Analysis of New York City Department of Sanitation Curbside Recycling and Refuse Costs

Prepared For

Natural Resources Defense Council

FINAL REPORT

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EXECUTIVE SUMMARY

During recent years, there has been considerable discussion in public policy circles about the costs of recycling vis-à-vis out-of-state export of New York City's trash. While the environmental and natural resource benefits of recycling have long been widely acknowledged, proposed cuts to the city's recycling budget in 2002 raised questions both in New York and around the nation as to whether recycling was a cost-effective strategy for dealing with municipal solid waste. Even after New York City Mayor Michael Bloomberg and the New York City Council agreed to restore glass and plastic recycling collections for all households in 2004, and to enter into a long-term contract for the sorting and reselling of collected recyclables, some economic questions lingered.

In late 2004, DSM Environmental Services, Inc. ("DSM"), a consulting firm with specific expertise in economic analysis of solid waste and municipal services, was commissioned by the Natural Resources Defense Council, Inc. ("NRDC") to undertake a study of the economics of recycling in New York City. To our knowledge, this is the first independent review of the City's cost allocation model by a recognized expert in recycling economics.

The primary purpose of this study was to analyze the City's present and future recycling costs, focusing specifically on a comparison of curbside collection for recycling versus curbside waste collection for export to out-of-state landfills and incinerators. This study effort also sought to assist policy makers in creating a more transparent system for calculating the costs of recycling.

Over the past three years, DSM has exhaustively analyzed the Department of Sanitation ("DSNY") data and conducted dozens of interviews with key personnel from DSNY, as well as from the city's Economic Development Corporation, Independent Budget Office and City Comptroller's Office. We greatly appreciate their cooperation and invaluable assistance. However, the conclusions in this report are solely those of DSM.

Here are the major findings and conclusion of our analysis of the economics of New York City's recycling program.

- The citywide costs per ton of curbside collection and disposal of recyclables in fiscal year 2005 (the most recent year for which complete data were available) were very close to the costs per ton of curbside collection and disposal of non-recycled refuse. Specifically, we concluded that the overall FY '05 cost per ton of curbside recycling was $284 dollars per ton vs. $267 per ton for curbside refuse, representing a difference of roughly six percent. (See pages 19-20.)

- This is a relatively insignificant difference given the type of accounting method utilized by DSNY to allocate large shared refuse and recycling costs. (See page 3-4, 19.)

- The primary reason for the slightly higher per ton citywide cost for curbside recycling in FY '05 is simply that recycling collection crews collected fewer tons per shift than refuse collection crews. (See page 20.)

- Indeed, the overall cost of processing – as opposed to collection – a ton of the city's recyclables is currently significantly less than the cost the city must pay companies to bury or burn a ton of the city's regular trash.

- Further, City-wide average curbside costs of paper recycling are already less costly than average, City-wide curbside costs of refuse. (See page 21.)

- Looking to the future, DSNY has reported to the City Council that they expect export costs for curbside collected refuse will be $107 in FY 09 and $124 in FY 14. At $124/ton for export,

curbside collection of both paper and MGP recyclables would have been less expensive than curbside collection of refuse for export in 2005. We recognize that factors such as increasing fuel, labor, and equipment costs will negatively impact the cost of both recycling and refuse collection looking forward, and that it is difficult to predict what total system costs will be in future years. However, we believe that there will be continued upward pressure on export costs for refuse, and the potential to further reduce recycling costs as more material is collected and world-wide recycling markets continue to demand more secondary material. (See page 22.)

- In light of these trends, we conclude that the City's curbside collection program for paper and metal, glass and plastic will begin to reduce overall DSNY system costs within the near future – at least within the next five to six fiscal years. In the interim, the difference between curbside recycling and refuse costs will be relatively minor, and will continue to decline as more residents participate in the recycling collection program. (See page 25.)

- A key to making citywide curbside recycling overall less costly to the City than curbside refuse collection and disposal is to make recycling collections as efficient as possible. Therefore, DSNY should continue in its strategy to reduce overall system costs by focusing on increasing set-outs of recyclables by NYC households. (See pages 5 and 23.)

- Our analysis is based upon a review of, and adjustment to, DSNY's current cost allocation model. The current model must be adjusted to accurately compare curbside recycling costs with curbside refuse costs. This is because the current DSNY model lumps all "recycling" costs together – ranging from composting at Rikers Island to Freon removal to waste prevention activities – while simultaneously allocating some snow and ice removal costs to refuse and recycling. Therefore, we strongly recommend that these revisions to DSNY cost allocation model be adopted for future use by DSNY and others seeking to understand the economics of the City's curbside recycling program. (See page 11–13.)

- Finally, this analysis focused solely on an economic comparison of curbside recycling and refuse. It is important to underscore that an economic comparison does not fully account for the environmental impacts of the City's waste disposal system. For example, using EPA's Waste Reduction Model, which helps assess greenhouse gas emissions from different waste management practices, it is estimated that carbon emissions reductions from the City's recycling program have been dramatic, representing over 500,000 metric tons carbon equivalent savings in FY '05 alone. This is especially critical given that transportation (including export of refuse) and landfilling are two of the largest contributors to greenhouse gas emissions, and given the City's vulnerability to the impacts of global warming. (See Appendix A.)

SECTION I. INTRODUCTION

Beginning in 1994, the New York City Department of Sanitation (DSNY) has annually compared the per ton cost of recycling and the per ton cost of refuse collection and disposal using a total cost allocation model which allocates all DSNY costs among DSNY's cleaning and collection activities.[1] This cost allocation model has consistently shown per ton recycling costs to be higher than per ton refuse collection and disposal costs. For FY 05, the most recent year for which the cost allocation has been completed, DSNY calculated fully allocated refuse collection and disposal costs at $263 per ton and recycling collection costs at $343 per ton.

In June, 2002 higher bids to process metal, glass and plastic (MGP), combined with a fiscal crisis post 9/11 pushed the Bloomberg Administration to recommend elimination of MGP curbside recycling collection.[2] The final FY 03 budget, negotiated with the City Council, eliminated glass and plastic but left in metal curbside collection. Projected differences in curbside recycling collection costs when compared to curbside refuse collection costs were used, in part, to project savings associated with the elimination of glass and plastic collection. However, after one year, savings that had been projected were not realized. Simultaneously, DSNY received a proposal from the Hugo Neu Corporation (now part of the Sims Group) to process metal, glass and plastic (MGP) at a reduced rate compared to previous processing bids. This was among the factors that led the City to reintroduce plastic collection in July 2003, and glass in April 2004.[3]

Because DSNY's cost allocation model continues to show that City-wide average per ton costs for recyclables are greater than City-wide average per ton costs for collection and disposal of refuse,[4] recycling supporters have been concerned that the issue of elimination of the curbside recycling program might be raised again in the future. Some recycling proponents have questioned whether the DSNY model unfairly allocates costs to recycling compared to refuse, thus biasing the results of the City's calculations.

As a result, a number of efforts have been made to review and analyze the DSNY model. These include analyses by NYPIRG, the New York City Comptrollers Office, and, most recently (FY 02 and FY 06), New York City's Independent Budget Office (IBO).

NRDC, a long-time advocate of recycling, thought that it would make sense to identify a firm that could conduct an independent, expert analysis of the DSNY cost allocation model to determine if the cost allocation model was an appropriate methodology for allocating DSNY's costs, and whether it accurately and fairly allocated costs for recycling and refuse collection. DSM Environmental Services, Inc. (DSM), a firm specializing in economic analysis of recycling systems, was retained to conduct this analysis.[5]

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[1] As discussed in detail below, DSNY lumps all activities related to "recycling" (e.g., composting at Rikers Island, Freon removal from appliances, waste prevention activities) together for the purpose of this analysis.
[2] Contracts to process MGP came up for re-bid in June 2002. Processors bid between $95 and $165 per ton making processing costs higher than export costs for refuse.
[3] *Processing and Marketing of Recyclables in New York City*, Bureau of Waste Prevention, Reuse and Recycling, May 2004, p. 75.
[4] It should be noted that the Independent Budget Office concluded that in FY 02, average costs for paper recycling only were less than refuse collection, and we reach the same conclusion in FY 05. See also page 21.
[5] DSM Environmental Services, Inc. has twenty years of experience conducting economic analysis of solid waste and recycling systems. Clients include State governments (Vermont, Massachusetts, Delaware and Rhode Island); solid waste authorities (Delaware Solid Waste Authority, Solid Waste Authority of Central Ohio, Aquidneck Island Planning Commission, East Central Iowa Council of Governments); Cities (e.g., Boston, Cambridge, New York, Wilmington, Columbus, Johannesburg, SA; and international agencies (US AID, United Nations, World Bank, South African Development Bank).

In December, 2004 NRDC arranged for a joint meeting with the New York City Economic Development Commission and DSNY to request access to the DSNY model and DSNY staff who run the model. DSNY agreed to provide DSM with complete access, and provided DSM with the FY 04 model to begin the analysis. The only limitation that DSNY placed on DSM was that the analysis concentrate on the cost allocation model, and not on collection efficiency or other labor productivity issues.

