A COMPREHENSIVE SOLID WASTE MANAGEMENT PLAN FOR NEW YORK CITY

EXECUTIVE SUMMARY

TABLE OF CONTENTS

Printed on Recycled Paper

OVERVIEW

The Problem

Waste-management -- the way we collect and "dispose" of the materials that sustain everyday life after their value has been "consumed" -- is at once one of the most fundamental, and most invisible, of urban life-support systems. Every day, New York City receives and consumes tens of thousands of tons of materials extracted and transported from all over the world, and in turn, produces tens of thousands of tons of solid waste. These millions of tons every year make it the largest "materials sink" on the planet.

Virtually all of the municipal solid waste disposed of by the City of New York is piled on a 2,500-acre landfill on Staten Island. Although landfilling may seem the cheapest waste-disposal solution from a one-year-at-a-time, money-out-of-pocket perspective, such a short-sighted analysis ignores the environmental damage created by landfills and the economic and environmental benefits that alternative waste-management options could provide. Most importantly, Fresh Kills will not last forever, and when it is gone, it is inconceivable that a replacement could be sited within the City's limits.

Virtually all of the municipal solid waste generated by private businesses is hauled by private carters to landfills out of the city. Many of these landfills, if they are not filled to capacity first, may be forced by pending laws and regulations to close their gates to trucks carrying wastes from New York.

Only about one ton in twenty of the waste produced by New York's residents is being recycled. Due to inefficiencies in current collection systems, the inconsistencies of a partially implemented program, and weak demand for materials, that recycled ton costs the City about three times as much as does any other ton in the City's system. If the City is to comply with City and State objectives, this recycling rate must be increased at least five-fold.

Sewage sludge is being dropped into the ocean, a practice that by federal order must stop by July 1, 1992.

While many of the city's on-site hospital incinerators will be forced by new regulations to close at the end of 1992, more than half of the City's medical wastes is already exported to landfills and incinerators outside the city. As in the case of commercial wastes, this reliance on remote facilities leaves the City vulnerable to circumstances beyond its control. Moreover, the costs of complying with new disposal regulations have increased expenditures that were minimal in 1985 to well over a hundred million dollars in 1990.

As the U.S. Army Corps of Engineers searches for new ocean-disposal locations for the material dredged to keep New York's rivers and harbor navigable, evolving regulations are requiring more of the city's dredged wastes to be disposed of on land. The U.S. Environmental Protection Agency no longer allows shoreline and harbor debris to be burned at sea, which means that land-based facilities must be developed for this material as well.

In short, the City's waste-disposal needs and costs continue to increase, while the facilities and options available to meet them continue to decrease. This historical trend, though it has been obvious for decades, has never been adequately addressed by prior planning and facility-implementation efforts. Despite the variety of plans that have been prepared in the decades past, and the many new facilities of various types proposed, no major new facility has been developed in 30 years. The reason for this has been a widespread governmental inability to carry needed infrastructure projects through the public and regulatory approval process to completion. Two primary causes of this have been inadequacies in the planning process and a widespread perception that, because depletion costs are not reflected in the City's expense budget, landfilling at Fresh Kills has been "free."

Planning Premises

The current plan is an attempt to overcome the first of these difficulties by fundamentally re-thinking the premises on which the waste-management system is based. This approach may also represent the best hope of overcoming the second of these difficulties, the illusion that Fresh Kills is forever.

First, the materials in the various waste-streams can no longer be thought of simply as an undifferentiated mass of "tonnage" requiring disposal, but as many discrete material components from various kinds of sources, for which different types of management techniques are most appropriate. To support this analysis, the City undertook one of the most comprehensive refuse-sorting studies ever conducted -- sampling 46 material categories, over four seasons, from nine representative residential sectors, 11 institutional sectors, and ten commercial sectors. (Similarly exhaustive surveys of waste from health-care facilities were also conducted.) And waste quantities were also measured and projected more closely than ever before.

Second, the entire waste-management process, from collection through processing, marketing, and disposal, was considered as an integrated whole. Collection systems are the most critical cost elements in a waste-management system because they are so labor- and transportation-intensive. Making collection systems as efficient as possible (i.e., minimizing the number of truck shifts and truck miles) is therefore key to an economically and environmentally sound solution to the waste-management problem. Collection systems are also the critical link between optimal participation in recycling programs by waste-generators and optimal processing (recycling, composting, and waste-to-energy) facilities. The compatibility and integrity of the collection-processing system is key to the successful marketing of recycled and composted materials. A systemic waste-management plan that starts with an analysis of waste generators and collection systems is also essential if facilities are to be sized and sited in a way that bears a relationship to rational "waste-sheds."

Third, a primary goal of this plan -- consistent with the State waste management hierarchy -- is to do whatever is feasible (from logistical, environmental, and economic perspectives) to **prevent** wastes from being generated in the first place, to **re-use, recycle**, or **compost** wastes that it is not feasible to prevent, to **recover energy** from wastes that it is not feasible to re-use, recycle, or compost, and to **landfill** only those wastes that cannot be managed in any of these preferred ways. If this hierarchy is ever to really "work," new ways must be imagined and implemented to give waste-generators a more enlightened understanding of their own interests at stake in the waste-management system, and to create incentives for taking more direct responsibility for the materials they discard.

Fourth, this plan considers the potential benefits of combining the management of wastes from different sources -- municipal solid wastes, construction and demolition waste, sewage sludge, medical waste, harbor debris and dredge spoils -- that might achieve economic efficiencies and/or environmental advantages. Of particular importance in this regard, given the enormous competition for New York City's limited space and the significance of compatible land-uses in facility-siting decisions, are options for co-locating facilities.

Fifth, this plan is conceived from a long-term perspective, as a "decision-tree" in which sequential decisions will be made in a way that maximizes the probability of attaining established goals while maintaining the flexibility to respond appropriately to changing circumstances. This approach is based on a profound appreciation of the uncertainties associated with a myriad of factors -- future markets for recyclables, collective-bargaining agreements for collection workers, rates of public compliance with source-separation programs, and technology developments, to name just the most obvious ones specific to waste-materials-management forecasts; these are in addition, of course, to the even-more-obvious fundamental demographic, economic and regulatory uncertainties that affect every other kind of plan or forecast.

Sixth, this plan starts with an expansive analysis of the full universe of potentially feasible options, narrows this universe according to an evaluation of technical, environmental and economic impacts within the context of an integrated waste-management system, and proposes a narrowed set of the most feasible and desirable alternatives. Instead of developing a proposed plan first, and examining its environmental impacts second, the evaluation of a full range of environmental, social, and economic impacts was used to shape the evolution of the substantive proposals.

Seventh, the complexity and scope of this enterprise required technical and policy expertise from a wide array of disciplines and perspectives. This plan was developed by a multi-faceted team that included a dozen consulting firms with a broad range of expertise (technical, environmental, analytical), an inter-agency task force composed of representatives from 13 City agencies under the supervision of the Deputy Mayor for Planning and Development, and extensive public access and review that included the active, ongoing participation of a highly qualified body of nationally recognized environmental advocates, local civic groups, community and business representatives, and staff members of elected officials.

Eighth, the scale of the computations and system analyses involved in this sort of planning process require sophisticated data-analysis capability. A massive computer program, called "NYC WastePlan," was developed specifically for the analysis of integrated collection, processing, and disposal systems for the city's multiple waste streams.

Planning Goals

Because waste-management is an essential, continuously needed service, in which significant breakdowns and interruptions cannot be tolerated, the most fundamental planning objective has to be the **reliability** of the system. In view of the range of uncertainties, risks must be minimized, flexibility maximized.

Landfill space in this city is a finite, irreplaceable resource. With the gradual exhaustion of in-city landfill capacity, all prudent measures must be taken to **conserve this landfill** space. The use of out-of-city landfill capacity, while almost inevitably necessary at some point in the future, will be more costly to the City, and make the City vulnerable to regulatory and economic factors beyond its **control.**

The system must perform as **cost-effectively** as possible. Any evaluation of costs must include an appropriately inclusive definition of **environmental and social costs.** All of these must be minimized.

A sound plan cannot advance solutions unless it can be **implemented effectively.** For this to happen, programs and facilities must be tailored to the unique characteristics and constraints of New York City.

Planning Process

The first conceptual steps were to establish baselines for the major planning factors, and to develop projections for how these would change in the future. The most critical baselines involve the composition and generation of the various waste streams; projecting these factors into the future relied on an analysis of various demographic, economic, and industry forecasts. Another set of fundamental baselines involved an analysis of the existing waste-management system. Baseline analyses of environmental conditions, available technologies, recyclables markets, waste "export" conditions, and legal and regulatory requirements were also developed.

The next conceptual planning element was assembling a set of collection-program and facility "building blocks." That is, the range of feasible collection-system and facility alternatives was defined, and detailed data on the costs, operations and environmental characteristics of this universe of 34 "reference facilities" and 16 "collection alternatives" were assembled.

These collection and facility alternatives were then paired to create the universe of feasible system alternatives (waste-management "scenarios"), and through computer modelling, their relative costs and environmental impacts were compared. This scenario-evaluation process proceeded in an iterative, top-down way, from relatively abstract analyses of the broadest range of potentially feasible alternatives, to successively more detailed analyses of a more narrow range of the most optimal alternatives.

In the first stages of scenario analysis, 13 system scenarios, which combined six different collection systems with facility networks that involved varying proportions (and types) of recycling, composting, waste-to-energy, and landfilling, were compared to the benchmark waste-management system that existed in 1990, and to the year 2000 projections of how this system would function if current trends and practices continue unchanged. The initial 13 scenarios were designed to "bound" the universe of practical possibility, with the understanding that the most desirable scenarios were likely to be somewhere between the two extremes.

"Sensitivity" analyses tested the system-wide effects of the most significant uncertainties. Parallel environmental analyses provided an understanding of differential environmental and social impacts between scenarios.

The findings from all of these analyses were used to develop a narrower range of more-detailed system scenarios. Four such systems were examined in the final stage of scenario analysis. As was the initial universe of scenarios, these four "finalists" were designed to represent "boundary cases" that could inform future system design within the range of uncertainties associated with any enterprise on this scale. Of these four, two represent the boundaries between which the proposed implementation-sequence/decision-tree of this plan passes. The City's proposed plan for the next five years, the so-called near-term implementation plan, represents the first step in the transition between the current waste-management system and the full-scale systems represented by these alternatives.

The Proposed Plan

Prevention programs are the most cost-effective waste-management technique, but their effectiveness is also the most difficult to predict reliably. The proposed prevention programs for residential waste focus on yard wastes, consumer education programs, and support for shops and services that facilitate product re-use. Commercial and institutional programs focus on minimizing waste by more effectively tying volumes to disposal costs, a process that can be facilitated by waste-audit programs.

The core of the proposed recycling program is an expansive definition of "high quality" residential wastes. Under the system proposed in this plan, waste-generators would separate recyclables in two color-coded plastic bags or bins (one for papers and textiles, another for glass, metal, and plastic). This citywide program would be simple to communicate, to understand, and to participate in. The two waste streams would be collected efficiently by a single two-compartment compactor truck, and taken to one in a network of about six to-be-developed materials-recovery facilities for processing. These facilities would be designed to respond with maximum cost-effectiveness to changes in market demand for various materials and material grades, and to produce secondary materials for re-sale at the highest achievable specifications. Long-term large-volume market contracts would provide a competitive advantage to New York City in its effort to maintain adequate market capacity for its materials supply.

Composting facilities offer potential benefits to the City's waste-management system, but the technologies and markets are not yet secure enough in relation to New York City conditions to warrant immediate implementation of a full-scale source-separated residential organic-waste program. A pilot-scale program for source-separated kitchen wastes from institutional waste-generators will allow the City to test the effectiveness of this type of system. If its extension to the residential waste-stream is determined to be feasible, the optimal collection system is likely to be in a second two-compartment compactor truck, with ordinary, non-recyclable/non-compostable refuse collected in the other compartment.

Depending on the success of these proposed prevention, recycling, and composting programs, and the impact that export bans have upon the amount of commercial waste that is disposed of within the city, some 6,000-12,000 tons of waste per day may remain for disposal. To meet the anticipated waste-disposal-capacity need, one of the three existing municipal incinerators (the Southwest Brooklyn incinerator, with a ~~total~~ capacity of ~~2,~~750 tons-per-day) will be upgraded to conform to newly established air-pollution-control standards and retrofitted with energy-recovery equipment. (The Betts Avenue incinerator will be closed in 1995, at which time a decision will be made as to whether or not the Greenpoint incinerator should be upgraded or closed.) The proposed 3,000 ton-per-day Brooklyn Navy Yard facility will also be developed.

~~Depending on the factors cited above, some 2,000-4,000 tons of landfill capacity will be required in the year 2000, about a third of which will be ash residue from waste-to-energy facilities.~~ The Fresh Kills landfill in Staten Island will continue to be upgraded to minimize its environmental impacts and to maximize its capacity. The City will procure out-of-city ashfill capacity and attempt to develop beneficial uses for ash to handle the projected need for about 1200 tons per day of ash-disposal capacity in the year 2000. The City will also take steps to procure out-of-city (MSW) landfill capacity to meet long-term future needs, and will develop programs to monitor and test new technologies to extend landfill life.

