates are expected to decline from 1992 to 1997, however, U.S. EPA estimates show projected increases between 1997 and 2000. It is believed that the apparent decline in 1997 is due to changes in the definitions for these two categories. For aluminum beverage containers and paper milk cartons only, the linear regression analysis conducted includes U.S. EPA's projections for 2005 in order to generate a line with the best fit. The 2005 projection data are not included for other categories because the data yielded sufficiently high R- Squared values.

[117] Calculations based on following per item weights: 1 qt. paper milk carton = 1.5 oz.; 1 qt. plastic milk carton = 1.7 oz.

[118] These practices were discussed more fully in *Characterization of Municipal Solid Waste in the United States: 1996 Update*, by Franklin Associates for the U.S. EPA. EPA 530-R-97-015. June 1997.

[119] *1999 North American Pulp & Paper Factbook*. Miller Freeman, Inc (San Francisco) 1999. p. 277-278.

[120] Franklin Associates, Ltd. *Old Newspaper and Old Magazine Supply in the Northeast*. Northeast Recycling Council. April 1996.

[121] Applied simple linear regression analysis to obtain 1998 waste generation and recycling rates. To obtain 1998 current waste prevention, used the methodology in Table 3-4 for materials substitution trends and applied regression equation for other trends.