A draft report was released by DSM to DSNY and NYEDC in January 2006. Comments were received from DSNY in early 2006 in preparation for release of a final report. However during the review of the draft report it was agreed by all parties that the FY 05 model would be more representative of the real cost of recycling because it was the first full year after reintroduction of glass and plastic curbside recycling.[6]

DSM began a review of the FY 05 model in May 2006 with an agreement that DSNY would incorporate mutually agreed upon changes to the FY 05 cost allocation model proposed by DSM. DSM received the revised model incorporating these changes in September, and subsequently worked to make additional revisions and clarifications to the model.

This report presents the result of this three year effort of DSM to evaluate the DSNY model.

[6] Lorenzo Cipollina, Deputy Commissioner, Charles Stamm, Deputy Director, Planning and Budget, and Barbara Rothenberg, Deputy Director, Operations and Management Division were DSM's primary contacts at DSNY. Venetia Lannon was the primary contact at NYEDC.

SECTION II. OVERVIEW OF COST ALLOCATION METHODOLOGIES

Various groups reviewing the DSNY model over the past several years have suggested that perhaps a different methodology would be preferable, or might yield results more favorable for recycling. Therefore, it is helpful to describe the various methodologies available for allocating costs before beginning the analysis of the DSNY model.

As a general overview, it is important to remember that there is more than one method for allocating costs, and all cost allocation methods rely on subjective decisions about how to allocate shared costs. The net result is that the combination of more than one acceptable methodology, combined with the need to make subjective decisions about allocation of shared costs under each methodology, provides for ample opportunity for honest people to disagree about the results.

Therefore, cost allocation should be viewed as an art rather than a science. The key is a consistent and defensible process for allocating shared costs that makes sense given the type of activity being analyzed.

This section (Section II) describes the methodologies commonly used to allocate costs. In Section IV we set forth DSM's analysis of DSNY's allocation decisions imbedded in their cost allocation model.

There are three primary methodologies that could be used to compare DSNY recycling and refuse costs. These are:

- Total cost allocation
- Incremental cost analysis
- Activity based cost accounting

Total Cost Allocation

The DSNY model, developed by KMPG and DSNY in the early 1990's is a *total cost allocation model*. That is, all $1.35 billion dollars of DSNY's annual budget (FY 05) are allocated to three DSNY functions:

- Collection and disposal of refuse
- Collection and processing of recyclables
- Cleaning (streets and baskets)

Once all costs have been allocated to these three functions, then the total cost for each function can be divided by the total tons managed by that function to determine a per ton cost.

The primary problem with total cost allocation models are that they typically allocate costs from the "top down" using a few surrogates to allocate all costs.[7] For example, the DSNY model uses sanitation worker labor to allocate roughly 90% of DSNY's costs to the three functions, including

[7] Description of problems with total cost accounting excerpted from *Activity Accounting, an Activity Based Costing Approach*, Brimson, James A.

indirect costs which are not directly attributable to any one function,[8] even though direct sanitation labor costs (posts) represent roughly 40% of DSNY's total budget, exclusive of export costs. For this reason, small differences in allocated costs (i.e., plus or minus 10 -15%) between functions should be viewed with an understanding that these differences may be the result of the allocation decisions instead of the result of actual differences in costs.

Because of the allocation problem, it is typically difficult to allocate costs among many different functions in a total cost allocation model; especially functions that make up a relatively small portion of the overall budget. In addition, these smaller functions are especially impacted by small differences in the allocation methodology because there aren't many tons to spread the allocation of indirect costs over.

The second, and related, problem associated with total cost allocation that especially impacts DSNY's allocation of costs to curbside collection of recyclables – the newest of the three functions – is that because *all costs* must be allocated to the three functions, "sunk costs" (e.g., extra garage space, administrative overhead) must be allocated proportionately to all three functions. This has an especially large impact on recycling because, for example in FY 05, for every 100 tons of refuse there were only 20 tons of recycling over which to spread these "sunk" costs.

Finally, because all indirect and "sunk" costs are allocated to refuse collection, cleaning, and recycling, one *cannot* use the difference in per ton costs of recycling and refuse from the total cost allocation model to project what would happen if recycling were no longer undertaken. That is because many of the costs that have been allocated to recycling would remain even if recycling were eliminated. For example, garage space that has been allocated to recycling would remain, as would the bulk of DSNY's administrative costs. And DSNY would still have to pick up the same tonnage of material, only this time it would be collected and disposed as refuse instead of recycling.

The correct way to analyze the true savings – or cost – of eliminating one of DSNY's functions would be to take the difference between total system costs with the function, and without the function. This is, in essence, incremental cost accounting, which is discussed in the next section.

Incremental Cost Accounting

Incremental costs can be defined as the *change in costs due to a change in activity.* There are two ways to use incremental costs. The first, which in essence is the economic definition of *marginal costs*, is the *change in costs due to an incremental change in a given activity.* For example, one could ask what the incremental cost would be to collect an additional 1,000 tons of refuse, over and above the 11,000 tons of refuse collected each day by DSNY. The incremental cost could be relatively small if there is sufficient capacity on the existing trucks, and sufficient time for labor to collect this additional refuse during the normal workday. Or, this cost could be quite high if the majority of trucks were already at capacity, and/or labor was already being utilized fully, requiring putting new trucks and Sanitation Workers on the street to collect this additional refuse.

Similarly, one could ask what the incremental cost would be to add another material to the recyclables that DSNY collects in the curbside recycling program. Again, the answer would depend on the capacity of the trucks and labor used to collect the existing material.

[8] Throughout this report costs are reported in ranges, or rounded, to reflect the fact that although the total cost allocation model allocates all costs to the nearest dollar, there are many assumptions involved in the allocation process which significantly reduce the accuracy of the final allocations.

Using short term marginal (or incremental) costs to analyze changes in refuse or recycling collection costs would result in a "saw tooth" type graph, where the addition of another increment of recycling or refuse collection would alternately cost very little, or a lot, depending on whether additional truck and sanitation worker capacity had to be added *at the time of the change*. The answer would also vary over time. For example, the number of Sanitation Workers varies year to year depending on retirements and restrictions on DSNY's ability to hire additional Sanitation Workers -- and the quantity of waste set out varies depending on the time of year and the economy.

Because this type of short term incremental cost analysis depends on the time when the analysis is conducted, and the capacity of the existing system *at that time*, short term incremental cost analysis is not a good method for analyzing the long-term impacts of adding or deleting curbside collection of recyclables.

A second type of incremental cost analysis is more appropriate for analyzing the impacts of adding or deleting curbside collection of recyclables, although it too suffers from short-term impacts. That is, one could analyze the incremental change in *total system costs* associated with collecting all of the material set out by New Yorkers as refuse, compared to the total system cost of collecting a certain portion of that material as recyclables. In this case, the incremental cost effectiveness of recycling is the reduction, or increase, in total system costs associated with the change.

DSNY's existing total cost allocation model could be used to conduct this analysis, essentially by running the model with and without recycling collection, although, as explained in the following section, an activity-based cost model would be a better tool for this type of analysis.

It is important to note here that one *cannot* deduct the avoided cost of the recyclables not going to landfill when conducting this type of systems analysis. It would result in double counting. That is because all of the system costs associated with collecting the material for recycling, including the processing costs and revenues for this material, have been accounted for, as well as the system costs associated with collecting the remaining material as refuse, including the disposal cost for this material. If the recyclables were going to be disposed as refuse, they would have had to have been collected as refuse – which would have been less costly than collecting as recyclables. The gains associated with the higher recycling collection cost have already been accounted for in the lower processing cost (if that is the case) and the recycling revenues.

This is an important point in assessing the relative merits of recycling and refuse collection in New York City. The key to sustainable recycling is to make recycling collection as efficient as possible, recognizing that the closer recycling *collection* costs come to refuse collection costs the *greater the possibility* that the lower processing cost for recycling (and associated recycling revenue) will lower *total system costs* below the system cost of managing all of the material as refuse. This accounts for the fact that refuse typically weighs more than recycling (on a per cubic yard basis), and there are greater amounts of it per stop, making per ton refuse *collection* inherently less costly.

Activity Based Cost Accounting

Over the past ten years the methodology that has gained acceptance as the preferred approach for calculating the relative costs of refuse and recycling is *Activity Based Cost Accounting*. DSM typically uses this approach to build *program,* or *activity* based budgets for cities in the U.S. and internationally.

Under this approach, all of the costs for curbside recycling would be built from the "bottom up" (the opposite of total cost allocation) based on some key "driver" of recycling and refuse costs. In most cases this is the number of trucks necessary to collect recyclables and the number of trucks necessary to collect refuse.