Proposed prevention and recycling programs will reduce the medical-waste stream in half; on-site "chop-and-bleach" equipment in hospitals will process needles and other "sharps" and plastic intravenous bags (provided that the NYS Department of Health approves of the use of this technology); remaining "red-bag" medical wastes will be incinerated in upgraded on-site hospital incinerators and in a regional medical-waste incinerator, and "black-bag" medical wastes will be incinerated in an existing municipal incinerator.

Not firm

In the near-term, sewage sludge will be landfilled in out-of-state landfills, until a new network of compost, chemical-stabilization, and thermal-drying/pelletization facilities is in place. (The Department of Environmental Protection is responsible for the City's sludge-management plan; the DEP has published a separate series of environmental impact statements on this evolving sludge plan over the past few years, the most recent of which, "Draft Generic Environmental Impact Statement III," was released in December, 1991.)

Construction and demolition debris will be processed in recycling facilities, where saleable materials will be extracted and the volume of material requiring landfill significantly reduced. Shredding equipment will be added to one of the City's existing waterfront sites so that harbor debris can be incinerated.

Dredge spoils generated by the Department of Sanitation will be processed at a dredge-spoils dewatering system to be developed by the Department. Most other dredge spoils from New York Harbor probably will continue to be disposed of at sea, in "borrow-pits" designated by the U.S. Corps of Engineers.

This proposed integrated waste-materials-management system, compared to any alternative combination of practicable programs and facilities, is the most cost-effective and the most protective of the environment. If implemented, it will represent a significant and achievable improvement over existing New York City waste-management practices.

NEW YORK CITY'S WASTE-MANAGEMENT PROBLEM

Nearly 14 million tons of waste materials were generated in New York City in 1990. Of these, almost eight million were municipal solid wastes. The other waste-stream components were dredge spoils (2.6 million tons), followed by construction and demolition debris (2.5 million tons), medical wastes (0.3 million tons), sewage sludge (0.2 million tons), and harbor debris (0.04 million tons).

Most of these waste streams are projected to remain fairly constant over the 20-year planning period. The exception is municipal solid wastes, which (in the absence of new prevention programs) are projected to increase by about 15 percent to over nine million tons by 2010.

THE EVALUATION OF WASTE-MANAGEMENT OPTIONS

Waste-prevention, by definition, involves techniques outside of traditional waste-management systems. Although the effects of waste-prevention programs will affect the types and quantities of wastes that will remain for "management" in the conventional sense, the design of these programs does not directly affect the design of the remaining waste-management system in the same way that the inter-related effects of collection, processing, and disposal programs for recycling, composting, waste-to-energy, and landfilling do. Waste-prevention alternatives were therefore evaluated on the basis of their effectiveness in reducing waste quantities (and waste toxicity), their cost-effectiveness, and the feasibility of their implementation on a local level.

Recycling programs, on the other hand, are not only integral to the design of all other waste-management programs: maximizing the amount of recycling while minimizing costs and environmental impacts to the maximum extent practicable was the fundamental objective of this planning process. While decisions on recycling programs were made in the context of overall system designs that minimized overall cost and environmental impacts for the management of all of the wastes generated within New York City, the objective of maximizing recycling largely drove the design of the integrated waste-management system.

The universe of alternatives with which the analysis of recycling alternatives began (which, of course, is directly tied to the evaluation of alternatives for collecting, processing, and disposing of other municipal solid wastes) consisted of options that encompassed the continuum from set out, to collection, processing, marketing, and disposal. The options for each of these processes were:

- the number of "sorts" which waste generators would be asked to perform;
- the definition of the waste categories into which materials would be sorted;
- the type of container;
- the number of collection trucks to service each waste generator;
- the types of collection trucks;
- collection frequency;
- the type of processing facility;

- o <u>marketing arrangements.</u>

Composting programs present a somewhat narrower range of choices, since only one generic type of technology (called an "in-vessel," i.e., totally enclosed, facility) would be suitable for composting anything other than yard wastes in New York City, and since "set-out" choices simply involve whether compostable organic wastes are source-separated or combined with other refuse -- a choice that in large part is driven by the type of recycling program chosen and by the other types of processing facilities that are included in the system.

Waste-to-energy programs likewise, to a considerable extent, are dependent on other program choices that determine the quantities of waste to be incinerated. Choices between alternate waste-to-energy technologies or facility components are trivial within the context of overall system design.

The design of landfilling programs is almost completely dependent on prior system choices that determine the types and quantities of materials to be landfilled.

Combinations of alternatives for these various options were evaluated through computer modeling to compare: direct economic costs, environmental impacts (air, water, traffic, noise, odor, public health), land-use and landfill-capacity requirements, energy impacts (the balance of energy used and energy conserved both locally and in production processes elsewhere), and "secondary" (indirect) economic impacts. These impacts were compared to existing and projected (i.e., "no-action") "baselines."

The quantitative analyses were performed in three phases. The primary focus of the first phases was to analyze the relative differences between a broadly conceived "universe" of generic waste-management systems, particularly as they were affected by varying collection-processing combinations, and to compare them to "baseline" conditions. The second-phase analyses generally addressed the effects of individual system components and variables. The final phase involved more refined comparative analyses (including "life-cycle" costs and cumulative environmental effects) of four final system configurations.

<u>Scenario Analyses</u>

The findings from each stage of analysis were used to guide the development of more detailed subsequent phases. The analytical results that most directly shaped the evolution of subsequent scenarios were these:

Comparison of Alternative Scenarios and the Existing and Projected Baselines

Of all the feasible system alternatives, continuing the current waste-management system into the future essentially unchanged (the so-called "projected baseline") is the most costly, the most environmentally degrading, and would put the City at greatest risk of having to depend on out-of-City landfills to meet a substantial portion of its future waste-disposal need. The excess costs of the current system relative to the available alternatives are largely due to the depletion of expensive landfill capacity and to the inefficiencies of the existing recycling program. Of the latter, the most important stem from unproductive costs imposed by the existing collective bargaining agreement, which is currently being re-negotiated, so that the offsetting effects of collecting recyclable materials separately can be captured in reduced collection costs for "regular" refuse.

System-Design Considerations

Importance of Integrated Systems. Balanced systems that include all of the techniques in the waste-management "hierarchy" are the most cost-effective. Systems that exclude prevention programs, or recycling, composting, or waste-to-energy facilities, are more expensive.

Prevention. While it is not possible to predict accurately the potential effects of proposed prevention programs in reducing the city's wastes, the analyses of alternative systems with varying amounts of prevented waste demonstrate that the avoided economic and environmental costs of keeping materials out of the collection, processing, and disposal system are very significant. Using material-specific, program-based reduction estimates, the "avoided-cost" savings of a potential 7.5 percent reduction in the waste stream could be on the order of $60 million per year.

Landfilling. The most expensive type of waste-management facility is landfills. The reason for this is that landfills are the only type of facility that are irreplaceable. Since they are also the most difficult to site, landfills are the only type of facility that will be impossible to site within the boundaries of New York City.

Recycling. Collecting recyclable materials separately is more cost-effective than not doing so, provided that this collection is done efficiently. The most cost-effective collection system for recyclable materials is in plastic bags (as opposed to rigid bins), in two-compartment compactor trucks (with paper and textiles in one compartment and glass, metals, and plastic in the other). The most cost-effective processing facilities are flexibly designed to accept a variety of materials that can be sorted and processed to varying degrees depending on market conditions.

In designing an effective recycling system, several key parameters have to be balanced with the goal of achieving the lowest overall cost to the waste-management system as a whole. One parameter is ease of public participation in the system. Another parameter is minimizing collection costs. A third is minimizing processing costs. A fourth is maximizing marketability and market revenues. A fifth is minimizing landfill-disposal requirements.

To facilitate citizen participation and thus the largest possible rates of material diversion, the most effective systems will be citywide, simple to communicate, to understand and enforce, and convenient. The designation of recyclable materials should be as expansive as practicable, so that changes in secondary materials markets do not need to trigger changes in citizen behavior, but can instead be dealt with more flexibly on the processing end by increasing or decreasing the degree of sorting.

Plastic bags are more convenient for waste generators since they are more easily stored, one or more bags can be used to contain as much or as little material as is necessary, they do not have to be retrieved from the curb, and they do not have to be cleaned or be replaced when broken or stolen. Plastic bags also protect materials from sun, wind, rain, and snow. Plastic bags are more cost-effective for the City, since they eliminate the need for purchasing bins, and since bags can be tossed into a truck by collection workers in about two-thirds of the time required for bins to be picked up, emptied, and set back on the curb. Additional advantages of bags over bins are that they reduce spillage and litter, can themselves be recycled, and the marketing of bags in retail stores would create useful public-information opportunities at no cost to the City.

Dual-compartment compactor trucks are the most effective alternative, in spite of their higher capital and maintenance costs relative to single-compartment trucks, and in spite of the fact that, since one compartment will inevitably fill before the other, there will be some unused capacity and hence some reduction in collection efficiency. Collecting all refuse in a single-compartment truck (for instance, in a two-bag "wet/dry-type" system) would be the least costly collection system, but it would require a significantly more costly and risky (unproven) processing system, and would produce materials that could be more difficult to market, and for which lower revenues could be received. Keeping paper and textiles separate from other materials allows them to be compacted without endangering their market value because of contamination with broken glass or liquids.

Dual-compartment compactor trucks, and bag-breaking equipment for processing bagged recyclables stretch the limits of technology that has been clearly demonstrated on a large scale, but there are multiple manufacturers of these types of equipment both in this country and abroad, and both are coming into increasing use. Based on an evaluation of these "emerging" technologies, there is a high degree of probability that both will be reliably available by the time this plan is implemented. (The Sanitation Department recently field tested two versions of a "split-body" truck and is preparing its own specifications for a new prototype truck that will be procured and tested this coming fiscal year.)

Composting. Mixed-waste composting has not yet been demonstrated to operate reliably on a comparable scale in this country, and thus represents a greater risk than do proven waste-to-energy facilities. And in addition to the start-up operational problems of the several smaller-scale facilities just getting under way in this country (e.g., odor-control problems), the compost product itself is beginning to come under increasing regulatory scrutiny, which might eventually restrict the uses for which this product might be marketed. While the capital and operating costs of compost facilities are less than for waste-to-energy facilities, the fact that they do not produce revenues from the sale of energy means that overall system costs for a "maximum-compost" system would be a few percent higher (about $100 million per year more) than for a system that included a significant proportion of waste-to-energy processing.

Source-separated compost systems share some of the difficulties of mixed-waste systems, in that large-scale facilities have not yet been demonstrated successfully in this country, and in that there are not yet definitive analyses of the composition of the compost product with reference to current and pending regulatory standards for its use. Nor have large-scale kitchen-waste collection programs been tried in a dense urban area. While adding a third collection truck to pick up source-separated organics waste (in addition to a truck for recyclables and a truck for refuse) would be infeasibly expensive, using a two-compartment compacting truck to collect organic wastes and "regular" refuse simultaneously would be quite cost-effective. This would be particularly true if both compartments could be unloaded at the same location (at a marine transfer station, for instance), to avoid the expense of a "triangle" trip between dump sites.

A system in which source-separated organics from large-scale institutional generators only (e.g., schools, hospitals, correctional facilities) were composted, with the remainder of the non-recyclable portion of the waste stream processed in waste-to-energy facilities, would compost about two percent of the waste stream and be slightly cheaper than a system without this level of composting (by about $3 per ton). Such a system, however, would substantially increase facility acreage requirements.

Waste-to-Energy. Systems without waste-to-energy facilities would be considerably more costly than non-waste-to-energy systems, since they would consume far greater amounts of landfill capacity and require more land area for facilities. On the other hand, while a system that relied entirely on waste-to-energy (without any recycling or composting) would be relatively inexpensive due primarily to lower collection costs (since all wastes would be collected in a single truck), such a system would need significant landfill capacity for "by-pass" waste during the time the facilities would be down for maintenance, and would produce significantly more ash residue.

The City's three existing incinerators now cost about a third more on a per-ton basis than would a newly constructed waste-to-energy facility of the same capacity, but the added capital expense of retrofitting them with energy-recovery capability and upgrading the equipment for more efficient operation would be mor than offset by their substantially reduced operating cost. If the existing incinerators are fully upgraded to operate as efficiently as new privately run waste-to-energy facilities, the cost of a system with or without the existing incinerators would be the same.

A system without the proposed Brooklyn Navy Yard project, a 3000 ton-pe day, barge-fed waste-to-steam plant, would add about $3 per ton ($13 million annually system-wide) to a system with the same amount of waste-to-energy capacity. This increase is due in part to the relative economics of selling steam a the primary energy product as opposed to electricity (the Navy Yard facility, unlik facilities in most locations, has an adjacent utility-scale steam market as a customer), and to the economies of scale that come with being able to deliver 3000 tpd by barge (while at the same time minimizing truck transport distances b taking advantage of the existing MTS network). Additional advantages of a system that includes the Navy Yard facility are that fewer acres are required for a barge-fed than for a truck-fed facility, and that having two barge-fed facilities in the system (another one would be suitable for Staten Island) would allow the benefits of treating the barge system as a "surge tank" to buffer overflows due t outages at other facilities.