Once the number of truck shifts is known, all other costs associated with each truck shift can be added to the truck cost and multiplied by the number of trucks used. In this case, because DSNY uses two Sanitation Workers to collect recyclables (and refuse), the annual cost of two Sanitation Workers can be added to the annual cost of owning and operating the truck, and then the administrative costs associated with that truck and those Sanitation Workers can be added, until all costs associated with putting a truck and two workers on the street are calculated.[9]

There are three primary benefits to activity based cost accounting. First and foremost, it allows for the development of detailed activity based budgets for a much finer breakdown of functions. For example, an activity based budget could be developed for such DSNY activities as:

- Curbside collection of recyclables and curbside collection of refuse;
- Containerized collection of recyclables and containerized collection of refuse;
- Special waste management programs (e.g., CFC removal, HHW programs);
- Waste prevention programs;
- Lot cleaning;
- Snow plowing; and,
- Organics management programs.

The second benefit of activity based cost accounting is that it is a very good tool for analyzing the impact of changing the system. For example, once the cost per truck has been developed for curbside refuse and curbside recycling collection, then one can evaluate eliminating or adding to recycling by changing the tonnage that must be picked up by either the recycling or refuse trucks. Trucks are then added or eliminated and the costs recalculated for each district (because productivity targets are different in each district), or City-wide.

The third benefit of this approach is that sunk costs (e.g., garage space not needed to house these trucks, or administrative personnel not required to administer the recycling collection program) are not assigned to recycling – or refuse. While there is no guarantee that eliminating these sunk costs would make recycling more cost effective than refuse, it would increase the odds of this occurring because there are so many fewer recycling tons than refuse tons to carry the burden of those sunk costs.

[9] We understand the difficulty of calculating an average Sanitation Worker cost given the ability of Sanitation Workers to move between collection activities depending on seniority, however, this problem is no worse than the current problem of allocating all labor costs to the three functions.

DSM's Approach

Because of the merits of activity based cost accounting, DSM initially proposed to develop a new cost allocation model using activity based costing, based on models DSM had constructed for other cities. However, once we had had an opportunity to review the existing cost allocation model in detail, and to better understand DSNY's operations and constraints, it became clear that the sheer magnitude of DSNY's budget, limitations on DSNY's ability to collect activity based data, and the complexity of DSNY's operation made development of an entirely new model well beyond the scope and budget of this analysis.

Of special concern is that Sanitation Workers within different wage scales can move to different tasks (e.g., to recycling or refuse or cleaning) on any given day depending on the number of workers assigned to each task in each district each day and the seniority of the Sanitation Workers reporting for work on any given day. DSNY's existing "san form" accounting system and the associated payroll tracking system makes it difficult to account for each worker (and wage rate) on each truck each day at this level of detail.

Therefore, after meeting with DSNY and having an opportunity to review DSNY's total cost allocation model in detail, a decision was made to use the existing total cost allocation model as the basis for DSM's analysis. The existing model – with the changes recommended by DSM, below – is an acceptable methodology for allocating total costs, albeit with the inherent problems discussed in this report. More importantly, incorporating all of DSNY's costs into a new, activity based cost model (even if it were to create a better tool for analysis) would create an alternative, complex model, familiar only to DSM, and would involve a large investment of time and personnel on the part of DSNY.[10]

One important benefit of utilizing the existing model is that it already has formed the basis for discussions on the cost effectiveness of recycling, both within DSNY, with other City agencies, including NYEDC, the IBO, and the Comptroller's Office, and within the environmental community. One goal of this project has always been to better explain to all interested parties why recycling and refuse collection and disposal costs are what they are, and to use this explanation to evaluate the future role of curbside recycling in New York City.

[10] As it was, DSNY has invested many hours in meeting with DSM, providing DSM with background data, and working on changes to the total cost allocation model requested by DSM, over the past two years.

SECTION III. OVERVIEW OF DSNY

Any analysis of curbside recycling and refuse collection and disposal in New York City must begin with at least a summary understanding of DSNY operations and costs. This is because many of the issues facing DSNY are unique to DSNY compared to other cities in the United States, beginning with the sheer size and scope of DSNY's responsibilities, and continuing through DSNY's long history of organization and unionization. Important factors include:

- An annual budget of $1.35 billion (FY 05) which, for comparison is almost one-quarter of the entire state budget for Vermont or Delaware.
- DSNY is responsible for collection of refuse and recycling from *all* residential units in the City. Very few other cities in the US collect from all buildings, no matter the size or number of units.[11]
- DSNY also cleans the city, including street cleaning, emptying of litter baskets, and vacant lot cleaning.
- DSNY has responsibility for snow and ice removal in the winter, utilizing its refuse and recycling trucks for plowing and salting/sanding.
- Roughly 7400 unionized Sanitation Workers carry out or directly supervise refuse and recycling collection, cleaning, and snow and ice removal functions (referred to as "san workers") – working out of 59 district offices/garages located throughout the five boroughs.[12]
- Workers are allocated to each district based on the collection, recycling and cleaning needs of the district determined by agreed upon "productivity targets" for refuse and recycling established in DSNY's contract with union workers. However, on any given day Sanitation Workers may be moved between districts depending on the needs of each district on that day and the number of Sanitation Workers who report for work on that day in each District.
- The City-wide productivity target for refuse is an average of 10.6 tons of refuse per truck shift and 6.2 tons of recyclables per truck shift (FY 05), with a wide range among districts depending on density and waste generation. Sanitation Workers can be penalized for not meeting their productivity targets, which have been developed (and negotiated) over time based on historical collection records.
- Two workers, both capable of driving, are required under the union contract for every refuse and recycling truck during collection. Many other cities and private haulers have moved to one person trucks, especially for recycling. While DSNY has begun to make this change for containerized collection, the potential exists for additional conversion to one person trucks in the future which may improve recycling collection efficiency.[13]
- In addition to the roughly 7,400 Sanitation Workers, there is a large civilian workforce that enforces sanitation ordinances, collects and analyzes data, and administers the collection, cleaning, recycling and snow removal activity of the City.
- After closing the Fresh Kills landfill in 2002, the City now owns no operating refuse disposal facilities, exporting roughly 62,000 tons of refuse each week (FY 05) to out-of-city disposal facilities, either directly by truck, or through privately owned truck and rail transfer stations.

[11] DSNY collects no waste generated by business or industry, leaving this entirely to private carters.
[12] FY 2005 DSNY Annual Report
[13] The ability to move to one person recycling collection trucks will be limited because of the need for Sanitation Workers to collect appliances and other bulky metal as part of recycling collection.

- Much of the refuse and recyclables are “relayed” during the second and third shift by a single driver to the transfer/disposal or processing facilities. While this relay reduces non-productive collection time and overtime costs, it does add additional truck shifts for refuse and recycling.
- Despite the relatively large quantity of recyclables collected, DSNY owns no recycling processing capacity, relying instead entirely on existing private brokers and paper packing facilities located throughout the City and in New Jersey.
- Finally, DSNY is the only city DSM is aware of that collects appliances as part of its MGP curbside collection. This significantly changes the relative mix of paper and MGP collected, with MGP quantities (by weight) being greater than paper quantities in many areas of the City as opposed to most conventional residential curbside collection programs where paper typically represents around 70 percent of municipal recyclables set out. The impact of collecting appliances with the MGP is a two-edged sword. On the one hand, it increases the weight of the recyclable material, which theoretically lowers per ton collection costs. On the other hand, the ability to load large appliances reduces the ability of DSNY to switch to one-person collection crews in the less dense districts. And, the appliances add a whole new level of potential contamination to the MGP once they are compacted in the truck. This reduces the value of the plastic (especially) and increases processing costs for MGP.

SECTION IV. DSM'S ANALYSIS OF THE COST ALLOCATION MODEL

DSM started the project with four days of meetings in New York City on December 6 through December 9, 2004. We met first with Executive Vice President of Infrastructure, Kate Ascher, and Venetia Lannon, of the Economic Development Corporation, and Deputy Commissioner Larry Cipollina, DSNY, to discuss the purpose and proposed scope of work for this project.

We then met with Director Robert Lange and Senior Policy Analyst, Samantha MacBride at DSNY's Bureau of Waste Prevention, Reuse and Recycling; with Elisabeth Franklin, Budget and Policy Analyst and Preston Niblack, Deputy Director of the Independent Budget Office and with Chris Boyd of the Comptrollers Office to learn what areas of investigation they believed would be most fruitful to pursue with respect to comparison of refuse and recycling costs.

The following day Deputy Commissioner Cipollina arranged a meeting for us with his staff, including:

- David Nati (now retired), Director, Operations and Management Division
- Peter G. McKeon, Chief of Collection/Recycling Operations
- Marty Bellew, Director, Bureau of Waste Disposal
- Charles Stamm, Deputy Director, Planning and Budgeting
- Barbara Rothenberg, Deputy Director, Operations and Management Division
- Michael Ebert, Director, Planning and Budget

Deputy Commissioner Cipollina made it clear during the meeting that DSM could have complete access to his staff and to the cost allocation model for purposes of the analysis. He provided a hard copy of the 2002 model and, on request, an electronic version.

We requested an opportunity to observe refuse collection and recycling operations in various parts of the City so that we could gain a better understanding of operations underlying the DSNY cost functions. Chief McKeon made arrangements for us to tour various garage, collection, transfer and recycling operations in the Bronx, Manhattan, Staten Island, and Brooklyn on December 8 and 9, 2004. In each case we were given access to the District Superintendent to discuss truck and post reporting procedures, spare truck capacity, and any other issues we thought appropriate before going out to observe collection and transfer operations.

We then turned our attention to the 2002 cost allocation model (we ignored 2003 because of the change in the program eliminating glass and plastic collection in 2003), going through the model in detail and developing a series of questions for review with DSNY.

We returned to DSNY headquarters on January 14, 2005, meeting first with Chief McKeon and Director Nati to better understand the issue of posts – which drive much of the cost allocation model, and then meeting with Barbara Rothenberg and Charles Stamm, who are responsible for maintaining and updating the cost allocation model.

In February, 2005 DSNY provided DSM with the new 2004 cost allocation model and we shifted our emphasis to 2004 because of more up-to-date information, some changes in allocation subsequent to 2002, and because glass and plastic collection had resumed by 2004.[14] We worked through the 2004 model and developed a list of questions for an April 8 meeting with

[14] Plastic recycling resumed at the beginning of FY 04 (July, 2003), while glass recycling did not begin until late in FY 04 (April, 2004).

Barbara Rothenberg and Charles Stamm. As a result of the April 8 meeting, Charles Stamm made some minor revisions to the 2004 model reflecting some of our comments and correcting small errors we had detected in the spreadsheet. We received a revised 2004 spreadsheet dated April 19, 2005 and additional snow budget allocations on May 20, 2005, which became the basis for our analysis. Over the next six months we completed our analysis of the model and prepared a draft report, which we provided to DSNY in January, 2006. On January 30, 2006, we met with DSNY and NYEDC to review DSNY's comments on our analysis Subsequently NRDC and DSNY agreed that it would be better for DSM to focus our efforts on the FY 05 allocation because FY 05 was the first full fiscal year after resumption of collection of plastic and glass City-wide.

We were provided with the FY 05 model in May, 2006 with an agreement that DSNY would work with us to make mutually agreed upon changes to the model proposed by us. We received the final version of this revised model in September, 2006, which became the basis for a draft report which was provided to DSNY for review in early April, 2007. DSM received verbal comments on the April, 2007 draft in May, which are reflected (to the extent DSM agrees with DSNY's comments) in this Final Draft report.

Overview of DSNY Cost Allocation Model

At the time that DSM began working with DSNY, the 2004 model allocated DSNY's $1.35 billion budget to three major functions: refuse collection, recycling, and cleaning. While the allocation methodology varies by function and department, typically the allocation is based on "posts" (labor) assigned to the three functions to allocate costs. This is because sanitation labor (including fringe benefits) is the largest single cost category, at roughly 40 percent of DSNY's budget, and because DSNY keeps daily records of sanitation posts used for each of the three functions in each district.[15]

The allocation methodology is relatively complex and difficult to understand, requiring 32 linked worksheets to account for, and allocate, all of DSNY's costs. Despite these constraints, it is DSM's opinion that the cost methodology used by DSNY is an acceptable *methodology* to allocate costs, given the constraints of total cost allocation discussed above. Further, during our review of both the FY 04 and FY 05 allocations we have not found any indication of a deliberate attempt by DSNY to bias the results in favor of refuse over recycling.

However, one of the key problems with the model is that it lumps all "recycling" functions (ranging from composting on Rikers Island to waste prevention programs to curbside collection) together to derive a single cost per ton for "recycling." This makes it impossible to assess and compare *curbside collection of recyclables* (the function responsible for much of the debate on the merits of recycling versus refuse) and curbside collection of refuse.[16]

In addition, as with any allocation of a budget as large and complex as DSNY's, a number of decisions have been made by DSNY on allocation of costs not directly attributable to any given function, which impact on recycling and refuse comparisons. For example, in FY 04 overtime costs and chart shift differentials add up to $107 million, with another $46 million of labor related costs which include supper pay, holiday pay and uniforms. These costs are allocated proportionally across the functional activities (based on posts) in part because the "scan" input system utilized by DSNY to record overtime and related costs isn't designed to allocate actual

[15] The record is not as clear during snow events because of agreements with the union which assign all labor to snow until less than a certain percent of labor is actually working on snow related tasks, at which time all labor is assigned back to refuse, cleaning, and recycling even though some labor may still be conducting snow related activities.

[16] A similar problem exists with refuse collection, which does not differentiate between containerized and curbside collection.

pay differentials associated with snow events, overtime and chart differentials among the different DSNY activities.

Another significant problem with the current model is that large cost items such as administration, and the associated legal and engineering functions of DSNY, are also allocated based on posts[17] instead of based on actual expenditures devoted to managing each activity. While we understand the reasoning behind these allocation assumptions, the result is that posts (or Sanitation Workers assigned to each function each day) are the largest driver in the model determining the cost per ton each year. And, since Sanitation Workers are essentially interchangeable in the tasks they perform, the accuracy of post allocations becomes critical in comparing the cost of each DSNY activity.

Finally, it is DSM's opinion that the current cost allocation model essentially ignores the fully allocated cost of snow and ice removal, which negatively impacts on recycling, refuse, and cleaning cost allocations.

Each of these issues is discussed in detail below.

DSM's Proposed Revisions to the DSNY Model

During the course of our review we identified three important allocation issues which we believed required revision to more fairly allocate costs between recycling and refuse. We also identified areas where we believed the allocation could be revised in minor ways to more fairly allocate costs among the various functions. With the changes proposed by DSM (see below), we believe that curbside recycling and curbside refuse bear the cost allocation burden more proportionately than in the original model.

The primary revisions that we requested were:

- The addition of *Snow and Ice Removal* as a primary function
- The separation of *Curbside Recycling* from other recycling and waste reduction activities
- The addition of *Recycling Revenues* to curbside recycling collection costs

The Addition of Snow and Ice Removal as a Primary Function

As stated above, DSNY is responsible for snow and ice removal for the City. This responsibility is extremely important to the economy of the City, given (probably) millions in lost economic activity for each day that the City is shut down due to a major snow or ice event. If DSNY did not remove snow and ice with its refuse and recycling collection fleet and Sanitation Workers the City would either have a separate snow removal agency and/or would contract with private vendors to provide the service. In either case, costs for garage space, truck operation, maintenance and depreciation, and administrative overhead would all be attributable to snow and ice removal.

Prior to DSM's review of the cost allocation model DSNY only accounted for snow removal labor during a snow emergency, and supplies (e.g., salt and sand). This cost was deducted from DSNY's total costs based on a rolling five year average of previous year's costs for snow and ice removal.

We feel strongly, and have argued so with DSNY that snow and ice removal is an essential function of DSNY and must be treated in *the same manner* as refuse, recycling and cleaning.

[17] DSNY uses the term "headcount" in this case, but we believe that headcount is still based on posts of sanitation workers.

DSNY agreed to modify the FY 05 allocation to include snow and ice removal as a function, using posts assigned to snow during snow emergencies to allocate costs. While DSNY has come a long way in incorporating snow and ice removal as a separate function in the revised FY 05 allocation, which DSM has used for this analysis, it is DSM's opinion that DSNY has not yet fully integrated snow removal as an equal function to refuse, recycling and cleaning, and we have made additional adjustments to attempt to do so.

Separation of Curbside Collection of Recyclables from All Other Recycling and Waste Prevention Activities

The 2002 decision to eliminate curbside collection of glass and plastic was the catalyst for many of the subsequent attempts to evaluate the DSNY allocation model. As such we have viewed our task throughout the last several years as breaking out and fairly accounting for the costs of *curbside recycling* when compared to *curbside collection of refuse*. As such, we have worked with DSNY, as discussed below, to break out curbside recyclables collection from non-curbside recycling activities, which we believe should be separately accounted for, and to compare that with curbside collection of refuse.

We recognize, based on data provided to us by DSNY that roughly 15 percent of households in New York City are not curbside collection households. These households are served through dumpsters collected with front loading trucks, or roll on/roll off containers and hoist trucks. This is typically a more efficient and low cost way to collect refuse, and *can be* a low cost way to collect recyclables as well. It is also an area that DSNY has recently targeted for productivity gains by going to one person trucks.

However, because usage of these community dumpsters is anonymous, it is typical to have high refuse contamination in the recycling dumpsters. As such, many of these housing complexes no longer receive recycling collection because DSNY has been unable to control contamination rates in the recycling dumpsters.[18] The net result is that inclusion of these households in the total cost allocation model, lumped with curbside households, is to reduce per ton refuse collection costs, but (because of the lack of recycling tonnage) increase the per ton recycling collection cost.

As proposed by DSNY at our January 2006 meeting to review the first draft report, the September 2006 version of the FY 05 allocation model separates curbside collection of refuse and recyclables from non-curbside collection activities. We believe that this is an important refinement of the model.