Pre-processing of the refuse stream in front of waste-to-energy or composting facilities might increase the recycling rate by several percent system wide by removing additional recyclable glass and metals, and the cost of this fro end pre-processing does not appreciably increase the overall costs of waste-to-energy facilities (while improving their energy production and reducing the amou and cost of ash residue disposal) or compost facilities. The effect of adding pre-processing capacity at all waste-to-energy facilities (with the exception of the Brooklyn Navy Yard, where site-size constraints preclude the addition of this equipment) would increase the amount of recycling by about two percent syster wide, reduce the amount of ash residue for landfilling, increase the energy outpu and thus produce higher revenues, and slightly reduce overall landfilling requirements, at a cost of just $1 per ton ($3 million system-wide per year).

Waste-Sheds; Facility Sizing, Siting. Minimizing transport distances between collection routes and dumping points is one of the most critical elements in minimizing overall system costs. Sensitivity analyses of this factor show that the economic benefits of reducing travel distances far outweigh the economies of scale associated with larger, more centralized facilities. (Collection costs could be on the order of 20 percent higher, while the economies associated with larger facilities would be on the order of five percent.) On the other hand, the awesome competition for space in New York City creates constraints that greatly limit the number of potentially appropriate sites (in terms of adjacent land-uses, acreage, traffic and transport access, stack height limitations, regulatory requirements, etc.) for the development of waste-processing facilities. And acreage requirements for relatively small-scale facilities could be about 15-20 percent greater than for larger-scale facilities.

Together, these factors make the City's existing barge and marine-transfer-station network crucially important. The eight existing marine transfer stations spread around the periphery of Manhattan, the Bronx, Queens, and Brooklyn significantly shorten the travel distances required to dump loads of non-recyclable materials. And barging waste (at about 700 tons per barge) is a cost-effective way to move waste relatively longer distances to waterfront disposal facilities around the City, in a way that minimizes traffic congestion and other environmental impacts.

The barge system has the further considerable advantage -- in a multi-facility, "utility-type" system -- of being a cost-effective way of absorbing an "overflow load" in a "surge" time at a particular facility (e.g., in the event of unscheduled facility downtime, seasonal fluctuations in refuse volume and characteristics, or problems related to a particular type of transportation system), by "distributing" it to other facilities. (It is much easier to "micro-control" daily shipments of waste by barge than by truck.) In this way, the amount of excess facility capacity that is required at any one facility can be reduced.

Costs

For residential waste only, collection costs vary by as much as 60 percent when one, two and three trucks are used (depending on the design of the source-separation programs). Scenarios with higher collection costs have generally lower facilities costs; more effective source-separation using separate trucks or a more expensive two-compartment truck results in more cost-effective processing operations. "Projected baseline" (i.e., "no-action alternative") costs are in the range of about 10 to 75 percent higher than any of the alternative systems analyzed, due to the higher proportion of landfilling, the less-efficient deployment of trucks, and the relatively low rate of public participation in recycling programs.

Environmental Impacts

From a public-health and regulatory perspective, none of the alternative scenarios produced unacceptable environmental impacts. There are differences in facility air emissions between the scenario extremes of maximum waste-to-energy systems and no-waste-to-energy systems, and lesser differences in vehicular air emissions associated with the type of collection system proposed, but none of these differences, in comparison to background levels is very significant.

Water-pollutant impacts are negligible in all scenarios, and the differences between scenarios trivial. The largest amounts of water are used in systems with waste-to-energy facilities; the requirements of such systems, ranging up to severa million gallons per day, represent an insignificant fraction of the almost two billion gallons of water used daily in New York City.

No type of proposed waste-management facility (if properly sited) produces noise impacts beyond the facility boundary. Collection-noise impacts (i.e., truck noise, particularly the grinding/crashing sound of compaction cycles) will have a greater impact on human ears. The difference in overall collection noise between scenarios, however, is insignificant.

Facility odor impacts, provided that facilities are properly sited, designed, and operated, would be negligible.

Energy is used when waste is collected, processed, transported and disposed. Energy is also generated at waste-to-energy facilities and at landfills where gas is produced naturally by the decomposition of organic waste. The assessment of energy impacts of alternative waste-management systems, therefore, involved calculations of "net energy use," or total energy consumed less the total amount of energy generated. In all scenarios with waste-to-energy facilities, which recover about 10 times more energy than is produced by a landfill more energy is generated than is directly consumed systemwide. However, the single most important factor in determining a system's overall energy efficiency, which far outweighs all other effects, is the amount of energy saved in producing new materials using recycled rather than virgin feedstocks. Therefore, systems with the highest degree of material recovery produce the greatest energy benefits (although these do not accrue locally).

Most of the feasible alternative scenarios, on a dollar-for-dollar basis, woulc have more favorable local (New York City) employment and economic-multiplier effects than the projected baseline system. The most cost-effective systems, in terms of these "secondary economic impacts," provided the greatest degree of waste processing. Because of the many difficulties of developing major new manufacturing industries within New York City that could use recycled materials (e.g., aluminum smelters, steel mills, de-inking/paper mills, glass manufacturers), this analysis of local economic benefits does not assume that new recycling industries will be developed locally. (The obstacles to developing such industries within the city include environmental impacts and associated regulatory requirements, space requirements, utility demands, transportation access, a competitive labor force, and local tax rates.) While some such industries (e.g., plastics molding and extrusion plants) may be developed, and while the City will take steps to encourage appropriate new manufacturing, it is not likely that in-city utilization of secondary materials will be a dominant economic force. If such industries, however, were included in this calculus, the effect would be to further magnify the benefits of systems that included the most processing and recovery of materials.

Final-Phase Alternative Systems Analysis

In the final stage of the alternatives analysis process, two "finalist" systems, described as System A and B, were evaluated in detail. Using the results from prior analyses, these two systems were conceived as potentially the least costly and most feasible means to optimize recycling and composting. They share the same combination of programs and facilities for dealing with all non-MSW wastestreams (sewage sludge, dredge spoils, medical wastes, construction and demolition waste, harbor debris). They also share identical prevention and recycling programs. They differ only in the relative proportions of material that would be composted, which in turn affects how much would remain to be incinerated and landfilled. Neither of these systems is the one "recommended" by this plan; rather, both are acceptable variations on the basic system that is likely to be the best-suited to the city's waste-management needs, and the "real-world" plan that is actually implemented over the next 20 years is likely to be somewhere between the boundaries defined here by the no-action baseline alternative and Systems A and B.

Several variations of these two basic systems were tested. One of these involved different ranges of assumed participation rates in the source-separation programs. Another tested differently designed processing systems to divert additional recyclable materials at the front end of waste-to-energy facilities.

In addition, these two systems were compared to two "bench-mark" systems involving, on one extreme, the maximum amount of waste-to-energy incineration (without any source-separation recycling or composting), and on the other, no incineration. In the latter "no-burn" system, wastes not recycled or composted would be further processed mechanically and manually before being landfilled. Neither of these extremist bench-mark systems would meet the objectives of the State solid-waste-management policy.

The Elements Shared by Systems A and B

These systems share a common set of assumed waste-prevention programs, which, on a material-specific basis, would divert a total of just over seven percent of municipal solid waste from the collection, processing and disposal system. This set of proposed programs was not intended to reflect either the limits of prevention programs or a quantitative prediction of the effects of specific prevention strategies. Rather, it was designed for the purpose of providing a standard "post-prevention" waste stream for comparative analysis.

The basic recycling program for both systems is a "curbside" program for "high-quality" materials collected in color-coded plastic bags or cans in one rear-loading, "split-body" compactor truck and processed in a network of materials-recovery facilities. Both systems A and B also include recycling of bulky items, post-collection separation of commercial waste, and front-end processing at waste-to-energy facilities.

The Differences Between System A and B

The composting components of System A would consist of two programs: special fall and spring collections of residential leaves and yard waste, which would be composted in open-air "windrows" at Fresh Kills and the former Edgemere landfill; and containerized collections of source-separated kitchen wastes from certain institutional generators of food waste such as hospitals, schools and correctional facilities, which would be composted in enclosed ("in-vessel") facilities. These facilities would be designed to be large enough to accept source-separated commercial organic wastes collected by private haulers from certain large generators such as restaurants and food retail stores.

In System B, source-separated residential organics (kitchen waste as well as yard waste) would be collected in a two-compartment compactor truck along with other refuse, and composted in in-vessel facilities along with the same institutional and commercial organics streams assumed in System A. The proportion of waste composted in System B would be about double that of System A.

All non-prevented, non-recycled, non-composted wastes in both System A and B would be processed in the upgraded existing incinerators (retrofitted with energy recovery capability) and in new waste-to-energy facilities equipped with "front-end" processing systems for removing recyclable and non-combustible wastes. The additional composting in System B over System A would reduce the amount of waste-to-energy capacity required in System B.

Comparison of Economic and Environmental Impacts of Systems A and B with the "Bench-Mark Cases" (Maximum Waste-to-Energy and No Waste-to-Energy Systems)

Although in-vessel composting facilities would be less costly to build and operate than waste-to-energy facilities, System B would be more costly overall than System A (on the order of $6 per ton, or about $50 million per year under a set of "mid-range" assumptions) due to the more expensive two-compartment-truck collection system for source-separated organics.

The "No Waste-to-Energy" system would be far more costly than any of the other systems due to the high cost and low efficiency of mixed-waste processing systems.

The "Maximum Waste-to-Energy" system would benefit from an inexpensive single-truck collection system, but would have relatively higher processing costs. Overall -- depending on the amount of commercial waste disposed in the city (as opposed to exported outside the city) -- the costs of this system would be slightly higher than those for System A, and somewhat lower than those for System B. In comparing "life-cycle" costs over the full 20-year planning period, the maximum waste-to-energy system costs are equivalent to or greater than the System A costs, and System B is only slightly more costly.

As might be expected, the environmental impacts of Systems A and B are very similar; both would produce air emissions from facilities that would be slightly lower than those produced in a "maximum-burn" scenario, and somewhat higher than those produced in a "no-burn" scenario. Vehicular air emissions also vary very little between Systems A and B and the "no-burn" case, and would be slightly lower in the "maximum-burn" case. Differences between these alternatives in terms of other environmental impacts would be trivial. The "no-burn" case would use significantly more landfill volume than any other alternative, as well as require significantly more facility acreage. In terms of secondary economic impacts as well, the impacts of Systems A and B would be quite similar, and generally more favorable than either of the bench-mark extremes.

The Near-Term Implementation Plan

The near-term implementation plan consists of the programs and facilities scheduled for implementation by the City over the next five years. Unlike the other systems, the near-term plan includes only those facilities on which the City is now prepared to move ahead in the next five years, plus two additional composting facilities, which are likely to be developed by the end of the decade. Depending on the experience with the near-term plan, additional facilities may be developed over the next decade, but they are not included in the near-term plan, which contains only what the City now expects to build.

THE PROPOSED WASTE-MANAGEMENT PLAN

Because of the high level of uncertainty in virtually every aspect of the solid-waste-management planning process, this plan can best be envisioned as a decision tree which identifies a set of immediate decisions that must be made, the additional information that will be available to inform the second round of decisions, and finally, the likely timeframe when the last, long-term decisions will have to be made to assure an adequate system to handle the City's solid waste at the 20-year mark. The City has not decided to proceed with System A or B or any other 20-year program. The City is committed only to begin to develop during the next five years the programs and facilities in the near-term implementation plan, which includes the following major elements:

- Aggressive City support for State and federal waste-prevention legislative proposals (e.g., expanded beverage container deposits, packaging controls, product labelling, possible virgin materials tax reforms, etc.), and local initiatives to reduce the amount of waste entering the City's collection, processing and disposal systems, including:

  (1) a homeowner education and assistance program to encourage backyard composting of garden and kitchen wastes (with possible extension to certain apartment building complexes);

  (2) a "leave-it-on-the-lawn" rule prohibiting the collection of grass clippings by the Sanitation Department and the receipt of grass at City waste-disposal facilities;

  (3) a City-sponsored commercial-waste auditing program to help businesses devise their own cost-saving plans for reducing the volume of waste they generate, combined with a program for restructuring commercial waste-hauling rates;

  (4) City procurement-policy reforms to reduce shipping wastes, improve product durability, and replace disposable items with re-usables where appropriate.

  (5) sustained consumer education programs to promote individual waste-prevention practices (e.g., purchasing products with minimal packaging or in bulk, buying refillable and reusable items, using durable shopping bags, opting off of unwanted direct-mail lists, etc.)