We also recognize that in the case of Freon removal, an argument can be made either way as to where to place this activity. This is because refrigerators and air conditioners are collected as part of the MGP curbside collection program, and those refrigerators and air conditioners could not be collected for recycling without Freon removal. However, Freon removal is mandated by federal law *no matter how* refrigerators and air conditioners are collected to protect the ozone layer. It is, therefore, our opinion that Freon removal, just like other HHW and special waste programs should be treated as a non-curbside recycling and waste prevention activity, and the costs should not be assigned to either curbside refuse or curbside recycling activities.

As stated above, one of the benefits of activity based cost accounting is that relatively small activities (e.g., Freon removal in this case) could be separately accounted for, as opposed to lumped into larger categories as DSNY's total cost allocation model currently does. In fact, as the discussion above illustrates, part of the reason that we continue to point out in our analysis that per ton costs that are within 10 or 15 percent of each other are, for all intents and purposes, equivalent, is that these type of judgment calls are typical of cost allocation models.

[18] According to Chief McKeon during meetings with DSM.

Recycling Revenues

It is essential that recycling revenues be allocated to the curbside recycling activity because this is one of the primary (and potentially growing) benefits of separately collecting this material. In FY 05 recycling revenues from paper recycling were roughly $6.6 million.[19] As discussed below, we believe that demand for secondary materials will continue to increase over time, making paper (and potentially plastic) more valuable looking forward.

FY 05 Model

Table 1 summarizes DSNY's FY 05 model results as provided by DSNY to DSM on September 18, 2006, rounding all numbers. This version represents changes agreed to between DSM and DSNY, with the changes undertaken by DSNY. It should be noted that in all subsequent tables, numbers may not add due to rounding.

Table 1
Summary of Total Costs and Costs by Function for FY 2005 As Stated by DSNY

		Main DSNY Functions				
DSNY Functions (1)	Total	Refuse	Recycling	Cleaning	Snow	Lot Cleaning
Administration	$32,862,000	$10,375,000	$5,534,000	$2,419,000	$1,489,000	$444,000
Enforcement	15,521,000	0	3,333,000	11,685,000	504,000	0
Admin OTPS	25,581,000	13,606,000	6,381,000	2,922,000	2,072,000	601,000
BWPRR / SWM	29,018,000	0	29,018,000	0	0	0
Building Mgmt & Motor Equipment	93,021,000	41,639,000	13,931,000	24,632,000	9,800,000	3,019,000
CI & Coll Operations	632,864,000	391,677,000	137,985,000	86,706,000	2,232,000	14,266,000
Field Support	80,920,000	51,122,000	18,817,000	10,980,000	0	0
Long Term Export/ Waste Disposal	376,018,000	357,692,000	15,000	18,072,000	0	240,000
Snow	66,145,000	0	0	0	66,145,000	0
	$1,351,950,000	$866,111,000	$215,014,000	$157,416,000	$82,242,000	$18,570,000
Tons Managed (2)		3,300,222	702,337	159,543	N/A	14,439
Cost / Ton		**$262**	**$306**	**$987**		**$1,286**

(1) Excluded Paid/Free Disposal which totals 12.3 million

(2) Excluding Lot Cleaning

(3) May not add due to rounding

Based on our analysis of the September 18, 2006 model supporting Table 1, we believe that there are still three areas where adjustments to DSNY's cost allocation methodology are warranted. These are:

- Removal of additional non-curbside related recycling costs (Step 1)
- Allocation of debt service to snow and ice removal (Step 2)
- Addition of revenues from the sale of recycled materials (Step 3)

[19] Includes reimbursements in barge and relay fees by Visy Paper.

Step 1: Separate out All Non-curbside Recycling and Refuse Costs

In the first draft of this report, DSM advocated separating out all non-curbside related recycling costs. DSNY agreed, but under the condition that non-curbside related refuse costs also be separated from curbside refuse collection costs.

Therefore, the September 2006 version of the model received from DSNY allocated costs to:

- Curbside refuse;
- Other refuse management;
- Curbside recycling; and,
- Other recycling.

These are shown in Table 2 below. The goal was to separate out the costs of all activities that are not part of (or required when) collecting recycling or refuse at the curb.

Table 2
Costs for Refuse and Recycling after Removing Non-Curbside Related Activities

DSNY Functions	Curbside Refuse	Other Refuse Management	Curbside Recycling	Other Recycling
Administration	$9,576,000	$799,000	$4,410,000	$1,124,000
Enforcement	0	0	3,333,000	0
Admin OTPS	12,601,000	1,005,000	5,883,000	498,000
Long Term Export / BWPRR / SWM	0	0	26,687,000	2,332,000
Building Mgmt & Motor Equipment	31,824,000	9,815,000	11,167,000	2,764,000
Cl & Coll Operations	362,830,000	28,847,000	123,746,000	14,239,000
Field Support	47,347,000	3,776,000	17,364,000	1,453,000
Waste Disposal	314,868,000	42,824,000	0	15,000
Snow	0	0	0	0
	$779,046,000	$87,066,000	$192,590,000	$22,425,000
Tons Managed	2,894,455	390,412	629,796	72,541
Cost / Ton	**$269**	**$223**	**$306**	**$309**

We have taken the separation one step further by moving Bureau of Waste Prevention, Reuse and Recycling (BWPRR) non-curbside recycling costs to Other Recycling. Tables 3A and 3B illustrate the DSNY (Table 3A) and DSM (Table 3B) allocation impact, based on DSM's assumptions about reasonable allocations of the Bureau's costs.

Table 3A
DSNY Allocation of BWPRR Expenses to Curbside Recycling

Processing	BWPRR Total	Curbside Recycling	Other Recycling
Metal, Glass, & Plastic Processing Fees	$12,683,000	$12,683,000	$0
Public Education	5,041,739	5,041,739	0
Waste Composition Study	3,200,000	3,200,000	0
Waste Prevention	1,164,000	1,164,000	0
Composting	1,700,000	0	1,700,000
Administration and Misc.	538,475	269,238	269,237
Total	$24,327,214	$22,357,977	$1,969,237

Table 3B
Proposed DSM Allocation of BWPRR Expenses to Curbside Recycling

Processing	BWPRR Total	Curbside Recycling	Other Recycling	Curbside Refuse	Other Refuse
Metal, Glass, & Plastic Processing Fees	$12,683,000	$12,631,919	$51,081	$0	$0
Public Education	5,041,739	3,781,304	1,260,435	0	0
Waste Composition Study	3,200,000	1,434,744	165,256	1,409,837	190,163
Waste Prevention	1,164,000	0	1,164,000	0	0
Composting	1,700,000	0	1,700,000	0	0
Administration and Misc.	538,475	269,238	269,237	0	0
Total	$24,327,214	$18,117,205	$4,610,009	$1,409,837	$190,163
Prior Totals, From Table 2		*$192,590,000*	*$22,425,000*	*$779,046,000*	*$87,066,000*
Recalculated Totals (Table -4B + 4A)		$188,349,228	$25,065,772	$780,455,837	$87,256,163
Tons Managed		629,796	72,541	2,894,455	390,412
Cost / Ton		**$299**	**$346**	**$270**	**$223**

The resulting impact is a per ton cost of $299 for curbside recycling and $270 for curbside refuse.

Step 2: Assign Indirect and Other DSNY Costs to Snow and Ice Removal

The greatest impact on per ton refuse and recycling costs is the cost of snow and ice removal. As stated above, DSNY's original cost allocation model carved out a relatively small "snow budget." This snow budget was derived from a running average of the direct costs of snow and ice removal over the past 3 – 5 years. These direct costs included:

- Sanitation worker overtime incurred during a "snow emergency" when some, or all Sanitation Workers (depending on the predicted severity of the storm), are placed on 12 hour shifts and paid time and one-half over eight hours.

- Plow and sand/salt spreader preparation time spent in the fall.
- The cost of salt and sand.

Working with DSM, DSNY agreed to more accurately allocate labor costs related to snow and ice removal and assign them to the snow category. Snow posts were estimated by DSNY by looking at actual snow overtime payroll reports and recalculating a post count from total hours devoted to snow. From this, other costs, such as administrative overhead, could be allocated to snow and ice removal because, as discussed above, most of the allocations in the model are based on the post count.

DSNY's September 2006 version of the model resulted in a snow and ice removal cost of roughly $82.25 million dollars. This represents 6 percent of DSNY's total budget. This compares to snow and ice removal of 15 to 25 percent of the City of Columbus and Boston's refuse and recycling budgets, respectively.[20]

It remains DSM's opinion that snow and ice removal is an essential function of DSNY and should bear the same total cost allocation burdens as refuse, cleaning and recycling, using the same *exact* cost allocation methodology. Therefore, we have gone through the 17 functional areas of DSNY's FY 05 budget and tried to identify other costs that should be allocated to snow and ice removal. The area that we have identified as having the greatest impact is *debt service on collection vehicles and on garages.*

The impact of assigning a portion of the debt service associated with collection vehicles and garages to the snow and ice removal function is shown below. It not only increases snow costs but also reduces some of the debt service costs allocated to refuse and to recycling.[21]

Further, we believe that debt service costs should be allocated based on truck shifts and not posts, since truck shifts more accurately reflect the portion of time that the truck would be in use either for snow and ice removal or for collecting and relaying refuse or recyclables.[22] DSNY's and DSM's debt service allocations are shown below in Tables 4A and 4B.