  (6) expanding the New York City Waste-Prevention Partnership, a public/private cooperative venture to promote waste-minimization

initiatives;

(7) incentives to promote product "re-use," such as diaper-cleaning services, appliance repair shops, thrift-shop-type storefronts, Material for the Arts and/or other "waste-exchange/donation" programs;

(8) research and pilot studies of "quantity-based user fee" systems for institutional and residential generators;

(9) pursuing changes to the City building codes to encourage waste prevention and recycling.

o A set of proposals to substantially reform the City's mandatory source-separation recycling program, including:

(1) expanding the current six-material curbside collection program citywide in FY '93, and in FY '95, expanding the number of recyclab materials collected to about half of the total waste stream (including all metal, glass, plastic, dry paper, textiles and bulk items, which constitute about 50 percent of the residential and 61 percent of the institutional/commercial waste streams);

(2) to facilitate high public participation levels and uniform, citywide public information dissemination, a simplified "two-sort" (paper/textiles in one, all other materials in the other) system for all generators using color-coded plastic bags (instead of the current blue bins and bundled paper);

(3) a streamlined curbside collection system for both waste streams of recyclables with a new, "split-body" dual-compacting truck (and containerized collection from some large apartment buildings);

(4) development of five new 500-ton-per-day-capacity materials processing centers designed for "high-level" sorting of multiple pape and plastics grades to obtain optimal net revenues and to compete most effectively against other regional suppliers of these secondary materials.

o Supplemental techniques for diverting additional materials for recycling, including:

(1) pilot testing of staffed and/or unstaffed (e.g.,"igloos") voluntary dro off facilities, including drop-off sites for household hazardous waste

(such as paint, used oil, batteries, pesticides, etc.); and

(2) an expanded program for collecting household hazardous wastes;

(3) contracts for five buy-back centers (one in each borough), and attempts to involve not-for-profit thrift organizations in a program to exchange and re-use goods collected at the buy-back centers.

~~(2) manual and/or mechanical "front end" separation systems at new waste to energy facilities.~~

- A secondary materials marketing and market-development strategy integrated with the implementation of the recycling collection/processing system that includes:

  (1) long-term contract arrangements for the sale of guaranteed quantities of certain secondary materials for which market demand is "weak," such as mixed paper, old newspaper and certain grades of plastic;

  (2) City procurement strategies (e.g., product-content specification changes, price preferences, guaranteed purchases, etc.) aimed at boosting weak end-product demand, particularly for low-grade paper products;

  (3) City economic development assistance/incentives for the development of manufacturing facilities that use recyclable materials;

  (4) development of additional "glassphalt" manufacturing capacity using otherwise-unmarketable mixed-color glass cullet as an asphalt admixture (displacing the cost of sand);

  (5) continued support of federal minimum-content legislation and tax incentives to encourage use of recyclable materials.

- Development of source-separation collection and facility systems for composting certain organic wastes, including:

  (1) development of an one in-vessel composting facility (approximately 450-tons-per-day capacity) for separately collected kitchen wastes (in "Dumpster-type" containers) from selected institutional generators such as hospitals, schools and correctional facilities;

  (2) development of special leaf-and-yard-waste collections (without grass)

from low-density districts in the fall and spring, and construction of a second windrow composting facility at the former Edgemere landfill;

(3) eventual development of two additional in-vessel composting facilities (total daily capacity of between about 1,800 and 3,700 tons per day) depending on the future feasibility of source-separated organics collection programs for commercial and residential generators.

- Continued maintenance and upgrading of existing City waste-management infrastructure, including:

  (1) maintenance of seven of the existing marine transfer stations and development of replacement transfer system capacity to service the Bronx;

  (2) upgrading the existing Southwest Brooklyn municipal incinerator (750 tons per day capacity with 85 percent annual availability) to meet new federal and State environmental standards, and retrofitting it with energy-recovery capability to reduce operating costs with offsetting energy revenues; a decision as to whether or not the Greenpoint incinerator will also be upgraded (rather than closed) will be made in fiscal year 1995;

  (3) continuing programs to upgrade operations at the Fresh Kills landfill and installing planned environmental controls (leachate containment/ treatment and landfill gas recovery systems).

- Developing ~~sufficient~~ new waste-to-energy processing capacity to reduce the volume of all combustible wastes that are not feasibly prevented, recycled or composted at the Brooklyn Navy Yard (with 3,000 tons per day capacity and 85 percent annual availability).

- Development of sufficient environmentally complying ash-residue disposal capacity for existing and new waste-burning facilities, including:

  (1) continued City-supported research and development studies and ongoing monitoring of other studies of potential beneficial re-use options for ash (e.g., road-bed material, asphalt admixture, construction materials);

  (2) steps to contract for out-of-city ash-disposal capacity.~~a proposed ash monofill at Fresh Kills and possible development of another in-City ash~~

~~monofill depending on the availability of a suitable site~~

- o Exploration of alternative future disposal options (for by-pass wastes and/or residues) when Fresh Kills' capacity is exhausted, including:

  (1) further studies to evaluate the feasibility of innovative landfilling techniques such as landfill mining and off-shore containment islands;

  (2) contracts for, purchase of, or new development of new landfill/disposal capacity outside of the City;

  (3) possible participation in a cooperative regional landfill development venture.

- o Development of a new system of land-based processing and treatment facilities to produce beneficial re-use products from all of the City's sewage sludge (which was the subject of a separate site-specific environmental impact statement).

- o A multi-faceted set of proposed site-specific health-care facility internal management programs designed to maximize waste prevention, and source separation for recycling and composting, and to minimize co-mingling of "regulated" and "non-regulated" medical wastes in order to reduce the need for special, costly disposal.

- o Installation of wood-chipping equipment at a waterfront site to reduce harbor debris material (primarily demolished piers and pilings) to sizes suitable for co-incineration with other waste at one of the City's incinerators.

- o Construction of an upland dewatering facility to handle material dredged by the Department of Sanitation.

- o Further study of the feasibility, costs and benefits of creating a Solid Waste Management Authority to provide an alternative mechanism for the long-term implementation of this comprehensive plan and management of the future system. Issues related to the structure, role and financing basis of such an entity will need to be addressed.

Implementation

The implementation process for this plan is intended to balance the dual needs of creating new waste-management capacity as expeditiously as feasible so as to preserve capacity at Fresh Kills and to maintain sufficient flexibility over time so that future facility and program choices may appropriately respond to changing conditions and/or new opportunities.

Implementation of this plan, therefore, is designed as a sequenced "decision-tree" divided generally into two conceptual timeframes. Inherent in this approach is the notion that this plan will require ongoing monitoring, updating and revision as circumstances change. The near-term program reflects commitments that will be implemented over the next five years. The long-term phase will involve additional programmatic and facility-development decisions made on the basis of near-term program performance monitoring, research and development activities, and further updated analyses of the full range of conditions (demographic, economic, waste-generation and composition, technological, participation, marketing, regulatory) applicable to further system needs and choices.

The long-term implementation phase will involve further, incremental development of additional processing facilities, including in-vessel composting -- depending on the feasibility of source-separation collection of residential kitchen waste, composting technology experience and end-use markets -- and possible additional waste-to-energy capacity to reduce the volume of wastes not being recycled or composted.

To maintain an appropriate basis for future decision-tree choices, this plan itself will be updated at an appropriate level of detail on a regular basis.

Environmental Impacts of the Proposed Plan.

The impacts described below characterize the full-scale implementation of System A or B. The impacts of the near-term plan represent a sub-set of these impacts or a transition point between the impacts of the no-action alternative (the "projected baseline") and the implementation of a full-scale alternative system.

Air Impacts:

Facility Air Emissions

There are differences in facility air emissions between the scenario extremes of maximum waste-to-energy systems and no-waste-to-energy systems, and lesser differences in vehicular air emissions associated with the type of collection system proposed, but none of these differences, in comparison to background levels or in comparison to applicable standards or guidelines, is significant.

Both Systems A and B would produce air emissions from facilities that would be slightly lower than those produced in an "maximum-burn" scenario, and somewhat higher than those produced in a "no-burn" scenario. No exceedances of pollutant standards were predicted for either System A or B.

A conservative modeling of the deposition of airborne pollutants from facilities to New York Harbor and surface waters shows that levels of only one pollutant -- mercury -- might be increased significantly as a result of integrated waste-management systems. This modeling analysis, however, significantly overstates the amounts of mercury that could actually enter surface waters. This potential impact will be mitigated effectively through a series of measures ranging from reduced use of mercury in battery manufacturing (batteries are the major source of mercury in solid wastes); a source-separation collection program for batteries; "front-end processing" to remove recyclables, which would reduce the number of batteries remaining in waste entering in-vessel composting facilities; and carbon-injection air-pollution-control systems to control mercury emissions from waste-to-energy facilities.

Vehicular Air Emissions

Vehicular air emissions also vary little between Systems A and B and the "no-burn" case, and would be slightly lower in the "maximum-burn" case. The analysis of potential ambient air-pollutant (carbon monoxide) concentrations at intersections that would be likely to be affected by overlapping traffic flows associated with the facilities proposed in Systems A and B shows that there would be no significant impacts associated with cumulative traffic flows due to the alternative systems at these representative intersections. No violations of standards would occur, nor would the "de minimus" criteria established by the City and State be exceeded.

Transportation Analysis and Impacts

To assess the impact that the vehicle trips generated by any particular type and size of facility would have in particular regions of the city -- and to determine whether or not it would be feasible to consider siting such facilities at these locations -- intersections that serve as "portals" to potentially suitable areas, or which are typical of traffic conditions within these areas, were analyzed. One-day peak-hour(s) traffic counts were conducted for intersections for which there were no existing data from studies completed within the past three years. These counts and the projected vehicle trips for specific facility types were then used as inputs to a computer model to predict the incremental effects of these waste-management-facility-generated trips on projected traffic volumes at particular intersections.

This analysis of the pairing of specific intersections with the peak-hour traffic generated by specific types of facilities shows that traffic conditions are a relatively significant constraint in siting facilities in New York City. The facility types that generate the greatest amount of traffic are landfills (because of their size) and large-scale composting facilities (because of their size, because they are labor-intensive, and because of the amount of material that must also be removed from the facility). Of the 33 potentially feasible regions of the City in terms of land-use, the analysis of key intersections shows that only seven could handle these most-traffic-intensive types of facilities. Truck-fed waste-to-energy facilities on a 2,250 ton-per-day scale would generate enough traffic to suggest that 18 of the 33 regions would have potentially significant traffic impacts. These impacts could be avoided if facilities that generate traffic on this scale were not sited in these 18 regions.

For certain types of facilities in certain locations, these constraints could be overcome by the use of barge transport. Another factor that could reduce the effect of traffic due to waste deliveries in certain locations is that waste-management facilities of comparable sizes already exist in those locations, so that, since waste deliveries would simply be displaced from one location to another, there would be no net increase over current levels in certain regions.

The heuristic waste sheds and facility locations proposed for the alternative scenarios were used to assess the potential for cumulative effects from a network of facilities on a particular intersection. The wastesheds were sectioned into quadrants (or fifths, in some cases where geography dictated), and a quarter (or a fifth) of the traffic generated by a facility was assumed to come from each direction to a potential site. When wastesheds for different facilities overlapped, the overlapping portions of their traffic flows were assumed to go through the same sample critical intersection. The Bronx and Manhattan were deemed to have no cumulative traffic impacts, because solid waste facilities in the proposed systems would be separated in a way that would preclude the overlap of waste-management-related trips at any one intersection. Assessments of traffic patterns in Queens, Brooklyn, and Staten Island show a potential for cumulative traffic impacts. The analysis shows two cumulative impact locations within Queens and Brooklyn that could have minor significant traffic impacts.[1] For both intersections

---

[1]In assessing whether a significant traffic impact was created, New York City Department of Transportation guidelines were followed. For signalized intersections (all potential cumulative impact locations identified herein are signalized), a significant impact is defined as follows: a) when the volume-to-capacity (v/c) ratio increases from a No Build of 0.85, or less than 0.85, to more than 0.85 in the Build condition, or by 0.01 or more when the No Build v/c is more than 0.85; or b) when the average vehicle delay increases from the 30 to 39.9 second range in the No Build condition by more than two seconds in the Build condition, or when a No Build delay of 40 seconds or more increases by one second in the Build condition (all values are for lane groups, not

basic traffic-signal modifications, namely signal retiming and rephasing, would adequately mitigate these traffic impacts. A potential cumulative impact intersection in Staten Island was analyzed as having no significant traffic impacts.

Water Analyses

Water-pollutant impacts would be negligible. The water-usage requirements of the proposed systems represent an insignificant fraction of the total amount of water used daily in New York City.

With one exception -- a dredge spoils dewatering facility -- no type of facility would discharge pollutants directly into ground or surface waters. Two types of facilities, however -- landfills and ash monofills -- would produce leachate that must be carefully contained and monitored in order to prevent the discharge of untreated leachate into the environment. The remaining facilities, due to regulatory requirements as well as to standard design and operating practices for each type of technology, would discharge effluents only into the City's sewer system.

Water usage by waste <u>generators</u> -- for example, in rinsing out recyclable containers for the "high-quality" recycling program -- under a conservative set of assumptions, could approach eight million gallons a day citywide.

Public Health Analyses and Impacts

Considering all other sources of heavy metal and dioxin, the incremental contributions of arsenic, cadmium, lead, nickel, zinc and dioxin estimated for System A and B would add less than 0.1 percent to background levels. Using extremely conservative assumptions for mercury emissions and deposition, the projected loadings for mercury from airborne deposition and runoff indicate that from a health perspective, only mercury is identified as a potential water-pollution problem. However, this potential adverse environmental impact is overstated and will be mitigated by the reduction of mercury in the waste stream.

Air quality in New York City occasionally reaches unsatisfactory levels, particularly due to elevated ozone levels, which in turn depend on emissions of oxides of nitrogen and hydrocarbons. The proposed systems would contribute to the NOx and ozone levels in New York City, but only to a slight degree on a citywide basis, particularly in comparison with vehicular air-pollutant sources. (It should be noted in this context that simultaneous reductions in emissions due to the closure of most on-site medical-waste and apartment-house incinerators would

---

the overall intersection.)

produce a net environmental improvement.)

For all of the relevant air pollutants, the maximal ambient concentrations calculated by air-modeling analyses are well below the relevant standards or guidelines. For 10 of the pollutants (carbon monoxide, particulate matter [for the annual averaging period], sulfur dioxide [for the three-hour and annual averaging periods], antimony, copper, lead [which is of particular public health significance], manganese, selenium, vanadium, zinc, hydrogen fluorides, polychlorinated biphenyls [PCBs], and polyaromatic hydrocarbons [PAHs]), the Hazard Index (HI) lies well below 0.01, which shows that these are of negligible concern.[2]

For mercury, the Hazard Index is greater than 0.4, which indicates that mercury levels approach the standard. This requires careful attention to assure that standards are not exceeded, and efforts should be made to improve the margin of safety for mercury. This is also important because mercury figures prominently as a water contaminant as well. The mercury contribution is potentially important because of the propensity for biomethylation and bioamplification of methyl mercury in the aquatic food chain. Since this has implications for both ecologic risk and human health risk, steps should be taken to reduce mercury releases. These include reduction of mercury in manufacturing batteries and the proposed additional air pollution control methods, the effect of which was not accounted for in the estimation of emissions.

For dioxin, since there is no guideline or standard, the reference value is the maximum concentration predicted from the proposed Brooklyn Navy Yard waste-to-energy facility. This value was examined extensively in a publicly scrutinized health-risk assessment, and found to result in an acceptable risk; the resulting Hazard Index is (HI > 0.3).

For carbon monoxide and cadmium, the Hazard Indices exceed 0.1; although these levels do not pose an immediate health concern, they have a smal margin of safety and should be monitored carefully when the proposed systems a implemented.

Water contamination can arise from direct discharge of process water, fron runoff or leachate, and from airborne deposition. Only a few of the facility types discharge process water; the main release would be associated with a sludge-

[2] The "Hazard Index" (HI) represents the ratio of the maximum pollutant level, divided by the relevant standard or guideline. This calculation can then be "graded" in terms of its significance b a "yardstick" called "Category of Concern" (CAT). If the HI is less than .01, its CAT rating is -1, which represents a negligible level of concern. A HI which shows that the pollutant concentratior is at least half as high as the standard (i.e., greater than .49) would have a CAT rating of 5.

pelletizer system which releases significant quantities of chromium, copper, lead, mercury and zinc. The only other significant process-water discharge identified is lead from the incineration of medical wastes.

In terms of the overall loadings to New York Harbor, the incremental contribution from the proposed solid-waste-management systems for arsenic, cadmium, lead, nickel, zinc, and PCB's would amount to less than 0.1 percent of the total input. The added contribution of mercury is discussed above. (For dioxin, there are no available background data with which to compare incremental loadings to existing conditions.)

Energy Impacts

Solid-waste-management systems can use energy, produce energy, and "save" energy. Collection programs, processing and transfer facilities, and landfills all use energy. Usable energy is also produced by two types of solid-waste-management practices: methane gas can be collected from landfills, and steam and electricity can be generated by waste-to-energy facilities. And energy is saved when recycled materials are used in place of virgin materials in manufacturing processes.

In both proposed systems (as well as in the benchmark cases) -- unlike the no-action/projected baseline system -- more energy would be produced than would be used. By far the most significant beneficial energy impacts, however, would be the savings due to using secondary materials rather than virgin materials in the manufacture of new products (an impact which, as noted in the discussion of secondary economic impacts, would in all likelihood take place predominantly outside of New York City). When the effects of these savings are included in the calculation, the positive energy impacts increase by an order of magnitude.

Land-Use Impacts:

Acreage Requirements

System A would require a total of 315 acres (excluding landfill requirements) for MSW facilities. System B would require 265 acres. The difference between them is due to land-intensive windrow composting facilities for leaf and yard waste in System A; System B would use more land-efficient in-vessel composting facilities to process a greater volume of organic wastes. The "no-action"/projected baseline alternative would require a total of 170 acres.

MSW Landfill/Ashfill Volume Requirements

System A would require 5,800 cubic yards of combined landfill/ashfill capacity a day in the year 2000; System B would require 4,900. The comparable amount of MSW and ash that would require landfilling in the no-action alternative/projected baseline would be 28,500 cubic yards per day in the year 2000.

Visual Impacts; Impacts on Waterfront Usage (and Consistency with Coastal-Zone-Management Objectives); "Quality of Life" Impacts

The visual impacts of waste-management facilities may be thought of in three general categories: vertical interruption of aesthetically significant viewshed (including the blocking of sunlight), horizontal degradation of aesthetically significant visual resources (e.g., meadows, lakes/streams/waterways), and the general visual appearance of the facility itself in terms of its "architectural quality" and design and operating characteristics (e.g., enclosed vs. unenclosed storage of incoming and outgoing materials). The latter sort of visual impacts can be mitigated to varying degrees for any type of waste-management facility through high-quality architectural and operational design, landscaping, and lighting. Mitigation of the second type of visual impacts, "horizontal degradation," is primarily achieved by siting "big-footprint" facilities to avoid scenic and historical resources. The first type of visual impact, which is due to a facility's height and mass, is a function of the value of the viewshed that is blocked, and of the accessibility of that viewshed from the direction(s) that are blocked. These latter effects can be mitigated both by appropriate siting and by architectural and operational designs that minimize the effects of a facility's height and mass.

Waste-management facilities may be roughly grouped into two categories ir terms of their impacts on visual resources. Small-scale facilities, in general, woul have an insignificant impact on visual resources almost anywhere within New Yor City. The large-scale sorts of facilities would have a significant negative visual impact if located in areas that blocked views from a residential area or views to which a significant number of people had access (e.g., from an expressway); if such a facility were developed at such a location, appropriate architectural treatment of height and mass would be particularly appropriate.

The impacts on waterfront usage are generally consistent with the Department of City Planning's current waterfront planning goals, as well as with the Coastal Zone Management objectives.

"Quality-of-life" impacts, or effects "on neighborhood character," are in a way the "bottom-line" effect of a congeries of particular impacts -- e.g., noise, traffic, visual impacts, odors, air pollutants, vermin. These bottom-line impacts, which may be positive as well as negative, may be felt in such phenomena as property values or the types of businesses that are encouraged or discouraged by the development and operation of a waste-management facility. Negative impacts of this sort are best mitigated by selection of appropriate sites; appropriate design and operating controls are also important. These concerns are most significant in the case of the handful of large-scale facility types -- compost facilities, waste-to-energy facilities, and landfills -- that occupy the most acreage. Most other types of facilities would not be out of place or particularly noticeable in most light-industrial or heavy-commercial areas of the city, many of which closely abut residential neighborhoods.

Noise Impacts

No type of proposed waste-management facility (if properly sited) would produce noise impacts beyond the facility boundary. Collection-noise impacts (i.e., truck noise, particularly the grinding/crashing sound of compaction cycles) will have a greater impact. The difference in overall collection noise between scenarios, however, is insignificant.

Odor Impacts

Facility odor impacts, provided that facilities are properly sited, designed, and operated, would be negligible.

Siting Impacts

To ensure that the Zoning Resolution appropriately regulates the siting of waste-management facilities, the Department of City Planning is drafting amendments to the Resolution. The proposed amendments, among other things, distinguish between types of transfer stations and other handlers of discarded materials, such as recycling drop-off, buyback and redemption centers, which have less of an impact on the character of the surrounding community.

The proposed zoning framework would establish a new "Waste-Management Facilities" category that would include transfer stations and salvage facilities, including junk yards and vehicle-dismantling yards. These facilities could be built as-of-right (provided that all other applicable regulations are met) in zones designated for the heaviest use (M3); these facilities would be permitted in other industrial zones (M1 and M2) if stricter operational standards could be met. Buy-back, redemption and drop-off centers would be permitted in certain commercial zones, where they would be in closer proximity to residential and business areas that they service.

(Direct) Economic Impacts

The total cost of MSW management under System A is projected to be approximately $1.69 billion in the year 2000 ($203 per ton overall) (including all residential, institutional, and commercial waste), and the cost of System B approximately $1.75 billion ($210 per ton); the no-action/projected baseline cost would be about $2.03 billion ($243 per ton). The total cost of the sludge-management system in the year 2000 is projected at $211 million; the total cost of the medical-waste management system is projected to be $23 million; the construction-and-demolition debris system is projected to cost $523 million; the harbor-debris management system is projected to cost $11 million; and the management of dredge-spoils generated by the Department of Sanitation is projected to cost $4 million.

Secondary Economic Impacts

The proposed MSW systems would have more beneficial secondary economic impacts than would the no-action/projected baseline. System A would add a projected total of about 9400 jobs over the no-action/projected baseline level, while System B would add an estimated 7200 jobs over the baseline level. If the effects of new jobs in manufacturing industries that use recycled materials are included in this tally (though many of these jobs may be outside New York City), the additional job totals would be on the order of 22,000 for both systems.

General Cumulative Impacts From All Programs for All Waste Streams Combined.

Taken as a whole, the comprehensive integrated solid-waste-management systems proposed (Systems A and B) would produce an overall improvement in environmental quality in New York City relative to the "no-action" alternative represented by the "projected baseline" for the year 2000, while also reducing total system costs through the more effective delivery of waste-management services.

Direct air-pollutant emissions from waste-management facilities would increase (in relation to the projected baseline), but these emissions would be largely offset by reductions in air emissions from utility boilers that currently supply steam and electricity in the city. Vehicle miles travelled would not appreciably change. Facility acreage requirements would more than double.

$300 million fewer dollars per year would be spent on the system by tax payers and businesses. Instead of being a net energy consumer, the city's solid-waste-management system would produce enough energy to supply the electricity for over 400,000 households (while saving enough energy from the use of recycled materials to supply the electricity for over 10 million more).

The systems proposed in this plan would minimize the negligible public-health risks posed by the management of the city's wastes. (The specific environmental and public-health factors associated with each facility proposed for development must be addressed in the project-specific environmental assessments for those facilities.)

There would be no overall decrease in the "quality of life" of life in the city due to the implementation of the proposed systems; the new collection programs for recycling and composting, and the new facilities for recycling, composting, and incinerating wastes should, in a general way, improve rather than diminish New Yorkers' perceptions of how public services are delivered and of daily life in their neighborhoods.

There would be unavoidable short-term adverse impacts, compared to the projected no-action baseline, associated with the construction of the new facilities proposed. These short-term localized impacts will be examined in detail in the site-specific environmental reviews for each proposed facility.