Table 4A
Current DSNY Allocation of Debt Service to BCC Activities

Current Allocations	BCC General (Mainly Garages)	Collection Vehicles	Street Cleaning	Self Help	Total
Curbside Refuse Collection	$20,405,606	$31,854,375	$0	$0	$52,259,980
Other Refuse Collection	1,627,347	2,540,387	0	0	4,167,734
Cleaning	4,732,262	0	1,039,473	0	5,771,734
Curbside Recycling	7,483,569	11,682,301	0	159,221	19,325,091
Other Recycling	626,347	977,765	0	13,326	1,617,438
Support	4,299,804	0	0	0	4,299,804
Total FY 05 Debt Service	**$39,174,935**	**$47,054,827**	**$1,039,473**	**$172,548**	**$87,441,783**

[20] This is at best a rough estimation because it is difficult to assure that the reported budgets for Columbus and Boston include the same administrative costs incurred by DSNY.
[21] DSNY has argued that they would spec their refuse and recycling trucks exactly the same with or without snow and ice removal, and would purchase the same number of vehicles. While we don't disagree with this, the point remains that these trucks are used for snow and ice removal, and if they weren't some other department or private vendor would be allocating these costs to snow and ice removal.
[22] The use of posts assumes that there are two Sanitation Workers on the truck. This is not the case during relays and may not be the case during plowing and sanding.

Table 4B
Proposed DSM Allocation of DSNY Activities to BCC Activities

Proposed Allocations	BCC General (Mainly Garages)	Collection Vehicles	Street Cleaning	Self Help	Total
Curbside Refuse Collection	$19,313,243	$25,576,922	$0	$0	$44,890,165
Other Refuse Collection	1,527,822	2,303,174	0	0	3,830,997
Cleaning	4,465,943	3,469,294	1,039,473	0	8,974,709
Curbside Recycling	7,090,663	8,965,663	0	0	16,056,326
Other Recycling	587,624	339,019	0	172,548	1,099,191
Support	4,074,193	0	0	0	4,074,193
Snow	2,115,447	6,400,755	0	0	8,516,201
Total	**$39,174,935**	**$47,054,827**	**$1,039,473**	**$172,548**	**$87,441,783**

The impact of assigning part of the debt service costs to snow and ice removal (Table 4C) is more significant to the per ton cost of recycling than refuse because the reduction in costs are spread over fewer tons. The resulting per ton costs for curbside refuse and curbside recycling would be approximately $267 and $294, respectively after taking this step.

Table 4C
Impact of New Allocations on Cost Per Ton

	Curbside Refuse	Other Refuse Management	Curbside Recycling	Other Recycling
Prior Totals	$780,455,837	$87,256,163	$188,349,228	$25,065,772
Difference from Debt Service	*(7,369,815)*	*(336,738)*	*(3,268,765)*	*(518,248)*
New Totals	$773,086,022	$86,919,425	$185,080,463	$24,547,524
Tons Managed	2,894,455	390,412	629,796	72,541
Cost / Ton	**$267**	**$223**	**$294**	**$338**

Other areas that DSM believes warrant future investigation by DSNY as to whether they should be assigned to the snow and ice removal costs/budget include:

- The cost of field support (none of this cost is currently allocated to snow);
- Additional administrative costs (of which 5.9% of PS cost and no OTPS costs except for fuel costs and no debt service are allocated to snow);
- The costs of "Building Management" which currently has none of the costs allocated to snow and ice removal activities; and,
- The costs of "Motor Equipment" which currently has none of the OTPS or the PS costs allocated to snow and ice removal activities.

Step 3: Assign Recycling Revenues to Recycling Costs

The current DSNY model does not allocate revenues from the sale of recyclable materials to recycling. The impact of subtracting the roughly $6.6 million dollars in FY 05 revenues from the cost of recycling in FY 05 reduces the cost of recycling by about $11 per ton to roughly $284 per ton.

Table 5
Impact of Including Paper Revenues in Per Ton Costs

	Curbside Recycling	Other Recycling
Prior Totals (After Step 2)	$185,080,463	$24,547,524
Minus Paper Revenues		
Paper Tons	*383,495*	*32,974*
Revenues allocated	-$6,127,665	-$526,868
New Total:	$178,952,798	$24,020,656
Tons Managed	629,796	72,541
Cost / Ton	**$284**	**$331**

Enforcement

The other area that DSM believes may not be fairly allocated is enforcement costs. The current model does not allocate any enforcement costs to refuse, which seems unreasonable. We believe that some of the costs of enforcement should fall on refuse as well as recycling and cleaning. DSNY worked with DSM to try to determine a better allocation but this work is not yet completed.

Result of Changes in Allocation

The net impact of changes in allocation completed by DSM for FY 05 are that per ton curbside refuse collection and disposal costs are estimated to be $267 per ton, and per ton curbside recycling costs $284 per ton. This contrasts with DSNY's September 2006 allocation of $262/ton for refuse and $306/ton. The net result of all of the changes to the model for FY 05 is that curbside recycling was, on average across the City, roughly six percent more expensive than curbside refuse collection and disposal in FY 05. The word "roughly" is used here because the actual difference in costs could be less than or greater than six percent, especially given the many assumptions about allocating large shared costs, and the uncertainties associated with the assignment of sanitation worker overtime when they are "off chart."

Table 6
Final Cost Per Ton Comparison

Model Totals	Curbside Refuse	Other Refuse Management	Curbside Recycling	Other Recycling
FY 05 Model	$779,046,000	$87,066,000	$192,590,000	$22,425,000
Step 1: Reallocate Some BWPRR Expenses	780,455,837	87,256,163	188,349,228	25,065,772
Step 2: Allocate BCC Debt Service	773,086,022	86,919,424	185,080,462	24,547,524
Step 3: Add in Paper Revenues	773,086,022	86,919,425	178,952,798	24,020,656
Tons	2,894,455	390,412	629,796	72,541
Cost / Ton	**$267**	**$223**	**$284**	**$331**

Why were average per ton curbside recycling costs greater than per ton refuse collection and disposal costs in FY 05?

The primary reason for higher per ton costs for curbside recycling is simply that recycling collection crews collect less tons in a shift than refuse crews. Because labor costs are such a large component of DSNY's overall budget (and allocation surrogate), the lower productivity targets for recycling collection (defined as tons per truck shift) results in higher per ton collection costs.[23]

The impact of direct collection labor costs and of overtime and "other" labor costs on per ton costs are shown below in Tables 8A and 8B below. As illustrated by Table 8, each ton of curbside recyclables collected incurs almost double the labor and fringe cost of a ton of refuse under this total cost allocation model. It is primarily because of the high cost of export of refuse, when compared to the net processing cost of recyclables (after deducting revenues for paper) that curbside recycling does as well as it does in many areas of New York City.

Table 8A
Impact of FY 05 Collection "San" Labor Costs (including benefits)
On Per Ton Costs

	Labor Costs (PS and Fringe)	Tons Collected	Cost / Ton
Curbside Refuse	$286,155,843	2,894,455 tons	**$99**
Curbside Recycling	$95,460,045	629,796 tons	**$152**

[23] DSM is not suggesting that DSNY's productivity targets are wrong, but rather that the lower amount of tonnage of recyclables (in comparison to refuse) now being set out per stop results in lower productivity targets. See further discussion on page 23 below.

Table 8B
Impact of Overtime (OT), Fringe and Related "Other Costs on Per Ton Costs (FY 05)

	OT and "Other" PS and Fringe	Tons Collected	**Cost / Ton**
Curbside Refuse	$37,934,266	2,894,455 tons	**$13**
Curbside Recycling	$13,912,045	629,796 tons	**$22**

Paper versus MGP Recycling

The Independent Budget Office stated in their February 2004 analysis of DSNY's 2002 cost allocation that curbside collection of paper was, on average, less costly than curbside collection and disposal of refuse.[24] Our analysis of the FY 05 total cost allocation comes to the same conclusion. When paper revenues are included, the city-wide average cost of curbside collection of paper is roughly ten percent less per ton than the city-wide average cost of curbside collection of refuse.

It should be noted, however, that the City-wide average masks significant variations on a district-by-district basis. Based purely on district-by-district recycling collection productivity data provided to DSM by DSNY, we believe that there are districts within the City where curbside collection of MGP is more cost effective than either curbside paper or curbside refuse collection. There are other districts where neither curbside paper or curbside MGP are currently cost effective compared to curbside refuse.

DSNY has not provided DSM with district-by-district refuse export costs with which to perform this detailed district-by-district comparison, and it is beyond the scope of this analysis. However, the results would be useful in targeting future recycling programs and could be compiled by DSNY using the cost allocation model, district-by-district refuse export data, and district-by-district productivity data.

[24] Independent Budget Office, *Fiscal Brief, Refuse and Recycling: Comparing the Costs*, February 2004, p. 5.