FIGURE 1
WASTE STREAM COMPOSITION
1990

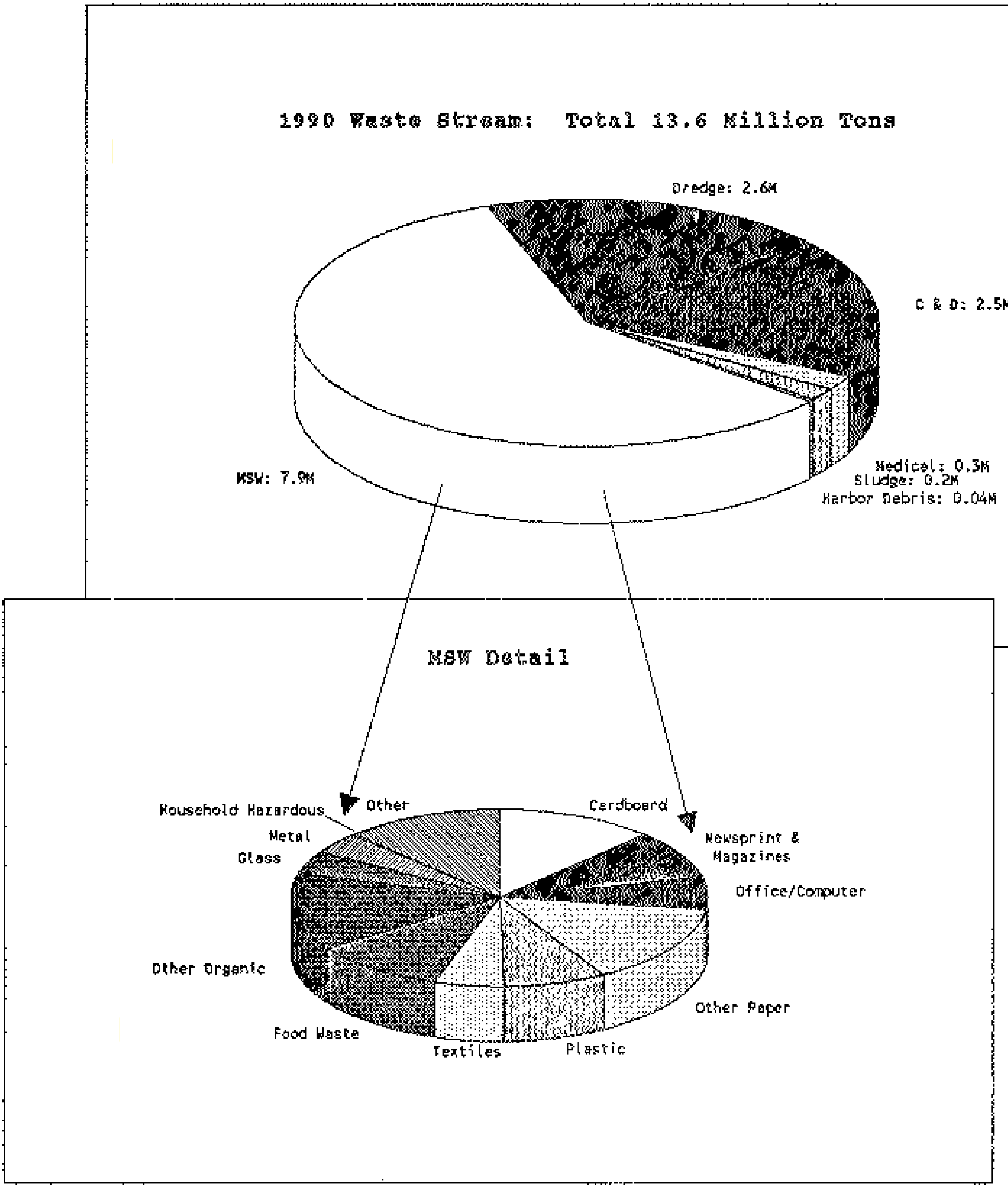


FIGURE 2
PROJECTED MSW COMPOSITION

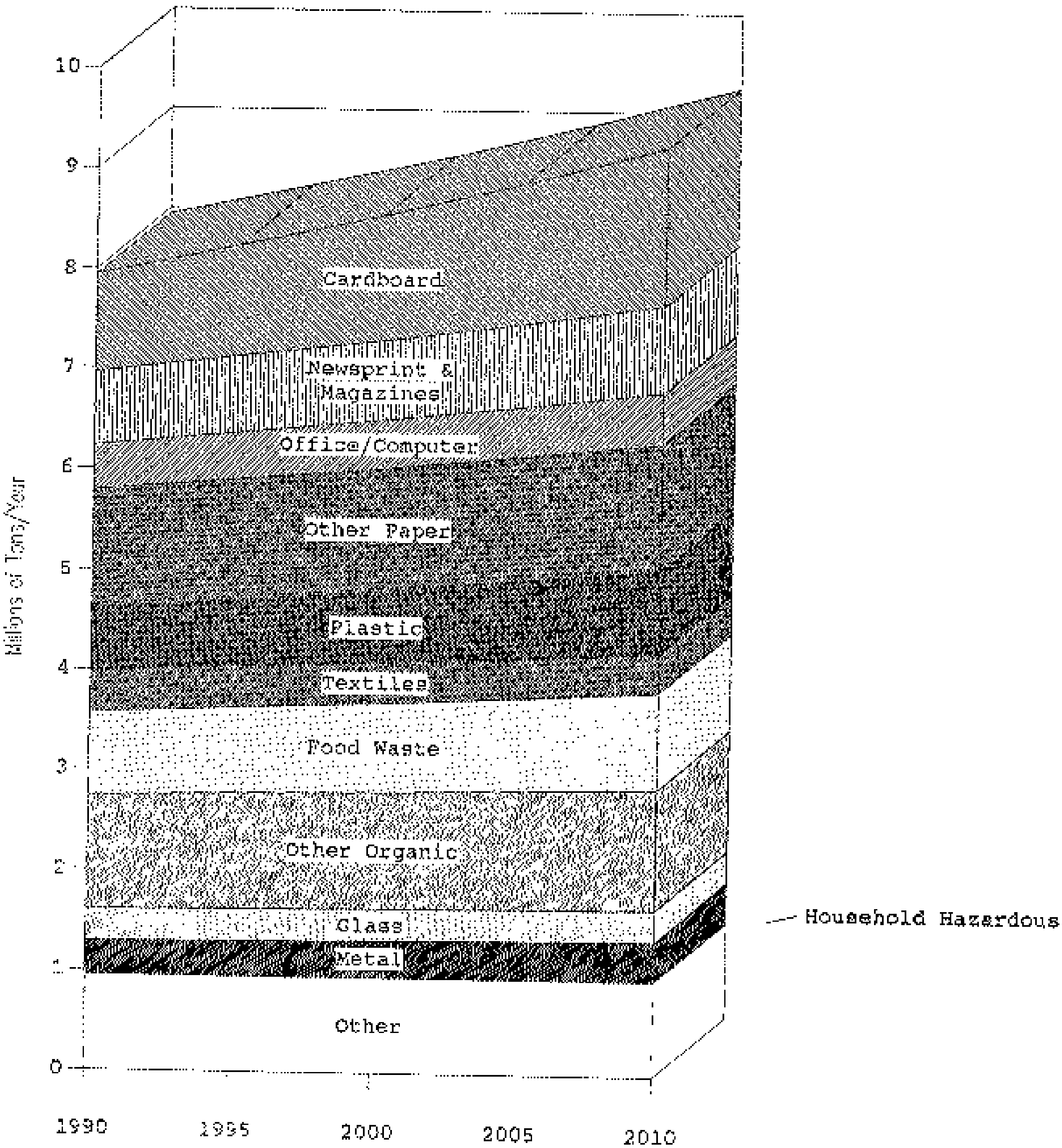
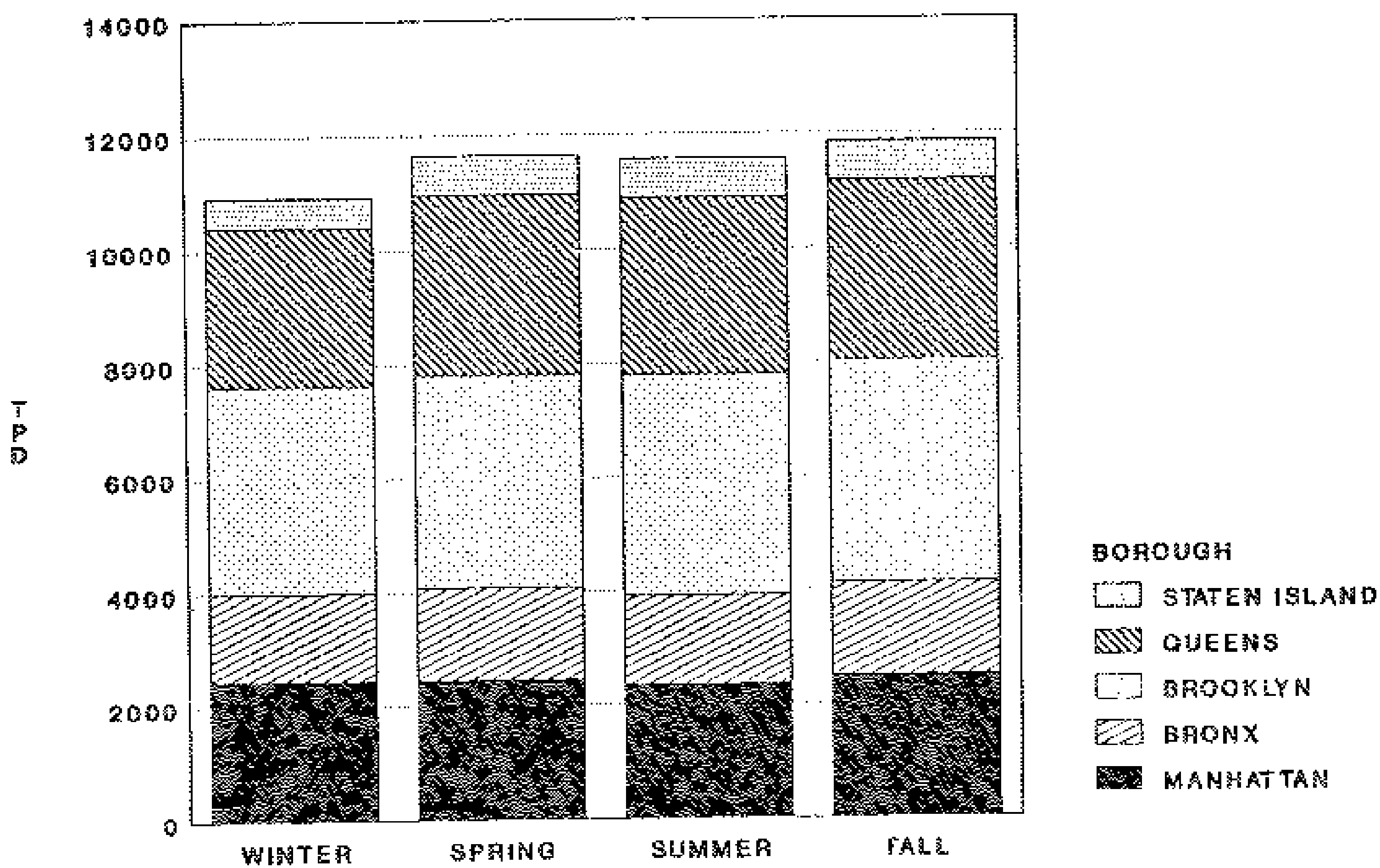


FIGURE 3

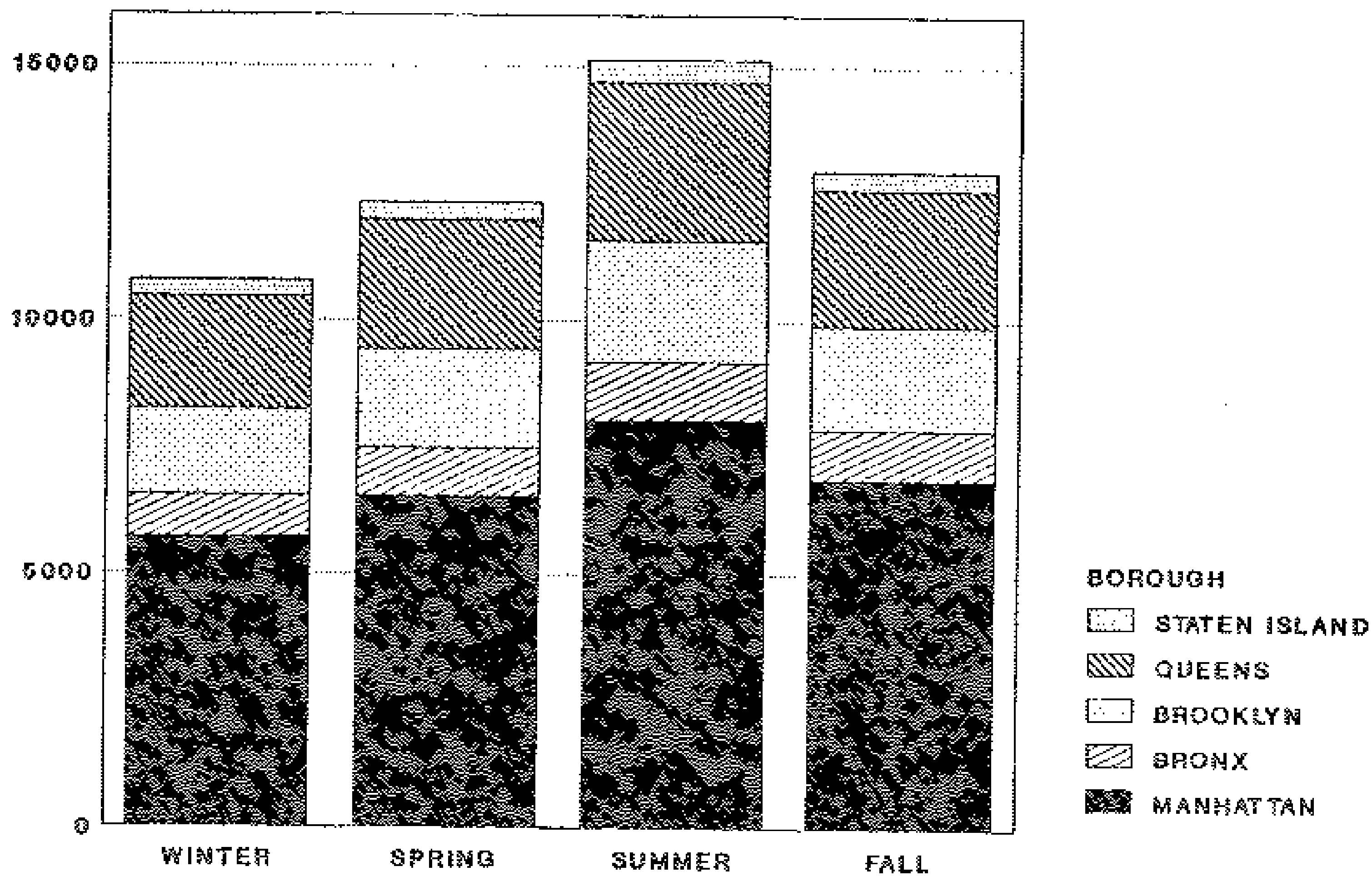
ESTIMATED RESIDENTIAL GENERATION BY BOROUGH



ANNUAL TOTAL = 3.6 MILLION TONS

FIGURE 4

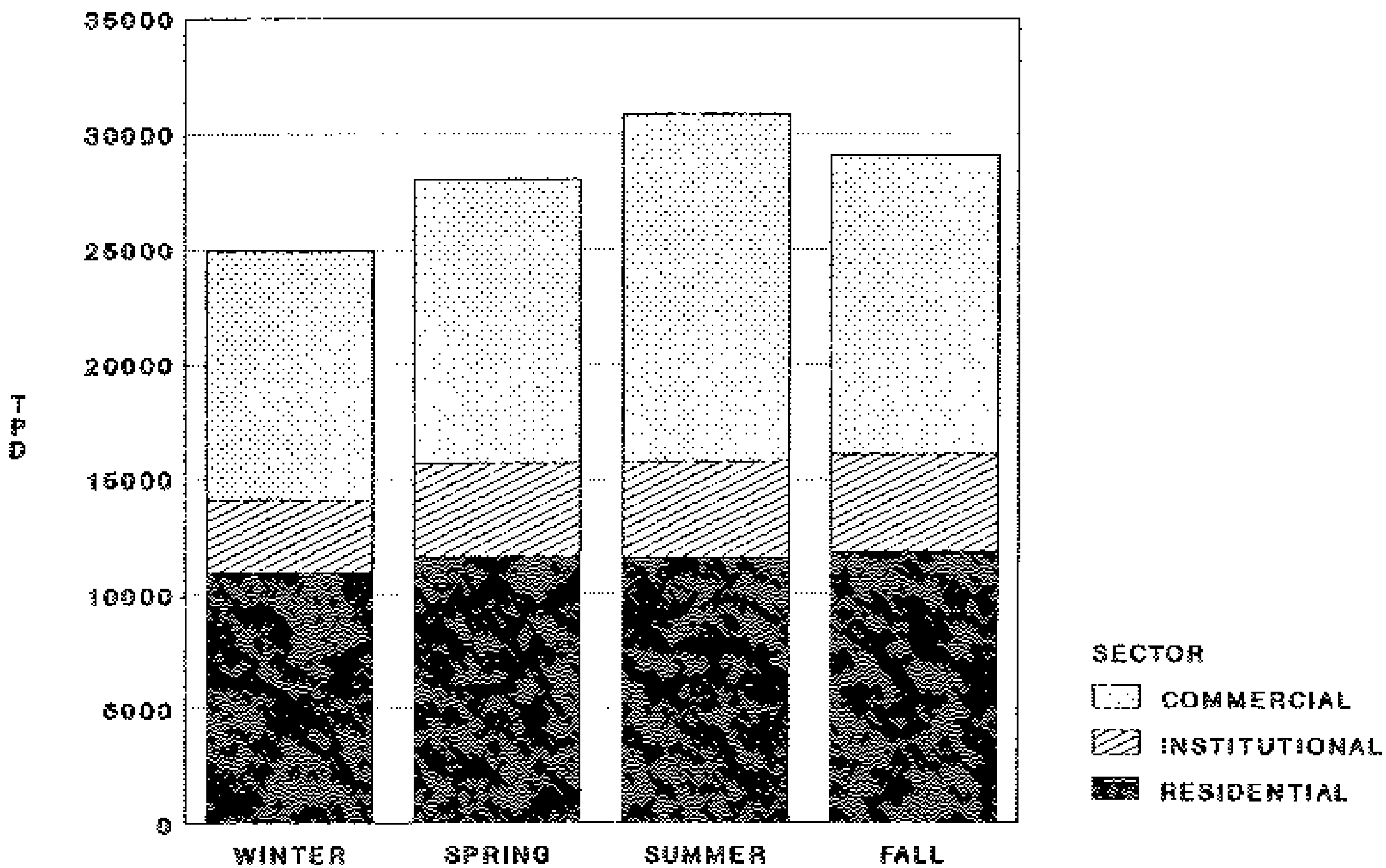
ESTIMATED COMMERCIAL GENERATION BY BOROUGH



ANNUAL TOTAL = 3.9 MILLION TONS

FIGURE 5

SEASONAL MSW GENERATION BY MAJOR SECTOR

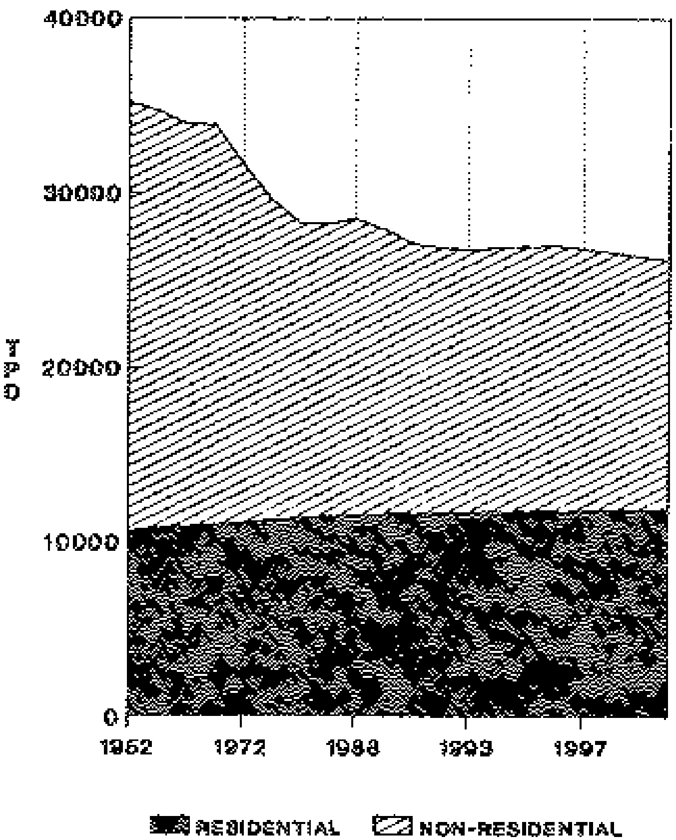


ANNUAL TOTAL = 8.5 MILLION TONS

FIGURE 6

PROJECTED AGGREGATE WASTE GENERATION CITYWIDE
1952 - 2000

RESIDENTIAL VERSUS NON-RESIDENTIAL



RESIDENTIAL PORTION OF TOTAL

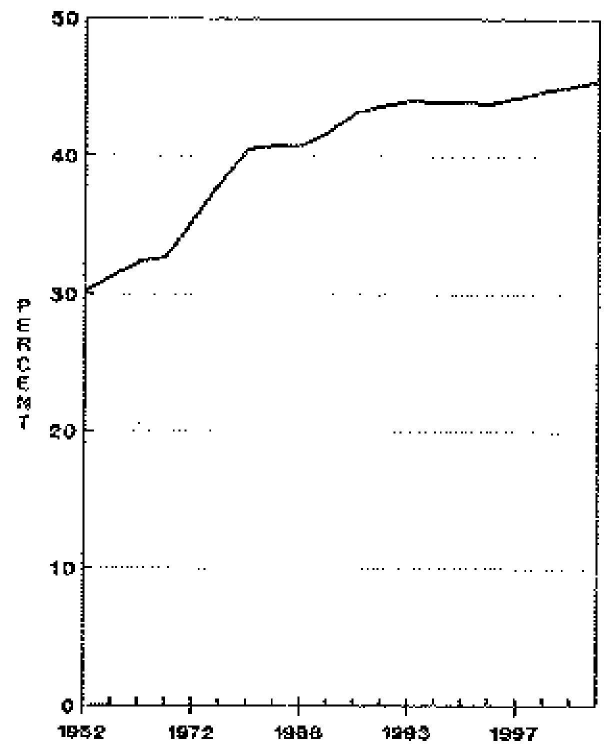


TABLE 1

Projected Total Residential Solid Waste Generated by Borough and Density Level (Tons per Year)

		1990	1995	2000	2005	2010
Bronx	High	254,642	257,840	263,305	266,888	274,586
	Medium	19,287	19,510	19,894	20,265	20,684
	Low	146,244	150,106	153,211	156,381	159,617
	Containerized Collections	21,290	21,557	22,014	22,481	22,957
TOTAL BRONX		443,463	449,013	458,425	466,015	477,844
Brooklyn	High	320,977	329,901	336,695	344,037	351,330
	Medium	93,213	95,612	97,445	99,312	101,215
	Low	595,075	611,313	623,961	636,871	650,048
	Containerized Collections	22,295	22,915	23,400	23,896	24,403
TOTAL BROOKLYN		1,031,560	1,059,741	1,081,701	1,104,116	1,126,996
Manhattan	High	600,996	606,424	618,353	630,516	642,918
	Medium	17,398	17,511	17,802	18,098	18,399
	Low	27,735	27,857	28,479	29,010	29,551
	Containerized Collections	32,170	32,460	33,099	33,750	34,414
TOTAL MANHATTAN		678,299	684,252	697,733	711,374	725,282
Queens	High	171,376	175,531	179,073	182,686	186,372
	Medium	65,448	66,668	67,708	68,765	69,838
	Low	682,860	698,718	713,171	727,924	742,981
	Containerized Collections	35,937	36,809	37,551	38,309	39,082
TOTAL QUEENS		955,621	977,726	997,503	1,017,684	1,038,273
Staten Island	High	4,522	4,710	4,905	5,104	5,312
	Medium	7,054	7,312	7,571	7,841	8,119
	Low	193,727	201,906	210,443	219,340	228,613
	Containerized Collections	7,224	7,529	7,835	8,154	8,487
TOTAL STATEN ISLAND		212,527	221,460	230,754	240,439	250,531
Housing Authority		116,231	118,196	121,048	123,974	126,978
TOTAL HOUSING AUTHORITY		116,231	118,196	121,048	123,974	126,978
TOTAL NEW YORK CITY RESIDENTIAL MSW		3,437,701	3,510,488	3,587,164	3,665,622	3,745,906

High Density = Residents of buildings of more than 4 units and 5 or more stories

Medium Density = Residents of buildings of more than 4 units but under 5 stories

Low Density = Residents of 1 - 4 family buildings.

TABLE 2 Projected Total Non-Residential Municipal Solid Waste Generated by Sector (Tons per Year)

	1990	% of City-Wide Total	1995	% of City-Wide Total	2000	% of City-Wide Total	2005	% of City-Wide Total	2010	% of City-Wide Total
Manufacturers										
Nondurable	606,055	17.77	769,434	16.17	721,195	14.41	675,981	12.80	633,601	11.33
Durable	99,101	2.18	84,955	1.79	79,054	1.58	73,564	1.39	68,454	1.22
Retail										
Non-food	612,700	13.51	661,872	13.91	719,575	14.38	782,309	14.82	850,512	15.20
Food	613,594	13.53	670,098	14.08	739,382	14.78	815,829	15.45	900,181	16.09
Fire	99,471	2.19	108,086	2.27	118,269	2.36	129,413	2.45	141,606	2.53
Hotel	625,679	13.79	714,539	15.01	795,152	15.89	884,861	16.76	984,690	17.60
Personal Repair	37,792	0.83	36,812	0.77	35,132	0.70	33,528	0.63	31,998	0.57
Business Legal	137,839	3.04	158,870	3.34	177,131	3.54	197,490	3.74	220,191	3.94
Proprietors	105,134	2.32	110,620	2.32	117,381	2.35	124,555	2.36	132,166	2.36
Government	104,756	2.31	102,454	2.15	105,092	2.10	107,797	2.04	110,571	1.98
TCU	25,753	0.57	26,076	0.55	26,718	0.53	27,377	0.52	28,052	0.50
Wholesale	269,000	5.93	277,310	5.83	291,769	5.83	307,025	5.81	323,056	5.78
Non-Profits	56,047	1.24	76,850	1.61	85,178	1.70	94,409	1.79	104,640	1.87
Hospitals	97,210	2.14	107,176	2.25	119,895	2.40	134,121	2.54	150,035	2.68
Nursing Homes	35,968	0.79	38,618	0.81	42,009	0.84	45,698	0.87	49,710	0.89
Schools	119,978	2.65	118,904	2.49	120,816	2.41	123,970	2.33	125,365	2.24
Colleges	12,842	0.28	11,311	0.24	11,931	0.24	12,585	0.24	13,274	0.24
Correctional Facilities	6,419	0.14	5,386	0.11	5,220	0.10	5,056	0.10	4,901	0.09
Buses/Subways	36,971	0.82	37,064	0.78	37,492	0.75	37,925	0.72	38,364	0.69
Airports	82,036	1.81	91,554	1.92	103,100	2.06	116,102	2.20	130,743	2.34
Street Sweeping	254,861	5.62	254,861	5.35	254,861	5.09	254,861	4.83	254,861	4.56
New York City Agencies	296,759	6.54	296,759	6.24	296,759	5.93	296,759	5.62	296,759	5.31
TOTAL NEW YORK CITY NONRESIDENTIAL MSW	4,535,785	100	4,759,312	100	5,003,131	100	5,280,317	100	5,593,732	100

6,269,800 ✓ 3,590,795

2,662,991 1/77

~ 8,818 4??