SECTION V. LOOKING FORWARD

Our analysis has been divided into two parts. First, we have estimated the impact of proposed changes to the cost allocation model assumptions for FY 05 -- the most recent year for which the cost allocation model had been calculated by DSNY as of the time of DSM's analysis. Then, we have used the FY 05 cost allocation model to examine what might happen to costs looking forward given the cost allocation assumptions used in the FY 05 model.

Here it is important to note that a cost allocation model is *not* a forecasting model. While it can provide a rough guide to what might happen if certain changes occur, it is not designed to project costs into the future. In fact, it is more accurate to say that changes can be made to costs and tonnage in the FY 05 cost allocation model to assess what would have happened in FY 05, and that these impacts can be used to judge what is likely to happen in the future if these changes actually occur.

The reason the cost allocation model cannot be used as a forecasting tool is that the model is static. It is based on a specific set of actual circumstances and costs that occurred in FY 05. Changes to the base model will occur in each succeeding year that will change the relative allocation among the three functions. Some of these may be favorable to recycling and some may not.

However, in the longer run there are many factors that point to average per ton recycling costs falling below refuse costs. These include the following:

- Export costs
- The impact of changes in waste composition on collection productivity over time
- Processing and marketing costs for recycling
- Relay costs

Each of these are discussed below.

Export Costs

The greatest uncertainty looking forward is most likely export costs for refuse.[25] While DSNY has received long-term bids for export of refuse which DSNY estimates will average $107 per ton in 2009 and $124 per ton in 2014,[26] not all of the long term contracts have been signed.[27] Negotiations of key points may have significant impacts on costs over time. In addition, circumstances beyond the control of either DSNY or the large waste management companies bidding on export may also have a significant impact on future costs. In almost every case, these impacts will be felt as higher, not lower future export costs. In fact, the *New York Times* reported that export costs could go as high as $160/ton.[28]

To demonstrate the significance of these numbers, if one simply substitutes export costs at $124 for current export costs in the FY 05 model, costs for curbside recycling of both paper and MGP

[25] It should be noted that the majority of recyclables are also exported. According to Robert Lange (December 1, 2006), roughly 50% of the paper, and the majority of plastic and metal are currently sold for export. However, DSNY does not pay this export cost, instead it is reflected in net materials prices received by DSNY.
[26] Venetia Lannon, May 18, 2007 based on recent presentations by DSNY to the City Council.
[27] The Staten Island and Bronx long-term export contracts have been signed and the Brooklyn rail-based export contract should be signed shortly.
[28] Ian Urbina, "Higher Costs Could Upset Trash Plan Mayor Favors," *The New York Times*, March 25, 2005.

would essentially be equal to the cost of curbside collection of refuse ($285/ton for refuse compared to $284/ton for recycling). At $160/ ton, curbside refuse collection and export would be roughly 13 percent higher than curbside collection of recyclables.

Changes in Collection Productivity

One of the primary reasons why it has been historically difficult for curbside collection of recyclables to compete with curbside collection of refuse on a cost per ton basis is that the productivity goals for recycling are significantly lower than for refuse. The City-wide target (FY 05) for recycling was 3 tons and 2.6 tons for paper and MGP, respectively, for the dual bin truck routes (or 5.6 tons per truck) and 6.8 and 7.2 tons for paper and MGP, respectively for the single compartment trucks. This compares with a City-wide average for refuse of 10.6 tons. These lower targets for recycling are a combination of the lighter weight nature of recyclables with lower set-outs of recyclables.

Because two Sanitation Workers are on each truck, whether it be refuse or recycling, the difference in productivity targets means that each ton of recyclables collected uses between 45 and 89 percent more labor than a ton of refuse (depending on the type of truck used for recyclables collection).

This difference in labor drives the majority of the cost allocations in DSNY's total cost allocation model. As a result, recycling must "make up" all of this difference in collection costs in the difference between recycling processing costs/revenues and refuse export costs.

Looking forward, the potential exists for recycling to become significantly less costly. This is because DSNY's Waste Characterization Study demonstrates that 22 percent of the material collected as refuse is designated recyclables.[29] This means that increased education and enforcement, combined with increased maturity of the recycling program could result in additional recyclables set out for recycling instead of as refuse.[30]

This is good news for recycling because the majority of recycling trucks are not packed out at the end of the truck shift. That is, the trucks have the capacity to hold more recyclables than are being collected during the truck shift.[31] Instead, the trucks are time limited. This means that if additional material is set out for recycling – either at each stop, or at stops that previously did not set out recycling -- costs for collection will not increase appreciably in most districts while the tonnage will increase.

Processing Revenues and Costs

As discussed above, it is important to note that the proposed Sims Hugo Neu contract is not necessarily going to reduce recycling costs compared to refuse in the short run. A long term contract with Sims Hugo Neu has not been signed, although is apparently close to being

[29] CITE

[30] Plastic and glass were eliminated from recycling in FY 03 and restored in FY 04. There is no better way to discourage participation and capture rates than to make these types of significant changes in a curbside recycling system.

[31] According to Barbara Rothenberg and Chief McKeon (September 30, 2005) DSNY compaction tests performed at the time trucks are purchased indicate that single compartment rear loading trucks are capable of holding up to 11 – 12 tons of paper or 8.5 – 9.5 tons of MGP, and dual compartment trucks are capable of holding 5.5 tons of paper and 3.5 – 4 tons of MGP. Clearly these weights are maximums performed at the time the truck was new, and under controlled conditions. However, current targets in many districts are so far below these maximum weights that even adjusting for the age of the truck and conditions on the street still provide for additional capacity.

completed. Processing costs of roughly $52 to $57 per ton are expected under this long-term (20 year) contract between DSNY and Sims Hugo Neu.

Per ton processing costs in the mid-$50's for MGP would be considered relatively high compared to rates of $25 to $35 per ton for MGP typically being offered by dual stream material recovery facilities in the eastern United States.[32] We recognize, however, based on our observations, the Waste Characterization study, and discussions with Waste Management officials who have been responsible for processing some of the MGP delivered from Sims Hugo Neu facilities, that high residue rates and compacted broken glass mixed with plastic film, makes New York City's MGP more costly to process. This is in part because DSNY collects appliances with MGP, and because MGP is set out in blue plastic bags which become a contaminant during processing. (It is also worth noting that New York City's refuse/export costs are high in comparison to other jurisdictions in the East, and indeed, in comparison to the rest of the country.)

In the long run, the fact that paper and MGP processing prices will be locked in – with the potential for revenue sharing – while refuse export costs face significant upside uncertainties, will tend to drive recycling costs down relative to refuse costs.

This is especially the case because factors such as increasing fuel costs which would increase export costs will act to increase the value of secondary materials. That is, as petroleum prices increase, the value of post consumer plastic will increase. And if the Chinese and Indian economies continue to grow – along with other developing countries such as Vietnam – there will be continued export demand for plastic, metals and paper, all of which are in short supply in many of these same rapidly growing countries. For this reason, it is DSM's opinion that future prices for recyclables, while continuing to fluctuate as commodities, will trend higher than historical averages.

Relays

There has been a great deal of discussion concerning the use of relays for refuse and recycling and whether the relay data reported by DSNY are correct, and if not, what impact would changes to relays have on per ton recycling and refuse costs.

Based on our observations of DSNY's operations, discussions with district superintendents, and Chief McKeon, it is DSM's opinion that the relay data used in the cost allocation model are relatively accurate. This is because many of the recycling trucks must be relayed to either the Visy plant (for paper) on Staten Island, or to New Jersey (for MGP). And, this problem will get worse for recycling until the contract with Sims Hugo Neu is completed, and the resulting long-term facilities are constructed for receiving recyclables in the various boroughs, including a large central plant in Sunset Park on the Brooklyn waterfront. In any case, as illustrated by Table 9 below, relay costs, while significant, are not great enough to significantly impact on the relative cost of recycling and refuse.

[32] See for example prices for MGP delivered to the FCR MRF in Chelsea, Massachusetts serving the Boston metropolitan area or the costs and revenue sharing agreements for the new 20 year contract for the Springfield, Massachusetts MRF owned by MassDEP and privately operated.

Table 9
Estimated Impact of FY 04 Collection Labor Relay Costs (including benefits) on Per Ton Costs

Service	% of Collection Posts Spent on Relays	Estimated Labor Cost of Relays	Estimated Relay Labor Cost / Ton
Recycling Collection	2.2%	$1,880,000	**$3**
Refuse Collection	7.5%	$23,770,000	**$7**

More importantly, once the proposed new Sims Hugo Neu facilities have been constructed, relay costs for recycling should drop because more trucks should be able to haul recyclables direct to Sims Hugo Neu facilities located in each borough.

Conclusions Looking Forward

As discussed throughout this analysis, there are significant uncertainties looking forward with respect to both refuse and recycling. However, the general conclusion has to be that the factors affecting future costs point toward increasing refuse export costs and stable or falling recycling collection and processing costs. For this reason, the conclusion must be that curbside collection of recyclables will play an increasingly important role in stabilizing DSNY's long-term solid waste management costs.