TABLE 3 Composition of Projected Total Residential Municipal Solid Waste for New York City (Tons per Year)

	1990	%	1995	%	2000	%	2005	%	2010	%
Cardboard (1)	234,831	6.83	258,677	7.36	283,978	7.92	310,259	8.48	337,556	9.03
Newsprint & Magazines	398,404	11.59	418,991	11.93	442,468	12.34	466,822	12.75	492,021	13.17
Office & Computer Paper	32,559	0.95	35,053	1.00	37,327	1.04	39,634	1.08	42,127	1.13
Other Paper (2)	408,322	11.88	418,266	11.91	423,636	11.82	429,051	11.72	434,509	11.63
Plastic (3)	282,627	8.22	310,842	8.85	351,086	9.79	392,972	10.74	436,580	11.68
Textiles	152,993	4.45	152,147	4.33	149,732	4.18	147,144	4.02	144,376	3.86
Food Waste	401,793	11.69	388,659	11.06	373,091	10.41	356,675	9.74	339,379	9.08
Other Organics (4)	534,080	15.54	524,938	14.94	511,001	14.25	496,216	13.56	480,549	12.86
Glass (5)	164,163	4.78	155,924	4.44	147,567	4.12	138,776	3.79	129,539	3.47
Metal (6)	160,065	4.66	163,276	4.65	167,359	4.67	171,540	4.69	175,823	4.71
Misc. Inorganics (7)	67,464	1.96	68,938	1.91	65,735	1.83	64,453	1.76	63,087	1.69
Misc. Household Hazardous Waste (8)	12,332	0.36	12,589	0.36	12,866	0.36	13,150	0.36	13,441	0.36
Bulk	331,996	9.66	346,929	9.88	358,215	9.99	369,809	10.10	381,811	10.22
Other (9)	254,886	7.42	259,289	7.38	261,434	7.29	263,549	7.20	265,634	7.11
TOTAL *	3,437,335	100	3,512,515	100	3,585,515	100	3,660,130	100	3,736,412	100

* Totals for the Waste Composition Table are slightly different than the totals calculated in the Waste Generation Table due to the rounding of numbers in the Waste Composition Table.

(1) Includes Corrugated/Kraft and Non-Corrugated Cardboard

(2) Includes Books, Phonebooks, and Mixed Paper

(3) Includes Clear & Colored HDPE Containers, LPDE, Films & Bags, Green & Clear PET Containers, PVC, Polypropylene, and Misc. Plastics

(4) Includes Grass & Leaves, Diapers, and Misc. Organics

(5) Includes Clear, Green and Brown Glass Containers, as well as Misc. Glass

(6) Includes Foil Food Containers, Beverage Cans, Misc. Aluminum, Food Containers, Mis. Ferrous and Hi-Metal Cans.

(7) Includes Non-Bulk Ceramics and Misc. Inorganics

(8) Includes Pesticides, Non-Pesticide Poisons, Paint/Solvent/Fuel, Dry Cell Batteries, Car Batteries, Medical Waste, and Misc. Household Hazardous Waste

(9) Includes Rubber, Fines, Brush/Stumps, Lumber and Polystyrene

TABLE 4 Composition of Projected Total Nonresidential Municipal Solid Waste for New York City (Tons per Year)

	1990	%	1995	%	2000	%	2005	%	2010	%
Cardboard	674,746	15.86	769,531	17.17	871,975	18.51	987,415	19.87	1,117,606	
Newsprint & Magazines	328,097	7.71	341,983	7.63	354,805	7.53	369,352	7.43	385,692	
Office & Computer Paper	408,196	9.59	428,635	9.56	439,441	9.33	453,184	9.12	470,127	8.93
Other Paper	717,375	16.86	737,595	16.46	750,064	15.93	763,354	15.36	777,143	14.76
Plastic	317,782	7.47	310,369	6.93	319,235	6.78	329,300	6.63	340,637	6.47
Textiles	260,242	6.12	261,141	5.83	255,405	5.42	251,189	5.05	248,484	4.72
Food Waste	394,292	9.27	442,032	9.86	491,079	10.43	546,073	10.99	607,727	11.54
Other Organics	305,836	7.19	335,786	7.51	366,473	7.78	399,696	8.05	437,561	8.31
Glass	151,220	3.55	158,810	3.54	164,501	3.49	170,377	3.43	176,370	3.35
Metal	143,300	3.37	153,372	3.42	162,484	3.45	172,539	3.48	184,106	3.50
Misc. Inorganics	11,358	0.27	11,353	0.25	11,197	0.24	11,216	0.23	11,243	0.21
Misc. Household Hazardous Waste	10,180	0.24	10,184	0.23	10,257	0.22	10,415	0.21	10,653	0.20
Bulk	12,058	0.28	12,771	0.28	13,666	0.29	14,706	0.30	15,845	0.30
Other	265,094	6.23	252,857	5.64	244,390	5.19	235,702	4.74	226,510	4.30
Street Dirt	254,661	5.99	254,661	5.69	254,661	5.41	254,661	5.13	254,661	4.84
TOTAL *	4,254,837	100	4,482,139	100	4,709,843	100	4,959,739	100	5,264,590	100

* Totals for the Waste Composition Table are slightly different then the totals calculated in the Waste Generation Table due to the rounding of numbers in the Waste Composition Table.

TABLE 5 Materials Designations for Projected Total Residential Municipal Solid Waste for New York City (Tons per Year)

	1990	1995	2000	2005	2010
RECYCLABLES *					
Corrugated Cardboard	150,544	171,718	196,301	218,830	245,330
Newsprint	305,263	307,200	304,786	302,130	299,222
Office & Computer Paper	32,559	35,053	37,327	39,804	42,127
Magazines & Glossy	92,141	111,791	137,792	164,092	192,799
Books & Phonebooks ***	55,545	59,675	63,356	67,170	71,121
Mixed Paper **	176,382	179,296	183,140	190,941	181,694
Clear HDPE Containers	23,693	29,907	38,268	48,898	56,106
Colored HDPE Containers	24,685	30,337	38,555	48,546	57,520
LDPE	5,612	5,792	5,029	6,272	6,523
Films & Bags	147,948	165,143	183,318	202,195	221,787
Green PET Containers	4,741	4,839	4,943	5,049	5,156
Clear PET Containers	19,756	23,005	26,777	30,706	34,805
PVC	8,315	11,538	15,071	18,744	22,582
Polypropylene	7,290	8,423	10,200	12,059	14,003
Misc. Plastics	39,304	31,258	26,025	22,400	17,686
Glass Containers - Clear	94,422	89,759	84,862	79,712	74,300
Glass Containers - Green	34,141	32,033	29,971	27,805	25,533
Glass Containers - Brown	27,763	25,122	24,564	22,906	21,175
Food Containers - Foil	17,623	17,650	18,065	18,262	18,501
Aluminum Beverage Cans	9,845	12,499	16,473	20,635	24,992
Misc. Aluminum	4,207	4,291	4,393	4,477	4,573
Food Containers	63,662	59,945	56,270	52,429	48,357
Bi-Metal Cans	599	611	624	637	651
Textiles	152,993	152,147	149,732	147,144	144,378
Polystyrene	20,313	23,142	26,275	29,533	32,920
TOTAL RECYCLABLES	**1,521,734**	**1,563,943**	**1,650,913**	**1,770,977**	**1,864,240**
COMPOSTABLES *					
Non-Corrugated Cardboard	84,187	85,959	88,077	90,420	92,219
Mixed Paper**	176,382	179,296	183,140	190,940	181,694
Grass & Leaves	175,016	169,421	165,221	161,011	156,161
Diapers	110,950	103,944	97,170	90,069	82,606
Food Waste	401,793	385,659	373,351	356,675	339,379
Misc. Organics	253,909	252,561	248,592	244,336	238,742
Brush/Stumps	24,829	24,804	24,557	24,243	23,923
TOTAL COMPOSTABLES	**1,222,074**	**1,204,953**	**1,177,446**	**1,148,509**	**1,117,763**
NON-RECYCLABLES/NON-COMPOSTABLES *					
Fines	75,418	74,997	73,831	72,980	71,241
Misc. Glass	7,857	8,013	8,180	8,353	8,530
Misc. Ferrous	64,131	68,113	71,538	75,082	78,749
Ceramics	4,780	4,802	4,965	5,093	5,203
Misc. Inorganics	62,694	62,066	60,750	59,360	57,884
Pesticides	343	352	359	365	374
Non-Pesticide Poisons	670	684	699	714	729
Paint/Solvents/Fuel	5,561	5,668	5,787	5,912	6,035
Dry Cell Batteries	695	709	725	740	757
Car Batteries	1,233	1,254	1,264	1,225	1,357
Medical Waste	804	821	836	857	876
Misc. Household Hazardous Waste	3,029	3,094	3,164	3,236	3,309
Rubber	65,223	66,334	66,669	67,044	67,375
Lumber	66,105	70,012	70,095	70,149	70,174
Bulk	331,996	345,979	358,219	369,839	381,611
TOTAL	**693,527**	**713,921**	**727,156**	**740,650**	**754,408**
TOTAL NEW YORK CITY RESIDENTIAL MSW	**3,437,335**	**3,512,515**	**3,565,515**	**3,660,130**	**3,736,412**

* These categories reflect the analysis and proposed programs developed in this plan.

** 50% of Mixed Paper is assumed to be "high quality."

*** Phonebooks are already being recycled by the NYC Sanitation Department. Other kinds of books are not designated for recycling.

TABLE 6 Materials Designations for Projected Total Non-Residential Municipal Solid Waste for New York City (Tons per Year)

	1990	1995	2000	2005	2010
RECYCLABLES *					
Corrugated Cardboard	659,625	754,145	855,870	970,524	1,099,854
Newsprint	287,689	292,226	293,778	295,336	296,727
Office & Computer Paper	408,196	428,635	439,441	453,194	470,127
Magazines & Glossy	40,405	49,755	61,029	74,016	88,355
Books & Phonebooks ***	6,252	6,534	6,983	7,476	8,025
Mixed Paper **	355,562	365,531	371,541	377,938	384,559
Clear HDPE Containers	21,362	23,509	26,585	26,993	31,173
Colored HDPE Containers	24,273	27,068	30,106	32,829	35,289
LPDE	329	348	379	409	440
Films & Bags	130,682	148,297	166,584	187,210	210,405
Green PET Containers	4,898	5,127	5,326	5,517	5,705
Clear PET Containers	18,668	19,157	19,941	20,688	21,400
PVC	334	362	377	404	435
Polypropylene	508	541	555	659	697
Misc. Plastics	117,336	85,599	69,355	52,614	35,004
Glass Containers - Clear	8,467	8,327	8,155	8,040	7,873
Glass Containers - Green	2,064	2,009	1,999	1,983	1,955
Glass Containers - Brown	1,225	1,279	1,352	1,436	1,533
Food Containers - Foil	1,536	1,694	1,798	1,914	2,041
Aluminum Beverage Cans	2,310	2,948	3,784	4,834	6,016
Misc. Aluminum	21,277	22,623	23,753	24,969	26,341
Food Containers	7,155	6,905	6,615	6,682	6,500
Bi-Metal Cans	46	50	51	54	56
Textiles	260,242	251,141	255,405	251,189	248,484
Polystyrene	8,456	9,781	11,485	13,424	15,832
TOTAL RECYCLABLES	**2,390,028**	**2,523,791**	**2,682,455**	**2,822,303**	**3,005,325**
COMPOSTABLES *					
Non-Corrugated Cardboard	14,918	15,386	16,105	16,891	17,752
Mixed Paper**	355,561	365,530	371,540	377,938	384,558
Grass & Leaves	37,391	37,119	37,085	37,057	37,035
Diapers	15,471	15,557	15,750	15,530	15,772
Food Waste	394,298	442,032	491,078	546,073	607,727
Misc. Organics	252,974	284,110	313,637	347,009	384,774
Brush/Stumps	114,061	115,836	115,721	118,093	119,939
TOTAL COMPOSTABLES	**1,184,665**	**1,275,570**	**1,361,918**	**1,458,801**	**1,567,558**
NON-RECYCLABLES/NON-COMPOSTABLES *					
Fines	135,737	120,237	105,905	96,577	82,975
Misc. Glass	139,454	147,302	152,905	158,918	165,006
Misc. Ferrous	110,573	139,245	126,303	134,245	143,152
Ceramics	309	318	334	352	372
Misc. Inorganics	11,049	10,569	10,863	10,864	10,871
Pesticides	29	32	35	40	45
Non-Pesticide Poisons	24	25	26	28	29
Paint/Solvents/Fuel	250	257	269	283	298
Dry Cell Batteries	374	393	417	444	474
Car Batteries	10	11	12	13	15
Medical Waste	822	897	994	1,102	1,227
Misc. Household Hazardous Waste	8,671	8,569	8,503	8,506	8,575
Rubber	1,301	1,379	1,481	1,594	1,722
Lumber	5,509	5,514	5,805	6,014	6,242
Bulk	12,056	12,771	13,586	14,709	15,846
Street Dirt	254,861	254,861	254,861	254,861	254,861
TOTAL	**681,341**	**682,779**	**685,470**	**688,545**	**691,707**
TOTAL NEW YORK CITY NON-RESIDENTIAL MSW	**4,254,837**	**4,482,130**	**4,708,843**	**4,969,730**	**5,264,590**

* These categories reflect the analysis and proposed programs developed in this plan.

** 50% of Mixed Paper is assumed to be "high quality."

*** Phonebooks are already being recycled by the NYC Sanitation Department.
Other kinds of books are not designated for recycling.