Based on our analysis of FY 05 cost allocation, the difference in per ton costs between curbside recycling collection and processing and refuse collection and export are relatively insignificant today given the large amounts of indirect costs that must be broadly allocated to refuse, cleaning and recycling in the total cost allocation model.

Nevertheless, accepting these uncertainties in the model, over the next several years – while export costs remain relatively stable under the existing interim export contracts, and new in-borough dumping capacity for recyclables remains limited – it is likely that average per ton, city-wide curbside recycling costs will remain higher than average curbside refuse collection and export costs.

However, once the ability to unload recycling on-shift, as opposed to through relay, becomes available for many of the districts that currently must relay recyclables, and the new, and potentially higher refuse export contracts begin, the spread between recycling and refuse will fall. As illustrated above, export costs of $124/ton or greater would have made average curbside collection of paper and MGP less costly than curbside refuse collection in FY 05.

For these reasons, it is our general conclusion that recycling will begin to *reduce* overall system costs for DSNY within the near future – at least within the next five to six fiscal years – and will act as a significant buffer against the uncertainties of future refuse export costs.

APPENDIX A: ENVIRONMENTAL IMPACTS

While DSM's analysis focused on an economic comparison of curbside recycling and refuse, no report comparing the two functions could be considered complete without at least addressing the underlying environmental impacts of recycling and refuse collection and disposal in New York City.

Much has been written about the savings in natural resources associated with producing paper from recycled paper as opposed to trees, aluminum from recycled aluminum cans rather than bauxite, or plastic from recycled plastic rather than from petroleum or natural gas.

Most importantly, it is becoming increasingly clear that our economic system does not fully account for the environmental impacts of our lifestyles. For example, it has been argued that the real cost of a gallon of gasoline would be roughly $10 to $12 per gallon, if all the environmental impacts of drilling, transport, refining, further transport, storage and dispensing were included, along with the military cost of defending our petroleum supplies.[33]

Global warming is the latest, and perhaps the most important example of understating the economic impacts we will face from our current activities. Given the potential impact on New York City associated with global warming, and the commitment the City is making to environmental sustainability, it is instructive to look, in very rough terms, at the impact of recycling and refuse export on greenhouse gas emissions.[34]

DSNY's solid waste management activities can substantially help the City reach their recently stated goal of 30 percent reduction of greenhouse gas emissions by the year 2030.[35] This is because "net emissions from recycling (and composting) is a negative number due to the offset of lower energy requirements in using recycled vs. virgin raw materials and the added benefit from diversion of waste from landfills that would produce methane and other greenhouse gases." Nationally, for example, recycling and composting are estimated to avoid about 8 million metric tons of carbon dioxide equivalent.[36]

US EPA's Waste Reduction Model (WARM model) was developed to help organizations or regions track and voluntarily report greenhouse gas emissions reductions from different waste management practices. The WARM model can be used to predict potential reductions in carbon emissions associated with recycling a ton of recyclable material as compared to landfilling. This model is at best a rough approximation because it must average a wide range of different recycling, disposal and transport activities. For example, there are clearly much larger savings in carbon emissions associated with using waste paper locally (e.g., at the Visy plant) than

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[33] Testimony of Milton R. Copulos (President, National Defense Council Foundation) before the Senate Foreign Relations Committee, March 30, 2005.

[34] Cynthia Rosenzweig and Vivien Gornitz, scientists at NASA's Goddard Institute for Space Studies (GISS) and Columbia University using the GISS Atmosphere-Ocean Model global climate model for the Intergovernmental Panel on Climate Change project sea levels to rise 15 to 19 inches by the 2050s around New York City. They report that with sea levels rises, not only does New York City's transportation system risk a complete shutdown but many neighborhoods risk extreme flooding. And with increased sea levels, greater storm surges are predicted. For example, with as little as 18 inches of sea level rise, and added to "the surge for a category 3 hurricane on a worst-case track would cause extensive flooding in many parts of the city. Areas potentially under water include the Rockaways, Coney Island, much of southern Brooklyn and Queens, portions of Long Island City, Astoria, Flushing Meadows-Corona Park, Queens, lower Manhattan, and eastern Staten Island from Great Kills Harbor north to the Verrazano Bridge." (Source: Goddard institute of Space Studies, New York. *NASA Looks at Sea Level Rise, Hurricane Risks to New York City*, Oct. 24, 2006.)

[35] PLANYC 2030, p. 13. See also http://www.nyc.gov/html/planyc2030/downloads/pdf/planyc_brochure.pdf

[36] NSWMA. Municipal Solid Waste Industry Reduces Greenhouse Gases Through Technical Innovation and Operational Improvements. Washington D.C. 2006.

transporting that waste paper to China for recycling. In addition methane releases from landfills has a global warming potential roughly 23 times than that of carbon emissions.[37]

Similarly, there are substantially different impacts associated with collection, transport and disposal of refuse depending on:

- How efficiently it is collected;
- Transport distance and mode (e.g., truck, train, barge);
- Whether refuse is burned with energy recovery or simply landfilled; and,
- Whether the landfill has methane (a relatively potent green house gas) recovery.

Given these limitations, rough, order of magnitude greenhouse gas savings/emissions can be estimated for the current system of curbside refuse and recycling collection, transport and disposal.

For purposes of this estimate we used the WARM model and made the following assumptions:

- Data entered into the WARM model were limited to the estimated tons of materials recycled in FY 05 using the total tonnage reported for paper and for MGP and applying the relative percent composition of the recyclables from the DSNY waste composition study (using the Fall Sort as a rough approximation);
- The alternative of landfilling 80% and incineration of the other 20% of this material was compared to the alternative of recycling 100% of this material;
- The Warm Model accounts for the national mix of landfill gas recovery and this was used as the default for our calculations; and
- The average distance to landfills was defaulted to 400 miles and the distance for recyclables was averaged at 4000 (to account for a mix of export to China and local use) miles, even though the Warm Model asks for distances to materials recovery facilities.

Given these simplifying assumptions, carbon emission savings from recycling have been calculated using the Warm Model and are illustrated in Table 8. Not surprisingly, given the large quantities of recyclables collected in a city the size of New York City, estimated carbon emission reductions from DSNY's recycling program are dramatic, at over 500,000 MTCE per year.

Note that the numbers in the far column for green house gas emissions are expressed in negative numbers to illustrate reductions in greenhouse gas emissions.

[37] According to the *Inventory of New York City Greenhouse Gas Emissions*, April 2007, p.26, New York City's solid waste disposal system is assumed to reduce carbon emissions assuming: (a) 75% recovery of methane at landfills receiving City waste; and, (b) the sequestration of carbon associated with landfilling of relatively inert carbon sources such as plastic and rubber. But even if these assumptions are accurate, this does not negate the additional positive benefits of recycling materials because the carbon reduction benefit of recycling rests primarily on the reduction in the extraction and manufacturing of materials from virgin sources.

Table 8
Estimated Carbon Emissions Savings from Curbside Recycling in New York City
(In Metric Ton Carbon Equivalent for FY 05)

	Recycling		Alternative Landfilling		Alternative Combustion		Net Total
Material	Tons	*GHG Emissions in MTCE*	Tons	*GHG Emissions in MTCE*	Tons	*GHG Emissions in MTCE*	GHG Emissions in MTCE
Aluminum Cans	4,204	(14,917)	(3,363)	(84)	(841)	(14)	(15,015)
Glass	32,688	2,505	(26,150)	(652)	(6,538)	(91)	1,763
HDPE	14,689	(3,338)	(11,751)	(293)	(2,938)	(744)	(4,375)
PET	13,329	(3,559)	(10,663)	(266)	(2,666)	(787)	(4,611)
Corrugated Cardboard	78,879	(54,908)	(63,103)	(7,808)	(15,776)	2,794	(59,921)
Newspaper	167,129	(101,765)	(133,703)	29,711	(33,426)	6,757	(65,296)
Mixed Paper, Resid.	152,689	(124,013)	(122,151)	(10,250)	(30,538)	5,405	(128,858)
Mixed Metals	182,406	(233,739)	(145,925)	(3,636)	(36,481)	10,594	(226,781)
Total	**646,013**	**(533,734)**	**(516,810)**	**6,723**	**(129,203)**	**23,915**	**(503,096)**

Parenthesis denote negative numbers

Using the coefficients in the EPA WARM model, these savings associated with DSNY's recycling activities are equivalent to taking roughly 338,000 passenger cars off the road each year, or providing electricity for 244,000 homes.[38] DSNY's costs associated with achieving these estimated savings in carbon emissions through curbside recycling can be compared against the cost of alternative means to achieve these same reductions in carbon emissions.

[38] Calculations made using the *Greenhouse Gas Equivalencies Calculator, Clean Energy, US EPA* based on data from: EPA (2007). *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005*. U.S. Environmental Protection Agency, Washington, DC, Table 3-7 (p.3-9); and, Table A-108 (p.A-126); and, *Highway Statistics 2005*. Office of Highway Policy Information, Federal Highway Administration. Table VM-1.

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